Cultural Ecosystem Service Assessment in a Semi-Mountainous Area of Japan: Case in Toyota City

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Abstract One of the categories included in the Millennium Ecosystem Assessment (MA) developed in 2005 is cultural ecosystem services (CESs), which includes a variety of factors such as aesthetic values, recreation and ecotourism. In order to assess the CESs, a simple questionnaire survey was conducted in a semi-mountainous rural town in Japan. The town of Inabu in Toyota City, Aichi Prefecture, was selected for the case study. The face-to-face (FTF) survey was conducted from October to November 2012 and prioritized forest-related sites in the town. According to the results, aesthetic values received the highest score among the CESs, followed by recreation and ecotourism, while each forest-related site had a different combination of CES values. By using cluster analysis, three clusters were identified: aesthetic values, recreation and ecotourism, and 'others'. In some sites, the CES scores differed between residents and visitors such that residents recognized a wider variety of CES than visitors did.

INTRODUCTION

Cultural ecosystem service (CES) is one of the ecosystem service (ES) categories in the Millennium Ecosystem Assessment (MA) developed in 2005 (MA, 2005). The CES category includes ten benefits, such as spiritual and religious values, aesthetic values, recreation and ecotourism, cultural heritage values, educational values, and several others (MA, 2005). There have been several studies on ES assessment (MA, 2005; Costanza et al., 1997; Milcu et al., 2013). While most of these studies focused on ESs (such as provisioning and regulating), the studies on CESs were limited (Brancalion et al., 2013). However, in the field of environmental economics, numerous studies have evaluated part of the CES, such as recreation or aesthetic value (TEEB, 2010). These studies endeavoured to place a monetary value on the cultural aspects of nature; in some cases, it was difficult to divide the values of each separate aspect from the whole. Recently, the number of studies focusing on CES assessment has increased (Daniel et al., 2012; Brancalion, et al., 2013; López-Santiago et al., 2014; Garcia-Nieto et al., 2013; Ota et al., 2013; Weyland and Laterra, 2014). Some of these utilized questionnaire surveys in an attempt to capture the people's perception of CESs. For example, Brancalion et al. (2013) studied aesthetic values, recreation and tourism values, religious and psychological values, educational values, knowledge generation, etc. in the Brazilian forest restoration project. López-Santiago et al. (2014) studied 16 ESs including tranquillity and relaxation, tourism, cultural identity, hunting, and aesthetic value in the case of transhumance in Spain. Ota et al. (2013) conducted a subjective assessment study on 36 ESs including 11 CES-related items. However, these studies did not focus on the identification and prioritization of forest-related sites in small scale areas. Also they did not capture the ES

characteristics of the sites which would be needed for spatially large scale assessment.

OBJECTIVE

The purpose of this study was to identify major forest-related sites in a semi-mountainous area and the characteristics of their CESs by employing a simple survey method. The town of Inabu in Toyota City, Japan, was selected for the case study.

METHODOLOGY

Study Area

Toyota City is located in Aichi Prefecture (Fig. 1). Inabu (the city branch office of which is at 35.216N, 137.509E) is located in the northeast part of the city, where about 87% of the area is forested (Toyota City, 2014a). The Japan Meteorological Agency (JMA) states that the average annual temperature for this area in 2013 was 11.9 °C and the average precipitation was 1785.0 mm (JMA, http://www.jma.go.jp/jma/index.html). The area of the town is approximately 99 km^2. The town has about 2,600 residents (Toyota City, 2014b) and is located 50–60 km east of Nagoya City, which is the third largest metropolitan area in Japan. The town is a typical example of a Japanese semi-mountainous area.
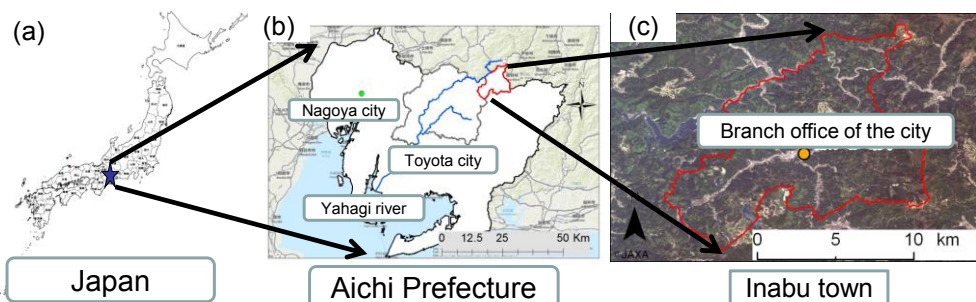
Fig. 1 Maps of the study area: (a) Japan with the Aichi Prefecture in the star symbol, (b) Aichi Prefecture outlined in black, Toyota City outlined in grey, rives in blue, (c) Inabu outlined in red
Source: (a) and (b) made by ArcGIS10.1 and (c) satellite image ©JAXA/ Distribution RESTEC

