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## 3-6

### 沖縄のフクギ屋敷林に関する住民意識調査及びCVMによる屋敷林の価値評価

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#### 要旨

本部町の備瀬・今帰仁村今泊・渡名喜島などに現存するフクギ屋敷林は、その推定樹齢から、その多くが18世紀の30年代以降に、王府によって計画的に造成されたものであることが、これまでの調査研究でわかってきた。フクギ林が選抜された最大の理由は、フクギのもつ多機能性（たとえば、潮害や台風からの防備、津波などからの防災、防火樹、建築材、染料など）に起因している。しかし、これらのフクギ林は、沖縄戦と終戦直後の木材不足による乱伐や開発によってそのほとんどが消滅した。現在では、一部の地域でその面影をみるのみである。フクギ屋敷林をどう保全し、今後、どのように活用すべきか、その方策に関する研究はほとんど見られない。

本報告の目的は以下の2つである。第1は、フクギ屋敷林について、地域の住民がどのような意識をもっているか、アンケート調査から、この点を明らかにすることである。第2は、CVMの手法を用いて、フクギ屋敷林の多面的な価値の評価を行い、それによって住民や行政による保全対策の在り方を考察することである。CVMとは、一般の市民に対してアンケートを行い、仮想的な条件を想定し、環境保全や改善のために支払ってもよいと考える最大金額、すなわち支払意志額（Willingness to Pay; WTP）等を質問し、環境価値を評価する手法である。沖縄県でフクギの屋敷林が最も多く残されている3つの地域（沖縄本島北部の備瀬、粟国島、渡名喜島）でアンケート調査を行った。

アンケート調査の結果、圧倒的多数の人が（91%）、フクギの屋敷林の存在意義を認めている。また、多くの住民の回答者や行政の回答から、フクギ屋敷林は住民の私的財産に属すると考えてもいることが分かった。回答者の約半数が、屋敷の所有者またはその村落共同体、地方自治体がフクギ屋敷林の保全に責任を負わなければならない、と答えている。屋敷林管理の放棄（たとえば空屋敷など）は、コミュニティ全体の集落景観や緑の空間によってもたらされる快適性の恩恵を大幅に低下させてしまうのではないかと懸念もみられる。

フクギ屋敷林を守っていくために「フクギ屋敷林保全基金」といったものを設立すると仮定し、回答者にフクギ屋敷林の保全基金にどの程度の支払い意志（WTP）があるのかを調査した。それによると支払い意志額（WTP）の1世帯当たりの平均値は、1,451円となった。なお、中位値を計算すると1,000円となった。支払い意志額の分析から、住民たちは全体としてフクギ屋敷林を評価していることが分かった。推計結果を見ると、「安定した収入源がある」と回答した者は、より大きなWTPを示していることが確認できた。また、「フクギ屋敷林を活用すべき」と回答した人のWTPも比較的高い数値を示した。

以上のことから、フクギ屋敷林の保全に関しては、その評価に対する潜在的な意識は高く、新たな活用法を開発し、地域住民自ら保全活用する施策を見出して、それを行政側が支援して行く体制の構築が、今求められている。

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## **Residents' Preference and Willingness to Pay for Conservation of Homestead Woodlands- a case of coastal villages in Okinawa Prefecture, Japan**

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Abstract: Fukugi (*Garcinia subelliptica* Merr.) tree homestead woodland has prevailed widely along the Ryukyu Islands, the southernmost part of Japan. The homestead woodland has played a key role in protecting the settlements from strong winds, as well as providing timber and green manure and etc. in the past. However, with the rapid urbanization and economic and societal change, homestead woodlands greatly vanish in Japan. The ecological multi functions of forests have been stressed in recent researches. The management and conservation of homestead woodland is little studied, although they have been closely relevant to habitants' wellbeing.

The primary purpose of this study is to reveal dwellers' perception of homestead woodlands. The secondary purpose is to explore dwellers' willingness to conserve homestead woodlands by using the contingent valuation method (CVM).

Survey was conducted in three hamlets with the best preserved Fukugi homestead woodlands in Okinawa Prefecture. Overwhelming majority of the respondents, accounting for around 91%, preferred homestead woodlands to being conserved. Residents have highly valued the amelioration of micro-climate by homestead woodlands, such as windbreak and cooling the air in summer. In contrast, the contribution to biodiversity was slightly assessed, in particularly, in two small isolated islands. It was revealed that residents at small isolated have highly valued standing Fukugi trees concerning the function of preventing from typhoons. It was found that Fukugi homestead woodlands were considered as private goods by the dwellers as well as local authority. About half of the respondents perceived that the house owners and/or local authority such as hamlet community should be responsible for the conservation. The interesting finding in this study revealed that the residents' attitude toward homestead woodland was significant factor influencing their willingness to pay for woods preservation. Around 25% of the total respondents rejected the payment. Estimated mean and median WTP values were JPY 1,451/household and JPY 1,000/household, respectively. Thus, environmental education and awareness arising will contribute to better conservation of their homestead woodlands. It is urgent to evaluate the non-use value of homestead woodlands as environmental goods and urge local policy makers to include Fukugi homestead woodlands in landscape planning and conservation.

