

Feasibility Study on “Satoyama Banking” in Japan

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1. Introduction

In the international community, CBD, IAIA, TEEB and BBOP have recommended that a biodiversity offset scheme be introduced into many countries. Biodiversity offsets have already been legislated in at least 53 countries. (Tanaka, Otaguro, 2010).

In Japan, Tanaka (1994) introduced concepts of mitigation hierarchy and biodiversity offset banking. After CBD COP 10 in Nagoya, a sense of biodiversity conservation has been strengthened among Japanese people, and Ministry of Environment Government of Japan released “Draft report for Introducing the biodiversity offset to Environmental Impact Assessment in Japan” in 2014. In 2010, the author proposed “Satoyama Banking” a biodiversity banking concept specific to Japan while there were currently no legal obligations for biodiversity offsets.

Tanaka (1994, 1998, 1999, 2003a, 2003b, 2010a, 2010b) surveys and analyzes the biodiversity banking systems in other countries and how to adapt them to Japan. However, empirical pilot study of the biodiversity banking has never been done in Japan.

Therefore, the purpose of this study is to consider the feasibility, especially the financial aspect, of the biodiversity banking in Japan, through the empirical pilot study of it.

2. Methodology

We conducted a literature review and questionnaire surveys to identify recent trends of biodiversity offsets with authorities, companies and NPOs in Japan. First, we analyzed 59 regional biodiversity strategies from the view point of similarity to

biodiversity offsets. We next conducted a questionnaire survey regarding level of awareness of biodiversity offsets in industry during the largest environmental exhibition in Japan, “Eco-Products 2013” . We received responses from 51 companies and 101 NPOs. In addition, we conducted a questionnaire survey to identify the ethical needs for biodiversity offsets in Chiba Prefecture during the “10th Satoyama symposium in Chiba” in 2013. We received responses from 88 participants.

From 2011 we started the first Japanese biodiversity banking “Satoyama Banking” pilot study by employing an NPO to do wet-paddy rice agriculture at a rate of five dollars an hour at a 6.39-ha Satoyama consisting of former paddy fields and second-growth forests in a suburb of Chiba City in Chiba Prefecture. We will use the term “the pilot study of a biodiversity banking” to refer to the development of three conservation plans, estimation of the cash flow for each plan, and the evaluation of the conservation and a questionnaire survey regarding “Willingness to Pay” for 23 companies. We will also use the term “Japanese “Satoyama Banking” to include selecting a banking site on real Satoyama area,

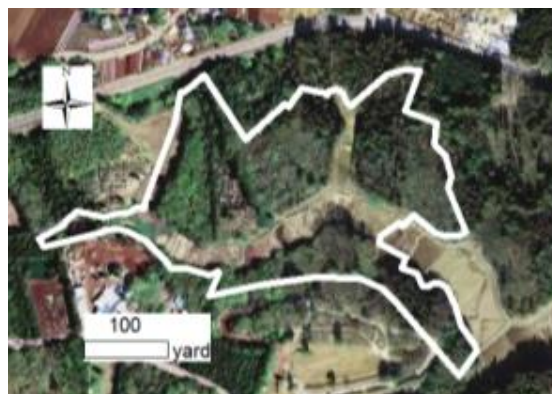


Figure 1: Aerial photo of the pilot study area

forecasting income under “Beneficiary Pays Principle” such as government grants with no legal obligations for biodiversity offsets and recommending wise-use such as rice cropping on the sites.

3. Results and Discussion

3-1. Current status regarding biodiversity offsets by Government, Companies and NPOs in Japan

(1) Governments

10 local governments have local goals and guidelines with PPP, and 6 local governments include biodiversity offset/compensatory mitigation in their glossaries. Aichi Prefecture has an experimental “Aichi mitigation” guideline which is very similar to biodiversity banking for which the author has been working.

Ministry of Environment of Japan released “Draft Introducing the biodiversity offset to Environmental Impact Assessment in Japan” in June 2014. Put simply, governments in Japan are surely moving towards the introduction of biodiversity offsets.