Methods

First, a document survey focusing on CESs was conducted in order to identify forest-related sites in Inabu. Second, a simple open-ended questionnaire was developed to ascertain respondents' opinions of 11 sites (Table 1); they could choose sites and also add others freely. The survey also contained questions on basic individual attributes including age, gender, municipality of residence, visiting frequency, etc. The reason for employing an open-ended format was to capture the people's direct opinions of a site. Third, a face-to-face (FTF) survey was conducted from October to November 2012 by the authors, research staff, and students in the author's lab with residents and visitors at local sites. Among the 11 sites, three (namely, Ooidaira Park, Donguri-no-sato (adjacent to Donguri Hot Spring and the Inabu Cultural Exchange Facility), and Mennoki Primary Forest) were selected as locations for the FTF survey as well as Inabu branch city office at a local event because the other sites received too few visitors during that season. Also during this period, interview surveys were conducted with an Inabu branch city officer, the city tourist office, a local museum, local knowledgeable people, and several other persons. Fourth, after collecting the answer sheets, two of the authors divided the responses for each site among the CESs based on the classifications of the MA (2005). If there was at least one explanation of a CES of a site, score 'one' was assigned to that CES for the site; if not, score 'zero' was assigned. Then, scores for each

CES were summed up both by site and overall. In cases where an answer sheet included several comments on a number of sites, each comment was treated as an individual comment for the site.

Table 1 Eleven forest-related sites in Inabu, Toyota City

Site name	General description
Donguri Hot Spring	Hot spring located near National Road 153 with some restaurants and shops
Ooidaira Park	Memorial park for a great man in this area and now is famous for autumn leaves
Mennoki Primary Forest	Primary forest of *Fagus crenata* and designated as a quasi-national park
Big Weeping Cherry Trees	370 year old tree in Zuiryuuji Temple and designated as a prefectural natural treasure
Others	Takadoya Wetland (famous for autumn leaves), Big Japanese Judas Trees (prefectural natural treasure), Oshikawa Waterfall, Big Ginkgo Tree (city natural treasure), Natsuyakejyou Mountain (hiking spot, famous for *Lycoris sanguinea var. kiushiana*), Inabu Cultural Exchange Facility, Wariyama (historical shared mountain forest system)

Source: Inabu Tourist Office (2014) amended by the authors

After collecting the data, a statistical analysis was conducted. First, as a basic study, a frequency distribution was developed for each CES in order to examine the cultural aspects of the Inabu forest sites as a whole. Second, the number of comments was totalled by site in order to gain an understanding of how the people prioritized the different areas. For this calculation, comments for a site were excluded if they were obtained through an onsite survey. For example, if an onsite survey was conducted in Ooidaira Park, comments on the park from that survey were excluded in the site totals. This exclusion was only applied to the calculation of site totals, and every effective answer sheet was used in the other analyses. Third, a cluster analysis on the total number of comments by site was conducted to categorize the CESs. Fourth, specific characteristics were examined by site and by residence. Fifth a logistic regression analysis was conducted focusing on cultural heritage values. The statistical analysis was conducted using SPSS statistics ver.22 (IBM).

RESULTS AND DISCUSSION

Table 2 shows the data collected in the FTF surveys. A total of 92 valid answer sheets were collected (95 were collected in all). In these valid answer sheets, there were 271 comments discussing all 11 sites.