Keywords: urban forest, dwellers' perception, traditional forest conservation, windbreak

## 1. Introduction

Multiple ecosystem functions of forest have increasingly attracted global attention in recent years. Forests regulate hydrological cycles, protect soils and water courses. The United Nations established the theme of International Year of Forest in 2011 of Forests for People highlighting our relationship with forests and humankind's role in ensuring their well-being and development.

There exist voluminous studies regarding ecological functions (e.g. Konijnendijk 1999) and landscape amenities as recreational sites of urban forests (Tyrväinen and Väänänen 1998; Tyrväinen 2001; Majumdar et al. 2011). Urban forests refer to the woody vegetation in and around dense human settlements, ranging from small communities in rural regions to metropolitan regions (Miller, 1988, p. 24 as cited in Majumdar et al. 2011).

Domestic garden or home garden was reported to constitute a considerable proportion of urban green space (Loram et al. 2007). An empirical study identified that home gardens provide a large set of ecosystem services, among which cultural services were most valued (Calvet-Mir et al. 2012). Due to the close proximity to the home and hence accessibility for many, possibly the greatest benefit of the domestic garden is on human health and well-being (Cameron et al. 2012).

Homestead woodland prevailed on the flat land throughout Japan. Homestead woodland in the hamlets along the coastal area and on small islands have played an important role in protecting the settlements from strong winds (Saito et al. 1990), as well as providing timber and green manure and etc. in the past. The wind speed was measured to be only around 40% of that in the periphery of the village (Hashimoto et al. 2006). A study in a dispersed village in mainland Japan found that residents perceived homestead woodlands as outstanding landscape and the town government paid subsidy to plant trees along the homestead (Inagaki et al. 2003). However, with the rapid urbanization and economic and societal change, homestead woodlands rapidly vanish in Japan (Ishimaru 1997; Inagaki et al. 2003).

Fukugi (*Garcinia subelliptica* Merr.) tree homestead woodland has prevailed widely along the Ryukyu Islands, the southernmost part of Japan, ranging from Okinoerabu Island in the current Kagoshima Prefecture in the north to Sakishima Islands in Okinawa Prefecture to the south (Chen and Nakama 2011a). The Fukugi tree landscape was assumed to be established around 300 yrs. ago (Chen and Nakama 2011b). However, the old trees decreased sharply in Okinawa after the WWII in Okinawa (Shigematsu 1979; Anto and Ono 2006). It is urgent to assess the value of these traditional forests around human settlements in order to conserve the greening.

Unlike the other types of urban forests, woodlands in the private yards are under management by the house owners. The routine maintenance is necessary to the good function of planted tree lines. For example, it was reported that cutting the low branches around 100-130cm above the ground improved the microclimate modification of tree lines, such as regulation of temperature in summer and prevention from snowdrifts in winter (Okada and Asakawa 2002). However, due to the changes of social economic conditions and people's lifestyle, implementing periodic management in the woodland has been a burden to the land owners. Although, local residents are the key hold of private homestead woodland conservation, some form of public involvement or introducing appropriately designed support systems (e.g. subsidy for management) can increase the opportunity to maintain woodlands, which in turn, provide ecosystem services and functions appreciated by many other people. In addition to identification and evaluation of woodland functions, information on local residents perceptions and values to those woodlands provides a basis for building the consensus necessary to implement such measures that local government can take.

In this study, we first, reveal dwellers' attitudes toward homestead woodlands. Whether do local residents prefer conserving the traditional homestead woodlands? What are the benefits and problems that have been perceived by local residents regarding the existence of woodlands to their houses? Who should be responsible for the conservation and management of homestead woodlands? Then, we explore the non-use monetary value of homestead woodlands based on residents' survey. Valuing the ecosystem service of environmental goods has the potential to inform policy decisions by highlighting the benefits of sustainable ecosystem management (Chee 2004). The contingent valuation method was used by asking the dwellers' willingness to pay (WTP) for conservation of homestead woodlands.

## 2 Method and survey sites

A combined methodology of questionnaire survey and in-depth interviews with stakeholders of local residents, community head and local authority were conducted to obtain the original data. The survey was conducted in three selected hamlets in Okinawa Prefecture.