(2) Companies and NPOs

Over 60% of both the companies and NPOs answered that they had heard of biodiversity offset. In addition, over 30% of companies answered that they knew the meaning of biodiversity offset.

According to Tanaka (2011), when he searched the internet for “biodiversity offset/compensatory mitigation” in Japanese language using the Japanese Google engine on June 2009, the only hits returned were his own journal articles. By February 2015, “biodiversity offset” returns 67,300 hits on the same search. All these things make it clear that biodiversity offset has been brought to national attention in Japan.

3-2. Residents of a Chiba Prefecture certain parts of the pilot study area.

The results clearly show three things. They acknowledge the degradation of their neighborhood nature due to impact by development projects (Figure 1 and 2). Then, they demand compensation from the developers under the PPP (Figure 3). That is to say, the residents of Chiba Prefecture have ethical needs for biodiversity offsets.

3-3. Outlook of the pilot study area and its three operating draft plans

The pilot study area is a 6.39-ha Satoyama comprised of abandoned former paddy fields and second-growth forests in a suburb of Chiba City in Chiba Prefecture. The potential natural vegetation is *Camellietea japonica*. Chiba City picked up 25 Satoyama areas to conserve, and the pilot study area was selected. In February 2015, a NPO began to rehabilitate 0.4 ha paddy field and a small *Quercus serrata* region in the pilot study area.

We developed three 30-year Satoyama banking working draft plans. “Plan 1: no action” is to conduct no action. “Plan 2: conservation for paddy field” is to restore a 1.16-ha wet-paddy rice agriculture field in cooperation with the NPO, paying them 5 dollars an hour. “Plan 3: conservation for paddy field and second-growth forests” is to restore a 1.16-ha wet-paddy rice agriculture field with NPO at 5 dollars an hour, and a 5.23-ha of *Quercus serrata* region with banks and others at standard salaries.

3-4. Evaluating conservation results of the 3 plans in accordance with HEP methods.

We selected *Rana japonica* as indicator species for

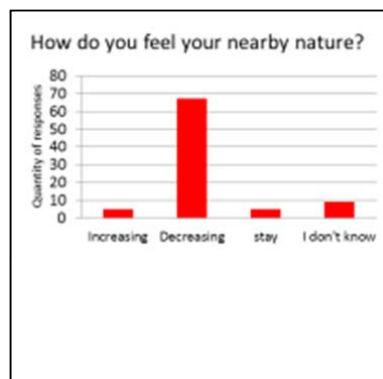


Figure 2: Residents' knowledge about the nature in the Chiba Prefecture

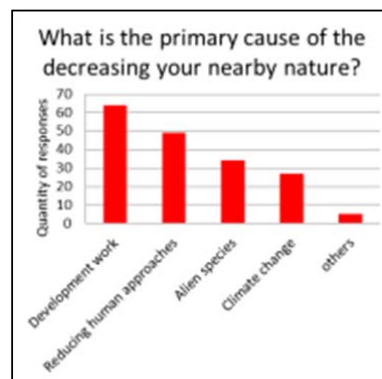


Figure 3: Residents' knowledge about the cause of matter of decreasing habitat in the Chiba Prefecture

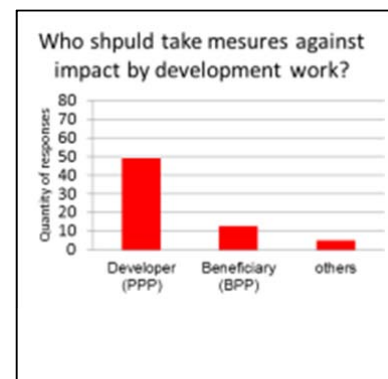










Figure 4: Residents' ethical needs for biodiversity offsets

destroying 1.45 ha healthy (HSI=1.0) Satoyama over 30 years (Table 3 and 4).