Fig. 2(a) shows the percentage of responses that each cultural service received. Aesthetic values ranked highest among the CESs, followed by recreation and ecotourism. In order to compare the FTF survey results, the following data was developed: first, the explanations given by the Inabu Tourist Office website (Inabu Tourist Office, 2014) of the sites' various cultural resources were analysed and divided among the CESs. If there was an explanation of a cultural aspect, score 'one' was assigned to the CES in question. If not, 'zero' was assigned. Second, the total scores for each CES were calculated. When the FTF survey results were compared with the Inabu Tourist Office data, it was found that the two highest scoring subcategories were the same: aesthetic values and recreation and ecotourism. One significant difference was that cultural heritage values were mentioned far more frequently on the Inabu Tourist Office website than in the FTF results.

Fig. 2(b) shows the number of comments that each site received with Ooidaira Park earning the most, followed by Donguri Hot Spring, Big Weeping Cherry Trees, and Mennoki Primary Forest (listed in descending order). There was very little data available on forest site tourism. Aichi Prefecture (2013) statistics reported that in that year, Donguri-no-sato received the most visitors, followed by Donguri Hot Spring and Ooidaira Park. The other forest sites were not listed in the statistics.

Next, a cluster analysis (using average linkage between groups and squared Euclidean distance) revealed that the CESs provided by the Inabu forests were categorized into three clusters: aesthetic values, recreation and ecotourism, and 'others' (Fig. 3).

Specific characteristics were examined by site and by residence. High scoring CESs differed among the sites (Fig. 4(a)). For example, Ooidaira Park scored highest, nearly 80%, in aesthetic values. However, Donguri Hot Spring scored highest, over 90%, in recreation and ecotourism.

Furthermore, in some sites the CES scores differed between residents and visitors. Fig. 4(b) shows that the Mennoki Primary Forest received high scores in aesthetic values, cultural heritage values, and recreation and ecotourism (in descending order) from residents. Visitors, on the other hand, ranked aesthetic values and recreation and ecotourism highly while rarely mentioning cultural heritage values. Fig. 4(c) shows the sum of all the scores for all sites for both residents and visitors. Visitors had more focused values than residents did, as their scores were concentrated on aesthetic value and recreation and ecotourism. Additionally, residents placed a higher priority on cultural heritage values. The total scores by residents were larger than visitors' even though they completed fewer answer sheets (Table 2). Thus, it may be concluded that residents recognized a wider variety of CESs and better understood each site.

Fig. 5 shows the spatial characteristics of aesthetic values and cultural heritage values for Ooidaira Park and Mennoki Primary Forest (by ArcGIS 10.1, ESRI). For both sites, the spatial range of visitors for aesthetic values (Figs. 5(a) and (c)) was wider than that for cultural heritage values (Figs. 5(b) and (d)).

Table 2 Basic data from the collected answer sheets and comments in Inabu

| Number of answer sheets collected		N	%	Number of comments received		N	%
Answer sheets	All collected	95		Age	Under 20 year old	20	7.4
	Valid collected	92	100.0		20–39 years old	62	22.9
Gender	Male answer sheets	38	41.3		40–59 years old	71	26.2
	Female answer sheets	48	52.2		Over 60 year old	110	40.6
	No data for gender	6	6.5		No data for age	8	3.0
Residence	Inabu residents	38	41.3	Residence	Inabu residents	141	52.0
	Visitors to Inabu	54	58.7		Visitors to Inabu	130	48.0
				Total comments received		271	100.0
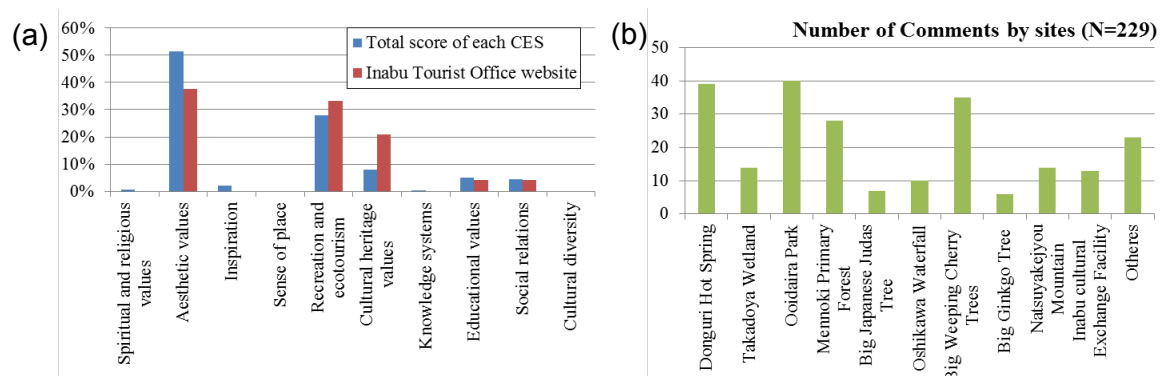
Fig. 2 Percentage of scores of each CES and the number of explanations on the Inabu Tourist Office website(%) (a) and number of comments by forest sites (N=229)[+] (b)