Residents' willingness to pay for conserving homestead woodlands in the village was calculated by contingent valuation method (CVM). Contingent valuation method is the most popular direct method to estimate the value of non-market goods (Chaudhry et al. 2007) and environmental assets (Tyrväinen and Väänänen 1998). To collect data, mail surveys or interviews (in person or by telephone) with the CV questionnaire as the principal tool. In a CV survey, normally, the respondents are asked how much they are willing to pay (WTP) towards the preservation or an improvement of an environmental asset. The monetary value of environmental goods can be estimated by calculating the mean WTP and total WTP.

The survey was conducted on site by face to face interview. A surveyor approached a dweller and asked whether he/she were available and willing to answer the survey. If a dweller rejected the cooperation, the surveyor expressed thank you and approached for the next dwellers. If a dweller was willing to answer the survey, then a questionnaire sheet was passed to him/her to fill out. Some dwellers needed the surveyors to read out the questions for him/her due to the age, etc.

The questionnaire survey is comprised of three different sections. The first part asked about the dwellers' attitudes towards the homestead woodland landscape in the village. A previous study of this part was conducted in Bise village of Mainland Okinawa in 2002 (Nakama 2008). The results were also used to compare with the findings in three other new sites in Okinawa.

The second part evaluated respondents' WTP to support the village homestead woodland conservation project. The surveyor explained to the respondents that Fukugi tree landscape is degrading due to the increasing abandonment of houses and ageing of village population. Then, the respondent was asked whether he/she would like to donate a certain amount of money/household one time for the project that recover and maintain Fukugi woodlands in their village. Dichotomous choice (DC) questions were used for elicitation of willingness to pay due to their purported advantages for avoiding many of the biases known to be inherent in other value elicitation formats. Respondents are asked to accept or refuse a donation for the conservation of Fukugi homestead woodland. The two monetary bids were set as JPY 1,000 and JPY 500. First, the respondent was asked whether he/she would like to pay JPY 1,000. If the respondent refused, then he/she was further asked whether he/she would like to pay JPY 500. The SPSS software (version 16.0) was used in statistical analysis and computation:

The third section contained the personal profile of the respondents, including questions related to gender,

age, education and occupation.

Survey was conducted in three hamlets of Imadomari of Nakijin Village in mainland Okinawa, Tonaki Island and Aguni Island. These three hamlets were selected because they have well preserved Fukugi homestead woodlands and have potential importance as tourist attractions. Imadomari is the castle town of the World Heritage of Nakijin Castle Remains. Regarding the two isolated islands of Tonaki and Aguni Island, the administration has been taking efforts to develop tourist industry.

Residences in Tonaki Island are clustered together in the small narrow sandy plain between two high hills in the north and south, respectively. Tonaki Island had a population of 400 as of March, 2012, among which about 50 people were not living on the island. Tonaki Island is the second smallest village in Okinawa prefecture, and is 58km northwest of Naha City. It has an area of 3.74km<sup>2</sup>. Tonaki Island was originally separated into two islands but the accumulation of sand between the two islands has joined the two islands, making it one. There are two hills on the island that have an elevation of about 200m above sea level.

Bise village is located in the northern part of Okinawa Island at lat. 26°42' North and long. 127°53' East. The population was 572 in 2006. Bise village is an arc like the protruding area on the tip of the Motobu Peninsula facing the ocean to the west. Bise village has a long coastal line extending from southwest to northwest. Among them, 180 were over 65 years old and accounted for about one-third of the total population. Major industries were agriculture and fishery.

Aguni is triangular, with a total area of 7.64 km<sup>2</sup>. Ryukyu limestone, which is coral limestone formed during the Pleistocene era, extends mainly through the central part and the southern end of the island, forming terraces. Aguni Island has a registered population of 782 as of November, 2011. Among them, around 100 lived out of the island and 180 were junior high school or below. Thus, around 500 people above junior high school actually lived on the island.

Imadomari, covered with sandy soil, is located in the westernmost part of Nakijin Village facing the ocean to the north. Large ports were also located east and west of the hamlet. As of January 2012, the village had a population of 812 who actually lived in the village.

### 3. Results

#### 3.1 Data collection

A total number of 535 copies of survey sheets were collected, among which 480 copies were complete. Thus, the sample size used in the attitude analysis was 535, among which 480 were used for WTP analysis. Around 21% of the respondents rejected to answer the questionnaire. Questionnaires took about 10 minutes for each respondent to fill in at average. The descriptive profile of respondents is listed in table 1. The results had a good balance of male and female respondents with male respondents being slightly more than female ones. The number of questionnaire sheets collected from Tonaki, Imadomari and Aguni were 134, 260 and 141, accounting for around 38%, 32% and 28% of the actual population, respectively.

