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Understanding People's Knowledge, Perceptions and Attitudes towards Restoration of Watershed Forests around Inle Lake of Myanmar

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ဒေါက်တာဖြူဖြူလွင်၊ ဦးစီးအရာရှိ၊ သစ်တောသုတေသနဌာန

စာတမ်းအကျဉ်း

အင်းလေးကန်သည် မြန်မာနိုင်ငံရှိ ကုန်းတွင်းရေကန်များအနက် ဒုတိယအကြီးဆုံး ရေအိုင်ဖြစ်ပြီး ဒေသခံပြည်သူများအတွက် ဂေဟစနစ်ဝန်ဆောင်မှုများစွာကို ပံ့ပိုးပေးလျက် ရှိပါသည်။ သို့သော်လည်း စိုက်ပျိုးမြေ တိုးချဲ့ခြင်းကြောင့် အင်းလေးကန်ရေဝေရေလဲ သစ်တော များ ပြုန်းတီးခြင်း၊ နောက်ဆက်တွဲ နုန်းမြေပို့ချမှုများဖြစ်ပေါ်ခြင်း၊ ရေအရည်အသွေး ကျဆင်း လာခြင်း၊ ရေပြင်ဧရိယာအတွင်း ကျွန်းမျောများ တိုးပွားလာခြင်းစသည့် အချက်များကြောင့် အင်းလေးကန်၏ ရေရှည်တည်တံ့မှုကို ဆိုးကျိုးများ သက်ရောက် စေပါသည်။ အင်းလေးကန် ရေဝေရေလဲဧရိယာများအား သစ်တောများ ပြန်လည် တည်ထောင်ခြင်းဖြင့် အင်းလေးကန်ရေ အရည်အသွေးတိုးတက်စေခြင်း၊ နုန်းပို့ချမှုများကို လျော့နည်းစေခြင်းနှင့် ဂေဟစနစ်ဝန်ဆောင် မှုများကို စဉ်ဆက်မပြတ်ပံ့ပိုးပေးနိုင်မည်ဖြစ်ပါသည်။ ဂေဟစနစ် ဝန်ဆောင်မှုများအား အခ ကြေးငွေပေးချေခြင်းစနစ်ကို ကမ္ဘာတစ်ဝှမ်း တွင်ကျယ်စွာ အသုံးပြုလျက်ရှိပြီး ထိရောက်စွာ ဆောင်ရွက်နိုင်ပါက အစိုးရ၏ ဂေဟစနစ်များ ပြန်လည်တည်ထောင် ရေးဆိုင်ရာ ကုန်ကျစရိတ် များအား လျော့ကျစေမည်ဖြစ်ပါသည်။ ဤသုတေသနတွင် အင်းလေးကန်၊ ပတ်ဝန်းကျင် သစ်တောများနှင့် ဒေသနေပြည်သူလူထု၏ ဆက်စပ်မှုကို အခြေခံကာ ဂေဟစနစ် ဝန်ဆောင်မှု များအား အခကြေးငွေပေးချေခြင်းစနစ်တစ်ခုကို စမ်းသပ်လေ့လာ ထားပါသည်။ အဓိက ဝန်ဆောင်မှုအဖြစ် ရေဝေရေလဲသစ်တောများ၏ အင်းလေးကန် တည်တံ့စေရန် ပံ့ပိုးပေးသည့် ဝန်ဆောင်မှုဖြစ်ကာ သစ်တောများပြန်လည် တည်ထောင်ခြင်းအတွက် ဒေသနေ ပြည်သူများ၏ ပေးချေလိုသည့်ဆန္ဒများကို ဦးတည်လေ့လာထားခြင်း ဖြစ်ပါသည်။ ဖြေဆိုသည့် ဒေသနေ ပြည်သူ ၁၆၃ ဦးအနက် ၁၄၆၅.% မှ သစ်တောများ ပြန်လည်တည်ထောင်ခြင်းအတွက် ငွေကြေးထည့်ဝင်လိုသော်လည်း အခြားဖြေဆိုသူများမှာ လူကိုယ်တိုင်လုပ်အားပေးခြင်း၊ မိမိတို့ အိမ်ခြံများအတွင်း သစ်ပင်များ စိုက်ပျိုးခြင်း နည်းလမ်းများဖြင့် ပူးပေါင်းပါဝင်လိုကြောင်း ဖော်ပြခဲ့ကြပါသည်။ တွေ့ရှိချက်များအပေါ်မူတည်၍ မူဝါဒ ရေးရာအားဖြင့် ပံ့ပိုးပေး နိုင်သည့် သုံးသပ်ချက်များအား ဤစာတမ်းတွင် အကြံပြုတင်ပြ ထားပါသည်။