Note: N=229 means that 42 comments (which were collected in on site surveys) were excluded from the total number of comments (N=271)
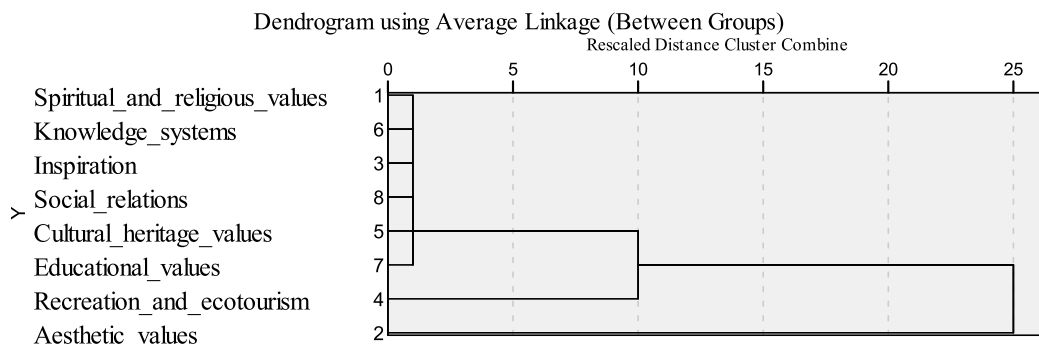
Fig. 3 Cluster analysis for forest sites by CES in Inabu (using average linkage between groups and squared Euclidean distance)
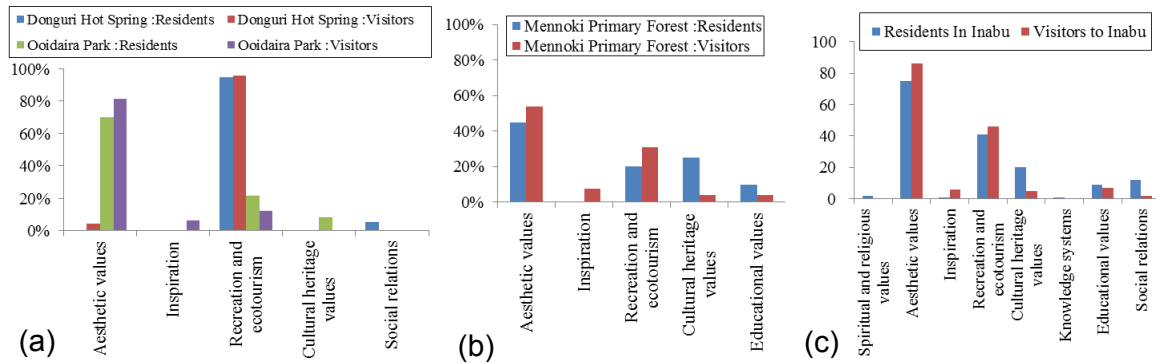
Fig. 4 Percentage of CES scores for Donguri Hot Spring[+] and Ooidaira Park[++] (a), percentage of CES scores for Mennoki Primary Forest[+++] (b), total CES scores for all sites[++++] (c)
Note: [+]total scores N=44, [++]total scores N=86, [+++]total scores N=46, [++++]total score N=313
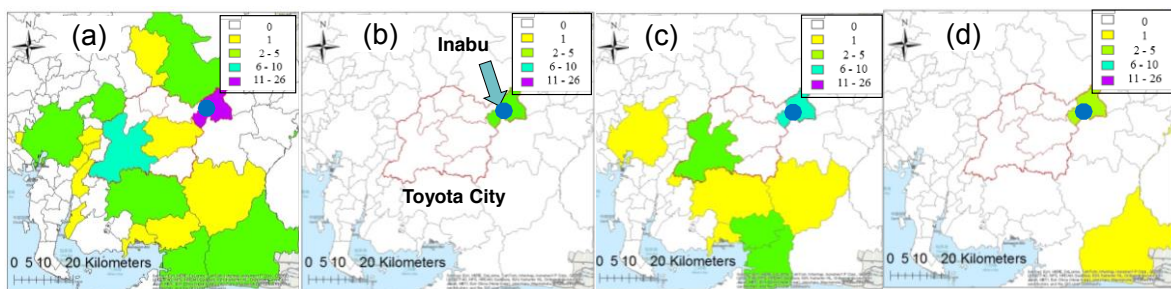
Fig. 5 Total Ooidaira scores by municipality for aesthetic values (a) and cultural heritage values (b), and Mennoki Primary Forest scores for aesthetic values (c) and cultural heritage values (d) by visitors' municipality of residence, blue symbol means Inabu branch office