Table 1 Profile of the respondents

	Total of three hamlets		Imadomari		Tonaki		Aguni	
	N.	%	N.	%	N.	%	N.	%
<b>Gender</b>								
Male	273	51.1	135	51.9	66	49.3	72	51.1
Female	250	46.6	117	45.0	65	48.5	68	48.2
No response	12	2.2	8	3.1	3	2.2	1	0.7
Total	535	100.0	260	100.0	134	100.0	141	100.0
<b>Age</b>								
~19	16	2.9	7	2.7	2	1.5	7	5.0
20~29	38	6.3	15	5.8	10	7.5	13	9.2
30~39	74	14.3	42	16.2	13	9.7	19	13.5
40~49	90	15.7	30	11.5	23	17.2	37	26.2
50~59	133	24.4	65	25.0	25	18.7	43	30.5
60~69	92	17.9	51	19.6	28	20.9	13	9.2
70~	80	16.3	42	16.2	30	22.4	8	5.7
No response	12	2.2	8	3.1	3	2.2	1	0.7
Total	535	100.0	260	100.0	134	100.0	141	100.0
<b>Occupation</b>								
Employee	83	16.1	48	18.5	13	9.7	22	15.6
Househusband, housewife	73	13.4	34	13.1	22	16.4	17	12.1
Teacher	13	2.2	3	1.2	8	6.0	2	1.4
Public officer	38	6.7	10	3.8	21	15.7	7	5.0
Farming	62	11.8	30	11.5	14	10.4	18	12.8
Forestry and fisheries	15	2.4	0	0.0	5	3.7	10	7.1
Self-employment	32	6.3	22	8.5	7	5.2	3	2.1
Undergraduate, graduate student	11	1.4	6	2.3	0	0.0	5	3.5
Part-time worker	63	11.6	30	11.5	14	10.4	19	13.5
Unemployed	82	15.3	44	16.9	22	16.4	16	11.3
Others	51	9.5	25	9.6	5	3.7	21	14.9
No response	12	2.2	8	3.1	3	2.2	1	0.7
Total	535	100.0	260	100.0	134	100.0	141	100.0

### 3.2 Residents' attitude

The results of residents' attitude towards the conservation and maintenance of Fukugi trees were summarized in Table 2.

Around 90.7% of the respondents said that they preferred conserving Fukugi trees. A slight percentage of the respondents said that they wanted to cut the trees at around 1.5%. The remaining 7.1% responded that they had no ideas whether Fukugi trees should be conserved or not. Around 72.3% of respondents have Fukugi trees, which is consistent with actual coverage of Fukugi trees at the surveyed sites.

Regarding the perceived benefits of Fukugi trees, an overwhelming majority of the respondents stated the function of protection from typhoons. Around half of the respondents agreed that its function of adjusting micro environment as providing with shadowy space in summer. Around 45% of the respondents said that greening

enhances the landscape scenery. About 30% of the respondents stated that they felt comfort, safety and mind peacefulness with the green surroundings. Only around 16.8% of the respondents stated the ecological function of Fukugi woodlands as providing the habitat for living creatures.