Understanding People's Knowledge, Perceptions and Attitudes towards Restoration of Watershed Forests around Inle Lake of Myanmar

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Abstract

Inle Lake, the second largest freshwater and inland pond of Myanmar has been providing numerous tangible and intangible services to the local communities. However, deforestation in the mountains due to agricultural expansion, consequent sedimentation load and change in the water quality, and expansion of floating gardens within the lake are some of the factors affecting the sustainability of the lake. Afforestation in lake's catchment regions, in particular, not only helps with improving water quality, but also significantly lowers siltation loadings and providing ecosystem services. A PES (payment for ecosystem services) mechanism relating the value of ecosystem services generated by forests was implemented throughout the world and it can lessen the financial burden of the Government to conserve the forests and protected areas. In this paper, we developed a PES mechanism for a sustainable management of an inter-linked socio-ecological system, namely a forest, a lake, and the communities dependent on them. We design the optimal rehabilitation strategies with the active participation of local communities to restore degraded and deforested catchment areas of Inle lake. In total, 163 respondents were surveyed and interviewed with semi-structured questionnaires. We observed various socio-demographic factors, cognitive factors, and affection factors that can influence people's willingness to pay (WTP) for ecosystem services of watershed forests around Inle Lake. Location of respondents, their education talk experiences and livelihood patterns were among the factors determining people knowledge, perceptions and attitudes towards conservation and restoration programs. As WTP in cash, only 14.65% of the respondents showed their desire to pay in cash as contribution to rehabilitation programs. The rest preferred to participate by means of in kind contribution, and planting trees in their owned croplands. As policy implications, we suggest to organize education talks frequently to enhance people's knowledge on ecosystem services, to deliver technologies of producing value-added products for their crops to reduce cropland expansion in order to increase their income, to ensure law enforcement to prohibit encroachment to watershed forests, to organize planting campaigns regularly to enhance people's contribution in kind, and to promote agroforestry systems in this study area.

Keywords: Catchment areas, Ecosystem services, Inle Lake, Watershed forests, Willingness to pay, Rehabilitation

Understanding People's Knowledge, Perceptions and Attitudes towards Restoration of Watershed Forests around Inle Lake of Myanmar

1. Introduction

Inle Lake, the second largest freshwater and inland lake of Myanmar, has been providing numerous tangible and intangible ecosystem services to the local communities. However, the presence of various stressors within and outside their immediate environments reduces the ability of the lakes to continue providing the same services indefinitely (Ranjan, 2019). Deforestation in the mountains due to agricultural expansion, consequent sedimentation load and change in the water quality, and expansion of floating gardens within the lake are some of factors affecting the sustainability of the lake (Sidle et al., 2007). In this context, the Inle Lake is faced with combined threats from natural and anthropogenic activities causing reduction in lake storage capacity, deterioration of water quality, effect on navigability, decline in livestock and other products (Lwin and Sharma, 2012).

There are five major streams flowing to Inle Lake namely: Nant Latt stream, Upper Belu stream, Kalaw stream, and Ye Pae stream covering a total watershed area of 5612 km^2 (Su and Jassby, 2000). According to the findings by analysis of land-use and land cover change in Inle Lake watershed areas (Htwe et al., 2015), the landscape surrounding Inle Lake has undergone dramatic changes mainly caused by an intensification of agriculture, deforestation and urbanization during the past 40 years. It confirms that the time has already due in order to reestablish deforested areas and to restore degraded watershed forest areas to guarantee the sustainability of Inle Lake as it is not only one of the biodiversity hotspot areas as well as the major source of foreign incomes for the country from the tourism sector.