Table 1: Three 30-year Satoyama banking working draft plans

Plan	content
Before activity	Before NPO activity, one landowner rehabilitates 0.33 ha wet-paddy rice agriculture field. But other areas in the pilot study area are leaving for many years. There are many <i>Pleioblastus chino</i> Makino in the second-growth forest.
Plan 1: No action	This plan means leaving for 30years at the pilot study area. The wet-paddy rice agriculture field will be dry grassland.
Plan 2: Conservation for paddy field	This plan means to rehabilitate 1.16 ha wet-paddy rice agriculture field with NPO by hourly 5 dollars an hour. North some wet grassland will be dry grassland due to build PVC greenhouse to put some activity tools.
Plan 3: Conservation for paddy field and second-growth forest	This plan means to rehabilitate 1.16 ha wet-paddy rice agriculture field with NPO by hourly 5 dollars an hour. North some wet grassland will be dry grassland due to build PVC greenhouse to put some activity tools. In addition, the banker and other by standard budget for salaries will rehabilitate 5.23 ha <i>Quercus serrata</i> vegetation

Legend	
	Conserved <i>Quercus serrata</i> forest
	Not conserved <i>Quercus serrata</i> forest
	Uncontrolled <i>Cryptomeria japonica</i> forest
	<i>Pleioblastus chino</i> Makino vegetation
	Paddy field
	Storage reservoir
	Wet grassland
	Dry grassland

wetlands such as wet-paddy rice agriculture fields and *Sasakia charonda* as indicator species for second-growth forests such as *Quercus serrata* region. The two indicator species are chosen as the target species in this area by Chiba City and obtained from Red Data Books of Chiba Prefecture.

In this study, we calculated the Cumulative Habitat Unit (CHU) used in HEP for the 3 plans. CHU is the index for the concept of “quality” x “area” x “time”. A HSI model for the two species has been developed by JEAS (2006) and KAMIGO (2007). So we adapted these models for the pilot study area. The HSI model is the index for the concept of “quality” in HEP.

In the results, the “Plan 2: conservation for paddy field” produces 6.22 (=63.21-56.99) CHU [ha/30year] by comparison with “Plan 1”. Also, “Plan 3: conservation for paddy field and second-growth forests” produces 43.48 (=100.47-56.99) CHU [ha/30year] by comparison with “Plan 1”. We decided that 6.22 CHU [ha/30year] could potentially offset the impact of some development projects such as destroying 0.31 ha healthy (HSI=1.0) Satoyama over 30 years. Also, we decided that 43.48 CHU [ha/30year] has the potential to offset the impact of same projects such as

Table 2: CHU [ha/30year] of the 3 plans by HEP

	<i>Rana japonica</i>	<i>Sasakia charonda</i>	Total average
Plan 1	101.04	12.95	56.99
Plan 2	113.47	12.95	63.21
Plan 3	125.99	74.96	100.47

Table 3: How much the biodiversity offsets potential of 6.22 CHU [ha/30 year]?

CHU [ha/30year]	Quality [HSI]	Area [ha]	Time [year]
6.22	Good (HSI=1.0)	0.23	30
	Normal (HSI=0.5)	0.42	30
	Bad (HSI=0.1)	2.10	30

Table 4: How much the biodiversity offsets potential of 43.48 CHU [ha/30 year]?

CHU [ha/30year]	Quality [HSI]	Area [ha]	Time [year]
10.88	Good (HSI=1.0)	1.45	30
	Normal (HSI=0.5)	2.90	30
	Bad (HSI=0.1)	14.50	30

3-5. Estimating the cash flow for each Satoyama banking operating draft plans

Table 5 and 6 show the estimated results of the cash flow for Satoyama banking in the pilot study area by “Plan 2: conservation for paddy field” and “Plan 3: conservation for paddy field and second-growth forests”.

education such as gathering bamboo shoots in “Plan 3”. Governments and financial group grants were estimated from the central value for the NPO that conserves nature in Chiba Prefecture. The income by annual fee and admission fee were estimated from the actual fee for NPO in the pilot study area.