Table 2 Residents' attitude toward homestead woodlands

	Total of three hamlets		Imadomari		Tonaki		Aguni		Bise	
	N.	%	N.	%	N.	%	N.	%	N.	%
1 Do you prefer conserving fukugi trees?										
Yes	485	90.7	225	86.5	131	97.8	129	91.5	194	93.7
No	8	1.5	7	2.7	0	0	1	0.7	4	1.9
Don't know	42	7.9	28	10.8	3	2.2	11	7.8	5	2.4
No response	0	0	0	0	0	0	0	0	4	1.9
Total	535		260	100	134	100	141	100	207	100
2 Do you have Fukugi trees around your house?										
Yes	387	72.3	188	72.3	103	76.9	96	68.1		
No.	143	26.7	68	26.2	31	23.1	44	31.2		
Don't know	0	0	0	0	0	0	0	0		
No response	5	0.9	4	1.5	0	0	1	0.7		
Total	535	100	260	100	134	100	141	100		
3 What are benefits from Fukugi trees? (Multiple choice)										
Protect the houses from typhoons.	458	85.6	207	79.6	128	95.5	123	87.2	188	90.8
Cooling with the shades in summer.	326	60.9	146	56.2	83	61.9	97	68.8	170	82.1
Saving electricity when using a cooler.	55	10.3	30	11.5	21	15.7	4	2.8	53	25.6
Feeling comfortable and peaceful with the trees	157	29.3	68	26.2	65	48.5	24	17	147	71
Landscape is aesthetically pleasing.	243	45.4	113	43.5	87	64.9	43	30.5	148	71.5
Providing the inhabit for the creatures such as insects and birds.	90	16.8	62	23.8	22	16.4	6	4.3	90	43.5
Others	33	6.2	22	8.5	6	4.5	5	3.5	31	15
No response	0	0	0	0	0	0	0	0	3	1.4
Total	535	100	260	100	134	100	141	100	207	100
4 Do you have any problems to have Fukugi trees?										
Yes	268	50.1	138	53.1	45	33.6	85	60.3	126	60.9
No.	132	24.7	57	21.9	59	44	16	11.3	77	37.2
Don't know	18	3.4	10	3.8	3	2.2	5	3.5	3	1.4
No response	117	21.9	55	21.2	27	20.1	35	24.8	1	0.5
Total	535	100	260	100	134	100	141	100	207	100
5 What are the problems to have Fukugi trees? (Multiple choice)(Only those answered "Yes" in Question 4 need to respond.)										
Fallen ripe fruits are smelly.	181	67.5	96	69.6	10	22.2	75	88.2	72	57.1
Being too shadowy without sunshine.	47	17.5	28	20.3	6	13.3	13	15.3	19	15.1
Cleaning the fallen leaves.	182	67.9	77	55.8	34	75.6	71	83.5	77	61.1
Life environment is destroyed by outside visitors	4	1.5	3	2.2	0	0	1	1.2	6	4.8
Problems of bats who come to eat fruits.	104	38.8	102	73.9	2	4.4	0	0	22	17.5



Others	30	11.2	9	6.5	16	35.6	5	5.9	37	29.4
Total	268	100	138	100	45	100	85	100	126	100
6 Whether, do you think, Fukugi trees should be used in other ways?										
Yes.	152	28.4	75	28.8	42	31.3	35	24.8	89	43
No, it is fine not to change.	222	41.5	110	42.3	57	42.5	55	39	94	45.4
Don't know.	52	9.7	27	10.4	7	5.2	18	12.8	11	5.3
No response.	109	20.4	48	18.5	28	20.9	33	23.4	13	6.3
Total	535	100	260	100	134	100	141	100	207	100
7 What are new means to utilize the current Fukugi trees. (Only those answered "Yes" in Question 6 need to answer.)										
Use as tourist resources	62	40.8	28	37.3	16	38.1	18	51.4	48	53.9
Use as environmental venues for the school kids.	72	47.4	40	53.3	22	52.4	10	28.6	56	62.9
Use to produce landscaping trees.	70	46.1	31	41.3	23	54.8	16	45.7	34	38.2
Others	20	13.2	7	9.3	11	26.2	2	5.7	10	11.2
No response									3	3.4
Total	152	100	75	100	42	100	35	100	89	100
8 Do you regularly maintain the woodland, e.g. pruning? (Only those answered "Yes" in Question 2 need to answer.)										
Yes.	88	22.7	43	22.9	31	30.1	14	14.6	31	15
Sometimes.	197	50.9	80	42.6	52	50.5	65	67.7	68	32.9
No.	102	26.4	65	34.6	20	19.4	17	17.7	83	40.1
Total	387	100	188	100	103	100	96	100	207	100
9 Who, do you think, should be responsible for conserving homestead woodland landscape? (two choices at most)										
Anyone who may concern should support	50	9.3	31	11.9	7	5.2	12	8.5		
House owners should maintain by themselves.	310	57.9	139	53.5	91	67.9	80	56.7		
Have tourists pay the entrance fee to the village.	23	4.3	15	5.8	5	3.7	3	2.1		
Local authorities of the village, town and the prefecture should subsidize.	283	52.9	112	43.1	64	47.8	107	75.9		
The state government should support.	72	13.5	50	19.2	20	14.9	2	1.4		
Volunteers such as from NPO should help with maintenance.	31	5.8	8	3.1	5	3.7	18	12.8		
Others	21	3.9	16	6.2	1	0.7	4	2.8		
No response	18	3.4	9	3.5	6	4.5	3	2.1		
Total	535	100	260	100	134	100	141	100		

Regarding the functions of Fukugi woodlands, there exists slight differences among the survey sites. The respondents from Tonaki Island have more highly valued the typhoon prevention function than those at the other two survey sites. It suggests that residents at the extremely small island cherish the surrounding woods as preventing their houses from strong winds. The respondents from Tonaki Island and Bise Village more highly valued the psychological peace and aesthetical landscape brought by the green trees than those at Imadomari and Aguni.