To restore the degraded forests, only Government Organizations (GOs), International Non-Governmental Organizations (INGOs) and Non-Governmental Organizations (NGOs) are not enough to implement the restoration activities, as the awareness and active participation of local communities are critical to the efficient and effective implementation of restoration programs. Co-management of the forests which means cooperation among different stakeholders especially local communities, is viewed as an effective forest conservation strategy in many parts of the world (Islam et al., 2019). Without local support, the long-term existence of protected areas (including Inle Lake as it has been designated as one of the forty-four protected areas of Myanmar) is not assured (Wells and McShane, 2004). If local people have negative perceptions and attitudes towards conservation activities, they are unlikely to support those initiatives (Alkan et al., 2009), resulting in failure or incomplete the conservation efforts. Actually, an individual's perceptions of his or her knowledge can play an integral role in shaping cognitions and influencing his or her decision making and behavior (Radecki and Jaccard, 1995).

Afforestation in lakes' catchment regions, in particular, not only helps with improving water quality, but also significantly lowers siltation loadings and providing ecosystem services (Ranjan, 2019). A PES (Payment for Ecosystem Services) mechanism relating the value of ecosystem services generated by forests was implemented throughout the world and it can lessen the financial burden of the Government to conserve the forests and protected areas. Several examples of the use of PES in the context of lakes, forests and protected areas

can be found in numerous cases. One study (Van Houtven et al., 2014) estimated households' willingness to pay (WTP) for improving lake quality in south-eastern US through presenting perceptible outcomes of water quality to the respondents.

Accordingly, we apply the concept of payment for forest ecosystem services especially supporting service in this research. We assume that watershed forests of Inle Lake are critical to the sustainability of the lake, and inevitably should be protected and also should be rehabilitated in degraded and deforested areas. To implement those conservation and rehabilitation activities, all stakeholders should be contributed their efforts as co-management scheme. Hence, we firstly explored the knowledge, perceptions and attitudes of local communities regarding Inle Lake, its catchment areas/watershed forests, and ecosystem services generated by those forests and lake. That is, people's perceptions about changes in their human and physical environments and how they respond to those changes are influenced by a number of factors, including worldviews, personal experiences and values, level of attachment to previous conditions, as well as specific characteristics of the household and farms (Córdoba et al., 2019).

In this paper, we develop a PES mechanism for a sustainable management of an inter-linked socio-ecological system, namely a forest, a lake, and the communities dependent on them. We design the optimal rehabilitation strategies with the active participation of local communities to restore degraded and deforested catchment areas of Inle lake. Afforestation in the catchment region is modeled as a key intervention measure to mitigate sediment loadings into the lake. A hypothetical market was created where people were asked "supposing there is an option of contribution by cash to restore degraded watershed forests in catchment areas of Inle Lake, it can cost 20,000 Kyats to plant 20 trees for an individual; would you like to pay this amount to support the sustainability of Inle Lake?". If the communities have attitudes leading to negative for WTP for ecosystem services, we tried to explore other favorable options of their participation pattern.

2. Objectives

This research was conducted to fulfill the following objectives:

(1) To determine the factors influencing on local perceived knowledge on forest ecosystem services;
(2) To observe the determinants of people's perceptions and attitudes towards conservation of watershed forests around Inle Lake; and
(3) To identify the patterns of willingness to participate in rehabilitation of degraded watershed forests around Inle Lake.

3. Conceptual Framework

Considering that a forest dependent community undertakes restoration of degraded lands in the lake's catchment regions through planting native forest tree species, there may be many underlying factors influencing on their behavioral intention and positive attitudes. From one widely accepted view in multi-component constructs, the tri-component attitude theory, individuals' attitudes are formed from three major components: cognition (non-evaluative perceptions and knowledge acquired through experience), affection (evaluations of like or

dislike, perceptions by personal taste), and conation (behavioral intentions) (Voon et al., 2011; Lantos, 2015; Luo et al., 2018).

Based on the tri-component attitude theory, people formulate perceptions and attitudes from cognition to behavioral intentions through available information, such as perceived knowledge, past experience and affection to the products or stated services (Huang, 1993). According to the theories of human behaviors, there is a proved statement that a person can have positive attitudes towards conservation through positive perceptions and a more complete understanding of ecosystem services with higher levels of knowledge (Luo et al., 2018). Moreover, people's prior practical experience and learning by attending trainings and joining education talks can also improve their knowledge (Spender, 1996). Thus, since a positive correlation exists between knowledge and experience-based cognition and conation, the degree of related knowledge and prior experience can affect people's willingness to pay for ecosystem services. Based on this theory, we construct the conceptual framework to be applied throughout this study (Figure 1).