Table 5 : Estimating results of the cost for Satoyama banking operating in the pilot area by each “Plan 2” and “Plan 3”

	Plan 2 (\$/0.21ha · 30year)	Plan 2 (\$/1.00ha · 1year)	Plan 3 (\$/1.45ha · 30year)	Plan 3 (\$/1.00ha · 1year)
Labor cost to rehabilitate paddy fields	411,600	1,960,000	411,600	283,860
Tool cost to rehabilitate paddy fields	115,600	554,760	115,600	79,720
Labor cost to rehabilitate <i>Quercus serrata</i> vegetation	0	0	350,400	241,650
Tool cost to rehabilitate <i>Quercus serrata</i> vegetation	0	0	162,900	112,350
Labor cost to administration of Satoyama banking	62,000	295,240	62,000	42,760
Tool cost to administration of Satoyama banking	65,300	310,950	65,300	45,030
Land fees	16,6800	794,300	166,800	115,040
subtotal	821,300	3910,950	1,334,600	920,410

Table 6 : Estimating results of the income for Satoyama banking operating in the pilot area by each “Plan 2” and “Plan 3”

	Plan 2 (\$/0.21ha · 30年)	Plan 2 (\$/1.00ha · 1年)	Plan 3 (\$/1.45ha · 30年)	Plan 3 (\$/1.00ha · 1年)
Income from some events for ecological education	30,000	142,850	60,000	41,380
Government and financial grants	99,200	472,380	99,200	68,410
Income by annual and admission fee	85,400	406,670	85,400	58,900
Income from paddy rice agriculture	0	0	0	0
Income from selling credits	?	?	?	?
subtotal	821,300	3910,950	1,334,600	920,410

The labor cost to rehabilitate paddy field fields was estimated as the accepted actual activities with NPO at 5 dollars an hour at the pilot study area. The item cost to rehabilitate wet-paddy rice-agriculture fields was also estimated from the NPO's actual activities at the pilot study area. The labor cost to rehabilitate *Quercus serrata* region was estimated as the banker or hired labor based on Kazama and Tahira (2012). The labor cost to administer of Satoyama banking was estimated from the actual NPO administration at 10 dollars an hour.

The income from some events for ecological education on “Plan 2” was estimated from the actual NPO income from the wet-paddy field in the pilot study area. The income from some events for ecological education on “Plan 3” was estimated as twice this income, as the second-growth forest is conserved and we can hold some events for ecological

The income from wet-paddy rice agriculture was estimated as zero, as we assume the paddy rice will be given to the NPO.

In the results, when the banker operates Satoyama banking under “Plan 2”, he has to sell 6.22 CHU [ha/30 years] at a price of 637 thousand dollars in order to balance. Also, when the banker operates Satoyama banking under “Plan 3”, he has to sell 43.48 CHU [ha/30 years] at a price of 1,090 thousand dollars from the balance of payments. From the balance of CHU and money, “Plan 3 (751 [thousand dollar / 1ha · 30 year]=1,090 [thousand dollar] / 1.45 [ha] · 30 year)” is better than “Plan 2 (3,032 [thousand dollar / 1ha · 30 year]=637 [thousand dollar / 0.21 ha · 30year]” to operate Satoyama banking in the pilot study area.

3-6. Willingness to Pay of biodiversity offsets by companies in Japan

We conducted a questionnaire survey regarding “Willingness to Pay” for biodiversity offsets for the 23 companies. We asked them how much they felt their company could pay for biodiversity offsets toward their companies’ projects such as destroying a 1.0-ha healthy (HSI=1.0) Satoyama for over 30 years without the obligation. In the results, the price companies are willing to pay is 490 thousand dollars from the answers based on double-bound model.

We then asked them how much they feel their company can pay of the biodiversity offsets for companies’ projects such as destroying 1.0 ha healthy (HSI=1.0) Satoyama for 30 years with the obligation. In the results, the price companies are willing to pay is 939 thousand dollars from the answers with double-bound model. They answered with some conditions such as depending on the development benefit.