About half of the respondents complained about the maintenance difficulty of woodlands. The problems listed by them included cleaning the smelly fruits and fallen leaves. Around 40% of them said that the bats who feed on fruits also brought problems, such as befouling their cars and noises at night. It is worth mentioning that only 30% of the respondents in Tonaki Island complained about the problems of woodlands. The tradition to

clean the garden and village road before breakfast by the housewife still exists in this small village.

Close to 30% of the respondents in the three new surveyed sites stated that Fukugi woodlands should be utilized in other means besides windbreak. In contrast, around 43% claimed that new ways of utilization should be considered in Bise Village in 2002. Around 40%, although slightly different in the three surveyed sites, agreed with new means of utilizing the current woodlands as the venue of environmental education for pupils, green tourist resource and producing seedlings of landscaping trees. Both Aguni Island and Bise village more valued them as attractions for tourists than the other two survey sites of Tonaki and Imadomari. The village office at Aguni Island is making efforts to develop tourism. According to the head of Bise village, approximately 200-300 tourists visit the village each day. Both these two sites have been considering to develop tourist resources.

More than 70% of the respondents said that they maintained the woodlands regularly or sometimes. The respondents at two islands of Tonaki and Aguni had a higher percentage for woodland maintenance than the other two sites in mainland Okinawa. Regarding who should take the responsibility for maintaining, more than half of the respondents stated that the house owners and the community should be responsible.

### 3.3 WTP for conservation

About 358 of the 480 respondents were willing to pay ( see table 3). Around 25.2% of the respondents rejected the payment to preserve Fukugi trees. Regarding the reasons of refusal to pay for conservation, half indicated that Fukugi trees should be preserved at other means. The result is consistent with the item 9 at table 2 that more than half of the respondents indicating that house owners should be responsible for woods preservation.

Table 3 Distribution of respondents by the amount of WTP (N=480)

Amounts of WTP	Frequency	Percent
0	121	25.2
100	4	0.8
200	1	0.2
300	3	0.6
500	61	12.7
1000	178	37.1
1500	2	0.4
2000	70	14.6
3000	22	4.6
4000	1	0.2
5000	14	2.9
10000	3	0.6
Total	480	100

Mean and median WTP values were estimated to be JPY1,457/household and JPY 1,000/household, respectively (see table 4).

Table 4 Estimation of WTP for Fukugi trees consevation (N=359)

Item	Mean	Median	Std. Deviation	Minimum	Maximum
WTP	1456.8245	1000	1273.0344	100	10000

The ordinary least square (OLS) regression was used to calculate the significant factors that influenced the willingness to pay for the conservation. The WTP was assumed as independent in this analysis. The model was shown as the following.

$$WTP = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_m X_m$$

where the dependent variable (WTP) is explained by independent variables ( $X_i$ ), while the  $\beta_m$  are parameters to be estimated. The independent variables  $X_i$  represent respondents' personal characteristics (such as gender, age, occupation), the situation of the conservation of Fukugi trees and the village of residence.

We also use the binary logistic regression (BLR) to identify relationship of attitude of Fukugi tree. The general form of binary logistic regression is as follows:

$$y = a + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_m X_m \quad (1)$$

$$y = \log_e \left[ \frac{P}{1-P} \right] = \text{logit}(P) \quad (2)$$

$$P = \frac{e^y}{1+e^y} \quad (3)$$

The variable's descriptions of the OLS and BLR models can be seen at table 5.

Table 5 Variable descriptions (N=480)

Variable	Description	Mean	Std. Deviation
WTP	willingness to pay of respondent	1089.5833	1269.7278
y1	=1 if respondent's attitude towards the conserving of Fukugi trees is positive, =0 otherwise	0.9146	0.2798
y2	=1 if respondent complains the problems in having Fukugi , =0 otherwise	0.4979	0.5005
y3	=1 if respondent's attitude towards the use of Fukugi trees is positive, =0 otherwise	0.2958	0.4569
IMADOMARI	=1 if respondent is from Imadomari Village, =0 otherwise	0.5250	0.4999
FUKUGI	=1 if respondent is having Fukugi trees around the house, =0 otherwise	0.7292	0.4449
MAINTAIN	=1 if respondent maintained the woodland, =0 otherwise	0.5479	0.4982
GENDER	=1 if respondent is male, =0 otherwise	0.5229	0.5000
AGEYOUNG	=1 if respondent's age<30 years old, =0 otherwise	0.2396	0.4273

Regarding the OLS model, coefficients of age and gender of respondents were not significant as table 6 shows. The finding of demographic variables as being insignificant was also reported at the other contingent valuation studies (e.g, Legget et al., 2003; Jim and Chen, 2006; Notaro and Salvo, 2010; Majumdar et al. 2011). However, NAKIJIN is high significant factor with the sign negative, suggesting that the respondents from Imadomari village where is located in Mainland Okinawa were more inclined to pay less. OFFICER is also significant factors, and the sign were positive. It is suggesting that respondents such as teachers, public officers who have stable income source were more inclined to pay have the willingness to pay more.