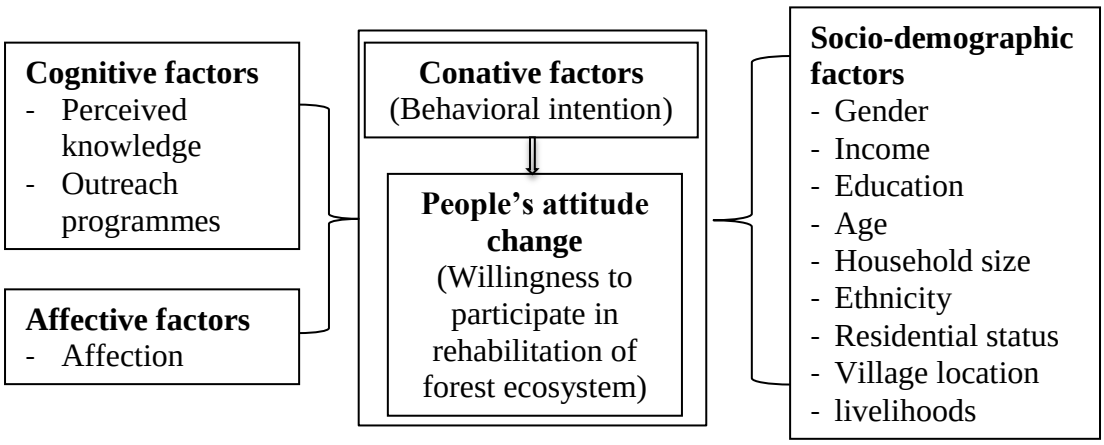

Figure 1. Conceptual Framework of understanding people's willingness to participate in rehabilitation of forest ecosystem

4. Materials and Methods

4.1 Study Area

The study was conducted around Inle Lake Area. Inle Lake was located in Nyaungshwe Township, Taunggyi District, Southern Shan State. It is located between 20° 18′ to 20° 53′ N latitudes and 96° 50′ to 96° 57′ E longitudes at an altitude of 890 m a.s.l (Su & Jassy, 2000) (Figure 2). It occupies the central part of a trough between two mountain ranges limiting the lake to the East and West (Htwe et al., 2015). The area is one of the popular tourist places of Myanmar, because of its rich biodiversity and unique ecosystem, it was designated as categories of protected area recognized by globally renowned organizations. Moreover. it has been determined as one of the 44 protected areas of Myanmar namely Inle Lake Wildlife Sanctuary, and conservation activities especially re-establishing natural habitats (RNH) programs for wildlife and wild plants will be implemented during 2019 – 2029 for ten years (NWCD, 2019). Globally, it has been designated as UNESCO's 27th Man and Biosphere Reserve (MAB) in 2015, as one of the Asean Heritage Parks in 2016,

as globally important Ramsar Site in 2018 (NWCD, 2019). Given its topography and the prevailing cropping systems, the study area can be divided into three agricultural zones: Floating gardens within the lake, lowland, and highland mountain zones (Htwe et al., 2015).