Table 3 Logistic regression analysis of cultural heritage values in Mennoki Primary Forest (Method = backward stepwise (Wald, P-value in 0.1 and out 0.1))

Basic data	Variables in the Equation					
		B	S.E.	Wald	df	Sig	Exp(B)
Number of comments	Model 1						
Included in analysis (N=35)	Visiting frequency	-.928	.442	4.409	1	.036	.395
Dependent variable	Age range	.766	.399	3.698	1	.054	2.152
Cultural heritage values (1: yes, 0: no)	Gender	3.681	1.755	4.401	1	.036	39.705
Independent variables	Constant	-5.166	2.501	4.266	1	.039	.006
Gender: 1: male, 0: female	Model 2						
Age range: 1:<20, 3:20–39, 5:40–59,7: 60<	Residence	2.157	1.225	3.102	1	.078	8.642
Visiting frequency: 1: several/y- 5:everyday+	Gender	2.288	1.220	3.519	1	.061	9.856
Residence: 1: residents in Inabu, 0: visitors	Constant	-4.383	1.490	8.649	1	.003	.012

Model Summary:	Hosmer and Lemshow test			Cox and Snell	Nagelkerke R
	Chi-square	df	Sig.	R square	square
Model 1	1.112	6	.981	.301	.502
Model 2	.171	2	.918	.213	.355

+: converted to values by 3/year, 4.5/half year, 2.25/month, 1.56/week and 2/3/day, and calculated log

To clarify the factors of cultural heritage values, logistic regression analysis was conducted on Mennoki Primary Forest with cultural heritage values set as the dependent variable. Table 3 shows the basic data and the results of two selected models. First, nonparametric correlations among the variables were checked. Residence and visiting frequency had a rather high correlation of –.570**; thus, two types of variable selection were tested. Model 1 included all of the variables and Model 2 used 'residence' instead of 'visiting frequency'. Both results showed that residence-related factors, namely visiting frequency and residence, were one of the effective variables along with gender.

CONCLUSION

In the study, a simple method was used to assess CESs. According to the results, aesthetic values scored highest among CESs, followed by recreation and ecotourism. Furthermore, each forest site had a different combination of CES values. By using cluster analysis, three clusters were identified: aesthetic values, recreation and ecotourism, and 'others'. In some sites, the CES scoring differed between residents and visitors, indicating that residents recognized a wider variety of CES values than visitors did, such as cultural heritage values. Future studies should include a variety of respondent attributes, such as economic condition and education. By utilizing the results, further studies on detailed and comprehensive assessments of CESs could be conducted. In the future, by upgrading the study method, the beneficiaries, and the burden of cost for biodiversity or ES provisions could be identified. This identification may be useful in the development of better policies such as payment for ecosystem service (PES) and biodiversity offset policies.

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