4. Conclusions

This study has the following three conclusions:

1. In Japan, biodiversity offsets may be an engine for conservation of nature.

Table 7: How much do you feel your company could pay for biodiversity offsets towards your company’s project as destroying good quality 1.0ha nature over 30 years without legal obligation? (Double-bound)

T1[\$]	TU[\$]	TL[\$]	YY	YN	NY	NN
30,000	45,000	15,000	3	1	0	0
45,000	60,000	30,000	5	1	0	1
60,000	75,000	45,000	3	1	0	0
75,000	90,000	60,000	3	1	0	2

T1 : Opening WTP[\$]

TU : If opening WTP is “YES”, we offer this WTP[\$]

TL : If opening WTP is “NO”, we offer this WTP[\$]

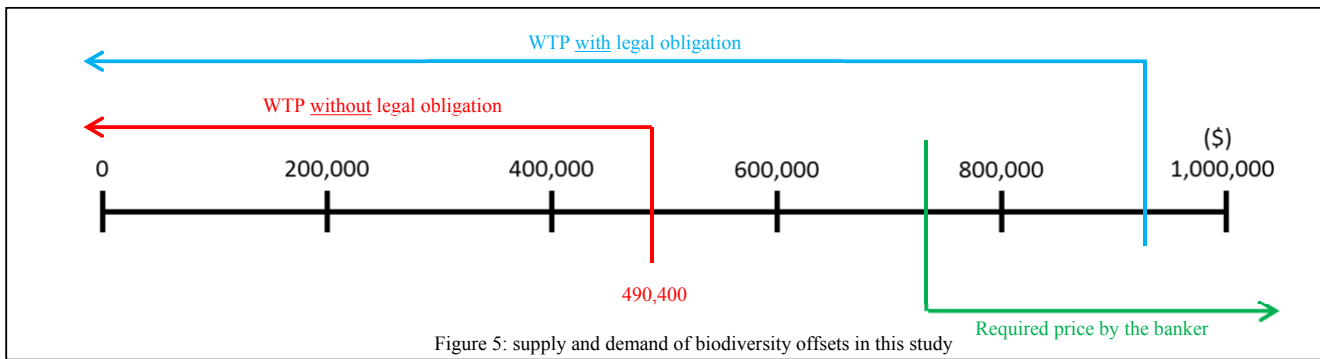
Table 8: How much do you feel your company could pay for biodiversity offsets towards your company’s project as destroying good quality 1.0ha nature over 30 years with legal obligation? (Double-bound)

T1[\$]	TU[\$]	TL[\$]	YY	YN	NY	NN
300,000	450,000	150,000	2	2	0	2
450,000	600,000	300,000	3	1	0	3
600,000	750,000	450,000	3	0	0	2
750,000	900,000	600,000	2	1	0	3

T1 : Opening WTP[\$]

TU : If opening WTP is “YES”, we offer this WTP[\$]

TL : If opening WTP is “NO”, we offer this WTP[\$]



2. There are the ethical needs for biodiversity offsets for some Japanese citizens.

3. The biodiversity “Satoyama Banking” might be feasible financially in certain areas of Japan when coupled with voluntary CSR activities by some companies and when there are obligations for biodiversity offsets.

The banker in the pilot study area must sell the conservation results on “Plan 3: conservation for paddy field and second-growth forests” at a price of over 751 thousand dollars to operate in the black. On the other hand, the WTP with voluntary CSR activities by some companies are 490 thousand dollars. Under the obligation for biodiversity offsets, some companies can pay 939 thousand dollars for it from the questionnaire survey regarding to WTP of the conservation results on “Plan3”.

We propose three approaches to promote “Satoyama Banking” in Japan.

1. Satoyama is the system to coordinate many biodiversity conservation activities by multi-stakeholders.
2. The local authorities should give companies the motivation to conduct biodiversity offsets until the biodiversity offsets will be legal obligation. Aichi Prefecture has started this action. We hope this action would be adopted by many other local authorities.
3. Mandating biodiversity offsets for all development works from Environmental Assessment Law. From this study, we conclude that biodiversity offsets is not a burden for large companies. In this study, we could get the answers about willing to pay for biodiversity offsets from the big companies. This is the reason that we propose that mandating biodiversity offsets for only development works from Environmental Assessment Law is necessary.

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