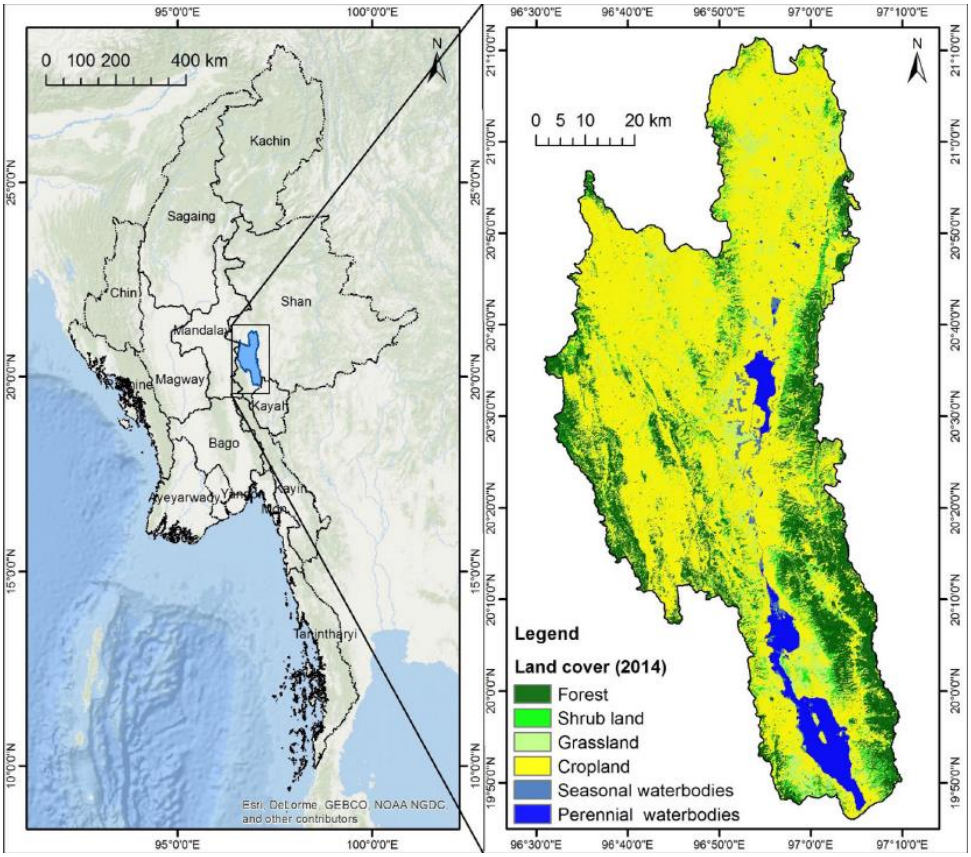

Figure 2. Map of the study area (Source: Karki et al., 2018)

4.2 Data collection and sampling design

Villages and respective stakeholders were first identified in the study sites through key informants' interviews by visiting local Forest Department, village heads and elders assisted by secondary data collection by reviewing reports, scholar articles and documents. Primary data was collected by means of questionnaires surveys combined with face-to-face interviews. In some areas where language barrier was encountered, local guides assisted us in translation or subsequent explanation of the questions.

Stratified random sampling design was applied during data collection. In Inle Lake, we can identify different stakeholders differed in their locations, ethnicity, livelihoods, etc,. In this study, the strata were defined based on their locations (that means residential places related with Inle Lake). Accordingly, we defined the locality of stakeholders into three types: people living in the lake, people living in lowland areas within the vicinity of the lake, and people living in highland mountain areas which mean upstream watershed areas of Inle Lake. The reason of choosing locations of the people for stratification was we assumed that livelihoods of people differed by their locations, and in turn, differed in degrees of dependency on forests and their positive/negative perceptions on forest rehabilitation accordingly. Respondents were selected randomly from each stratum. We conducted semi-structured questionnaire surveys during May 2019 and October 2019.

4.3 Questionnaire Design and variables

The questionnaire was prepared in local language (Myanmar language) so that the respondents themselves were able to fill the document and it made sure transparency of the questionnaire.

The questionnaire was prepared with four parts: (1) socio-demographic information; (2) knowledge and experiences about forest ecosystem services; (3) knowledge and experiences related with Inle Lake wetland areas and surrounding watershed areas; and (4) people's perceptions and attitudes towards watershed conservation (or) forest rehabilitation in degraded watershed areas of mountain ranges. In the first part of exploring socio-demographic information, the questions included gender, age, education, household sizes, residents or migration to that area, ethnicity, description of their livelihoods, land holdings and crops, and monthly income. The second part of determining people's knowledge and experiences regarding forest ecosystem services included both closed and open-ended questions as we tried to seek their perceived knowledge on tangible and intangible benefits of forest ecosystems. During interviews, we had to use the terms of tangible and intangible benefits of forests instead of using the term "ecosystem services". This was a result of testing questionnaires before actual survey as people could not understand the meaning of ecosystem services. Meanwhile we were conducting surveys, we included explanation of ecosystem services of forest ecosystem. This part included the questions: their perceived knowledge on tangible and intangible benefits of forest ecosystem; their previous experiences of joining trainings and education talks related with forestry; and their engagement on forest conservation activities. The third part of the questionnaire was designed to explore the opinions of local people in environmental conditions of Inle Lake, important role of watershed forests for sustainability of Inle Lake, and factors for water pollution in the lake area. The fourth part is to identify the people's behavioral intentions and attitudes towards watershed conservation and rehabilitation programmes. The questions were designed to seek the level of their opinions on watershed conservation to ensure the existence of Inle Lake, their willingness to participation in rehabilitation and conservation of watershed areas in mountain ranges, and their preferred ways of participation in rehabilitation (Table 1).