MAINTAIN is significant with the sign positive which means the respondents who have regularly or sometimes maintained the woodlands were willing to pay more.

The models based on BLR showed significant influence of respondents' demographic characteristics on their attitude of Fukugi trees (Table7). Preference differences were found in the respondents with difference in the village of residence, age and occupation.

The respondents, who are from Imadomari village, who have Fukugi trees around their house, or who have regularly or sometimes maintained the woodlands are more likely to complain the problems in having the woodlands. However, the respondents who are teacher or public officer are less likely to have the problem.

Regarding the attitude of the utilization of the Fugugi woodland, the respondents who have Fugugi trees are more likely to have positive attitude of utilizing Fukugi woodlands in other means besides windbreak.

Table 6 Results for OLS (N=480)

Variable	Coefficients	Std. Error
Intercept	1265.3467***	134.1725
NAKIJIN	-332.5264***	117.4088
YASHIKI	-238.3502	162.8514
MANAGEMENT	246.4028*	146.3353
OFFICER	410.2010**	202.8653
Adjusted R Square	0.0318	

\*\*\* Significant at 0.01 level.

\*\* Significant at 0.05 level.

\* Significant at 0.10 level.

Table 7 Maximum likelihood estimation of binary logistic regression for residents' attitude toward Fukugi trees (N=480)

Variable	Attitude toward conserving Fukugi trees		Attitude toward the problems to have Fukugi trees		Attitude toward the utilizationFukugi trees.	
	Estimate	Std.error	Estimate	Std.error	Estimate	Std.error
Intercept	2.8719***	0.4877	-2.5816***	0.3603	-1.7008***	0.3061
NAKIJIN	-1.4790***	0.4375	0.3998*	0.2238	-0.0033	0.2122
YASHIKI	-0.0346	0.4032	2.4907***	0.3616	0.9681***	0.3295
MAINTAIN	1.0686**	0.4292	0.5791**	0.2572	0.3555	0.2606
OFFICER	0.1594	0.6666	-1.1312***	0.4375	-0.6065	0.4460
GENDER	0.4734	0.3467	0.2807	0.2166	-0.2226	0.2081
AGEYOUNG	-0.5188	0.3644	0.0674	0.2701	0.1128	0.2554
Chi-square	32.6723		149.4912		28.6466	
-2 Log likelihood	247.4590		515.9218		554.3542	

\*\*\* Significant at 0.01 level.

\*\* Significant at 0.05 level.

\* Significant at 0.10 level.

#### 4. Discussion

##### 4.1 Windbreak vs. multi functions

Findings pertinent to residents' attitudes toward Fukugi tree conservation in three surveyed hamlets were similar to those in Bise Village surveyed in 2002 (Nakama 2008). Majority of the respondents, accounting for around 91.4%, preferred homestead woodlands to being conserved. However, special attention should be paid to

those who preferred without Fukugi trees since they are the potential threats to tree conservation. The fact existed that trees were cut due to various reasons. A male respondent at his 70s said that he had all the trees cut when his son rebuilt his new house. Another lady at her 40s told us that the tree lines at the rear of her house were cut around 10 yrs ago. Since her house is next to the community center, the drunkards always traversed the woodland at the rear of her house after the get-togethers. After cutting, her garden and house suffered a lot from tide water and then she had to replant with other tree species. Interview with local administrative staff also revealed their indifference towards Fukugi trees conservation. The officer of Education Section in Nakijin Village stressed that homestead woodlands are private property and it is difficult to restrict tree cutting. He said that there is no conservation strategy by the village office in the near future.

Residents have highly valued the amelioration of micro-climate by homestead woodlands, such as windbreak and cooling the air in summer. In contrast, the contribution to biodiversity was slightly assessed, in particularly, in two small isolated islands. It was revealed that residents at small isolated have highly valued standing Fukugi trees concerning the function of preventing from typhoons. However, in general the necessity of Fukugi trees as windbreak to protect typhoons has been sharply decreasing with the establishment of strong concrete houses in recent decades. The loss of traditional utilization led to the tree cutting in the homestead. The change to fossil fuel use has resulted in the sharp decrease of homestead woods in the plain region in Japan (Okada and Asakawa 2001).

Thus, the other functions such as its contribution to landscape scenery and green space should be recognized in order to conserve these trees.