Table 1. Variables and definitions of knowledge, perceptions and attitudes of the respondents

No.	Variables	Definitions
Perceived knowledge and experiences related with forest ecosystem services and conservation		
1	Know_tang	Do you know tangible benefits of forest ecosystems? 0 = No, 1 = Yes
2	Know_Intang	Do you know intangible benefits of forest ecosytems? 0 = No, 1 = Yes
3	Exp_training	Have you experienced attending forestry related trainings? 0 = Never attended 1 = one time attended 2 = two times attended 3 = three times and above attended

4	Exp_talks	Have you experienced joining education talks related on forest conservation and Inle Lake conservation? 0 = Never attended 1 = one time attended 2 = two times attended 3 = three times and above attended
5	Members_conserve	Are you a member of forests and Inle Lake related conservation teams/organizations? 0 = No, 1 = Yes
Local perceptions on environmental conditions of Inle Lake		
6	Inle_Liveli	Are your livelihoods (income generation) related with Inle Lake? 0 = No, 1 = Yes
7	Inle_waterbody	Compare the current water bodies area of Inle Lake with that in previous five years 1 = the same 2 = water bodies enlarged 3 = water bodies became shrinked 4 = No idea
8	Water_quali	Do you think the water qualities in the lake area changed? 0 = No, 1 = Yes
9	Lake_watershed	How do you think the existence of Inle Lake is related or not with its watershed forests in the surrounding mountain ranges? 1 = strongly disagree 2 = Generally disagree 3 = neutral 4 = somehow agree 5 = strongly agree
10	Forest_areas	How do you think the conditions of the watershed forests of Inle Lake compared with those in previous five years? 1 = the same 2 = forests became dense 3 = forest became sparse and degraded 4 = forested areas were cleared and transformed into other landuses
Local perceptions and attitudes towards watershed forest conservation for the sustainability of Inle Lake		
11	Conserv_need	How do you think watershed forest conservation is compulsory to ensure the sustainability of Inle lake? 1 = strongly unnecessary 2 = unnecessary 3 = no idea 4 = Should be conserved 5 = Should be conserved no matter what
12	Agree_conserve	Do you agree conservation activities of watershed forests around Inle Lake? 1 = Strongly disagree 2 = Generally disagree 3 = Neutral 4 = Somehow agree 5 = Strongly agree

13	Cooperation	How do you think the cooperation for watershed forests conservation? 1 = Only Forest Department have responsibility to conserve forests; 2 = Forest Departments and other line departments and organizations should be cooperated in conservation activities; 3 = All stakeholders (local people, FD and other departments and organizations) should be cooperation in implementation of conservation activities
14	Attitude	Are you willing to participate in conservation of watershed forest areas? 1 = totally do not want to participate 2 = do not want to participate 3 = neutral 4 = willing to participate 5 = strongly willing to participate
15	Ways_participate	Please choose your preferred way of participation. 1 = contribution by cash 2 = in-kind contribution 3 = contribution by tax 4 = Contribution by lands to reforest 5 = Contribution by planting trees in their owned lands

4.4 Data Analysis

Data input and statistical analysis of the survey data was conducted using Microsoft excel, R statistical software and PCOrd 5.0 version. Comparison was done among the strata to present the socio-demographic information of the respondents. Chi-squared test was applied for categorical data such as age group, education and Kruskal-wallis test was used to compare among the continuous variables, eg,. Land holdings. High collinearity between the independent variables poses astatistical problem in logistic regression models (Hosmer and Lemeshow,2000; Mertens and Lambin, 2000), we therefore first examined collinearity between the independent variables by the variance inflation factor (VIF) and tolerance using linear regression. High collinearity between independent variables occurs when tolerance< 0.20 or VIF > 4 (Mon et al, 2012). We excluded some factors significantly correlated with others for binary logistic regression to detect the factors influencing people's knowledge, perceptions and attitudes towards conservation and restoration of degraded watershed forests around Inle LakeLogistic regression is one of the appropriate statistical analyses to determine the odds or probability of the expected value that is the variable takes the value 1, corresponding to a unit change in predictor variables (Landau and Everitt, 2004).

5. Results

5.1 Socio-demographic information of the respondents

In total, there were 163 sampled respondents resided in three different locations. Table 2 shows the demographic information of the respondents including gender, age, education, household size, ethnicity and their residential status to those areas. About 67% of the respondents were male, and most of the respondents were involved in middle-aged classes

(Table 2). The education level of most of the respondents was primary school (45%). We classified the household size into two class: households with less than or equal five members; and households constituted with more than five members. As a result, about 73% of respondents were from households with less than or equal five family members. With the assumption that ethnicity may influence on the people's attitudes towards watershed conservation of Inle Lake, we also identified the ethnic groups of the respondents. As shown in Table 2, Innthar (the local inhabitants of Inle Lake) represents the highest proportion of respondents (56%) followed by Pa-O ethnic group (35%). About 92% of the respondents were local inhabitants to those areas including Inle Lake, Nyaung Shwe Township and Taunggyi Township whereas the rests moved to that area from other places for some reasons such as marriage with local inhabitants, and to do businesses.

Table 2. Demographic information of the respondents (N=163)

Variables	No. of respondents (n)			Total
	Within lake (n=29)	Lowland areas (n=54)	Highland mountains (n=80)	
Gender				
Male (=1)	11	36	61	108
Female (=0)	18	18	18	54
Total	**29**	**54**	**79**	**162**
Age class				
≤25 (=1)	4	13	12	29
26-50 (=2)	17	29	48	94
>50 (=3)	8	12	15	35
Total	**29**	**54**	**75**	**158**
Education				
No formal school (=0)	0	3	1	4
Primary school (=1)	14	16	44	74
Secondary School (=2)	7	19	18	44
High School (=3)	8	11	14	33
Graduate (=4)	0	5	3	8
Total	**29**	**54**	**80**	**163**
Household size				
≤5	19	41	54	114
>5	10	13	25	48
Total	**29**	**54**	**79**	**162**
Ethnicity				
Innthar	25	44	23	92
Bamar	1	4	0	5
Shan	2	3	1	6
Danu	0	3	0	3
Pa_O	1	0	56	57
Total	**29**	**54**	**80**	**163**
Residents/migration from other places				
Residents	27	50	72	149
Migrators	2	4	7	13
Total	**29**	**54**	**79**	**162**

Table 3 presents the income level of the respondents and their representation to different forms of stakeholders (differentiated based on their primary livelihoods and locations). Most of the respondents (49%) earned their monthly income within the range of 100,000 kyats to 300,000 Kyats (one USD = 1500 Kyats). Moreover, about 42% of the respondents made money lower than 100,000 Kyats monthly. Only a few numbers of respondents earned higher monthly income more than 300,000 Kyats (Table 3). In this study, stakeholders were differentiated based on their locations and primary livelihoods, but on the other hand, their livelihoods differ based on their locations. Most of the respondents depend on Ya cultivation for their livings. The areas (acres) of farmland holdings were within the range of 1-10 acreas while only a few people possess the farmlands in areas larger than 10 acres.

Table 3. Socio-economic information of the respondents (N=163)

Variables	No. of respondents (n)			Total
	Within lake (n=29)	Lowland areas (n=54)	Highland mountains (n=80)	
Monthly Income (Myanmar Kyats: 1 Lakh = 100,000 Kyats)				
Lower than 1 Lakh (=1)	2	26	39	67
1 – 3 Lakhs (=2)	21	20	36	77
3 – 6 Lakhs (=3)	5	4	1	10
6 – 10 Lakhs (=4)	1	2	0	3
Higher than 10 Lakhs (=5)	0	0	1	1
	29	52	77	158
Stakeholders (based on their locations and primary livelihoods)				
Souvenir shops	7	1	0	8
Boat_fishermen	5	6	0	11
Floating_islands	1	3	0	4
Hotels_restaurant	8	4	0	12
Casual_labor	6	5	3	14
Ya (lowland areas)	1	34	0	35
Ya (Upland mountain ranges)	1	0	73	74
Trade	0	1	4	5
Total	29	54	80	163
Land holdings (Farmland)				
≤ 5 Acres	5	24	47	76
5.01 – 10 Acres	0	5	16	21
>10 Acres	1	1	1	3
Total	**6**	**30**	**64**	**100**

Around Inle Lake areas, common types of farming systems were floating gardens within the lake areas; lowland paddy fields; and upland fields. Floating gardens were man-made islands composed of weeds and silt from the bottom of the lake (Akaishi et al., 2006); those were floating to and fro in the water bodies of Inle Lake, therefore named as floating gardens (locally known as “Kyun Myaw”: Kyun means islands and myaw means floating in Myanmar language). Tomatoes were the main cash crops growing on those floating gardens since years, and therefore, growing tomatoes in floating islands constitute as one of the major income generation activities for local inhabitants of the lake area.