#### 4.2 Private property vs. environmental goods

Both local residents and local authority have indicated homestead woodlands as private property that could be dealt with at house owners' will. Fukugi tree is an extremely slow growing species, thus, it is impossible to recover Fukugi trees in a short term once they were cut. The homestead woodlands also as environmental goods that provide a series of ecosystem services for free should be considered at public decision making process.

In addition, homestead woodlands in Okinawa has a long history dating back to around 300 yrs ago (Chen and Nakama 2011a). It should be valued as cultural property that have been created, shaped and maintained by generations of farmers based on local natural resources, using locally adapted knowledge and practices.

Around half of the respondents perceived that Fukugi trees could be used in other new means. Another half of the respondents preferred that it should be kept untouched. This part of respondents were also found to be less concerned about woodland conservation.

Residents have considered forest management as burden of chores. Given the soci-economic background of ageing and depopulation in the remote areas, there exists difficulty of good maintenance of current homestead woodlands.

In addition, about half of the respondents perceived that the house owners and/or local authority such as hamlet community should be responsible for the conservation, which attributes to consider homestead woodland as pure private property. Conservation strategy has not been considered yet by local authority. Not only local residents, but also local authority considered the private homestead woodlands as pure private goods, so that woodlands should be managed and dealt with by the owners at their free wills. Green space around the settlement is a significant factor of rustic landscape. The indigenous landscape with traditional culture is important attraction

to the tourists. In particular, Okinawa Prefecture has become one of the most popular tourist destinations in Japan, attracting around 5.5 million visitors in 2011 (Tourism Policy Division, Okinawa Prefecture). Bise Village is next to the Ocean Expo Park that is one of the major attractions. Being a stopover spot en-route to the Ocean Expo Park, Bise Village attracted around 200-300 tourists/day. These four survey sites are potential tourist hot spots in Okinawa Prefecture. Thus, importance of traditional forests as surrounding attractions should be recognized. The traditional aesthetic green space is also vital resources for sustainable tourisms, such as green tourism, alternative tourism, agro-tourism and etc.

Regarding the potential contribution of traditional homestead woodlands towards the green tourist industry in Okinawa. Tourist facilities, such as nearby hotels, the Ocean Expo Park and Nakijin Castle Remains should also financially support the forest conservation in these villages?

Subsidy system to support tree planting around the homestead by the local government is reported to be an effective tool for landscape conservation (Inagaki et al. 2004). A cooperative conservation strategy with the citizens and NPOs was proposed for green space conservation at the fringe of metropolitan (Murakami 2008).

#### 4.3 Environmental awareness of local residents are the key to homestead woodland conservation

Concern about environmental issues have a positive effect on the payment to conserve forests (Baranzini et al. 2010). Residents' participation in natural management is of prime importance to conservation (Badola et al. 2012). suggesting that the respondents who had a positive attitude towards conserving Fukugi trees were more inclined to pay more than JPY 1000 It was found in this study that the respondents who were indifferent to utilization of homestead woodlands were inclined to pay less for conservation.

Environmental education and awareness arising are needed for local residents to conserve their homestead woodlands.

### 5. Conclusion

Traditional homestead woodland landscape that was established around 300 yrs. ago prevailed along the islands in Okinawa Prefecture. However, these planted Fukugi trees have sharply decreased majorly due to the societal and economic changes. The residents' attitude towards homestead woodland was surveyed for traditional forest conservation.

Overwhelming majority of the respondents preferred homestead woodlands to being conserved. About half of the respondents perceived that the house owners and/or local authority such as hamlet community should be responsible for the conservation. Good maintenance and routine pruning were considered as additional chore to the house owner. The abandoned house woodlands and undermanaged planted woods have greatly degraded the rural landscape and the wellbeing brought by the green space. The difficulty of planted woods management is partly attributed to the tree cutting. A conservation strategy with multi-stakeholders including authority, citizens who may concern, NPOs is proposed.

It was found that Fukugi homestead woodlands were considered as private goods by the dwellers as well as local authority. Traditional green landscape with the prevalent Fukugi trees represents the co-evolved history of natural environment and human. The past should be recognized in order to build a sustainable and resilient rural settlements under the potential threats of extreme climate change and natural disasters for the small island region. Planted woodlands surrounding the houses, although at small area, also provide the ecosystem services for the

human's well-being, e.g., natural hazard regulation and amenity services besides its traditional productive function of building materials, fuel wood and manure.

The interesting finding in this study revealed that the residents' attitude toward homestead woodland was significant factor influencing their willingness to pay for woods preservation. Estimated mean and median WTP values were JPY 1,457/household and JPY 1,000/household, respectively. It is urgent to evaluate the non-use value of homestead woodlands as environmental goods and urge local policy makers to include Fukugi homestead woodlands in landscape planning and conservation.

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