In this study, surrounding areas of Inle Lake were identified into two types of landscapes: lowland areas and highland mountain ranges. Both upland fields (Ya in Myanmar language) and lowland fields (Le in Myanmar language) were dominant farming systems in those two landscape types. "Ya" means dry land cultivation and those areas do not need irrigation, and "Le" means wet land cultivation as those areas need irrigation (Htwe et al., 2015). Although the terms of farmland (it means Ya) were the same in both lawland and highland areas, crops grown were different in those two landscapes because of the different soil types (personal interview). Crops grown in Ya of lowland landscapes were both annual cash crops including onion, ginger, corn, garlic, and sesame while commonly grown perennial crops are sugarcane (*Saccharum* spp.). Although shifting cultivation systems had been the most common farming system in previous time in highland mountain ranges, those areas currently transformed into permanent Ya in those days. In those areas, commonly grown crops were perennial crops mainly sebesten trees (*Cordia dichotoma*) locally known as Thanatphet, intercropped with corn, turmeric and sugarcane.

5.2 Perceived knowledge about ecosystem services of the forests

Table 4. Summaries of knowledge and experiences related with forests and ecosystem services (χ^2 = Chi-square test statistics)

Variables	No. of respondents (%)			Total	X^2	P
	Within lake (n=29)	Lowland areas (n=54)	Highland mountains (n=80)			
1. Have you experienced **attending short/long term training courses** on forest conservation related subjects?						
Never attended (=1)	89.7	83.3	85.0	85.3	9.201	0.163
1 time attended (=2)	3.4	11.1	6.3	7.4		
2 times attended (=3)	0.0	5.6	7.5	5.5		
3 times and above attended (=4)	6.9	0.0	1.2	1.8		
2. Have you ever joined **education talks** on forests, nature conservation, watershed and lake conservation, etc.,?						
Never joined (=1)	69.0	77.8	57.5	66.3	11.712	0.069
1 time joined (=2)	13.8	16.7	27.5	21.5		
2 times joined (=3)	3.4	5.5	7.5	6.1		
3 times and above joined (=4)	13.8	0.0	7.5	6.1		
3. Do you know **tangible benefits** (direct products) generated by forest ecosystems?						
I do not know (=0)	24.1	29.6	38.0	32.7	2.196	0.334
Yes, I know (=1)	75.9	70.4	62.0	67.3		
4. How do you know **intangible benefits** granted by forest ecosystems?						
Never heard (=1)	24.1	31.5	52.0	40.1	13.054	0.042
Only just heard (=2)	55.3	46.3	35.4	42.6		
Clearly understand via talks TV programme (=3)	10.3	13.0	11.2	11.7		
Clearly understand via lectures and trainings	10.3	9.2	1.3	5.6		

5. Are you a **member of forest conservation** related organizations (e.g, Community forest user groups)?						
Not yet (=0)	100	100	73.8	87.1	25.010	0.000
Yes (=1)	0	0	25.2	12.9		

In this part of the study, we examined the perceived knowledge of the respondents on ecosystem services. We identified the degree of experiences on forestry related trainings and talks, and then their perceived knowledge on tangible and intangible benefits of forest ecosystem.

Table 4 summarized the perceived knowledge and experiences of the respondents and comparison was shown by means of Chi-squared tests among different locations. Only two items: experience on intangible benefits and participation on forest conservation related organizations, showed statistically significant difference among three different locations. Most of the respondents (85.3%) have not experienced attending training courses related with forestry. Similarly, most of them (66.3%) have never joined education talks related with conservation (forests, water and lake) whereas 21.5% of respondents have joined one time. While exploring their perceived knowledge on ecosystem services of forests, 67.3% responded they have ever known tangible benefits of forest ecosystems. Regarding knowledge on intangible benefits, 11.7% of respondents stated that they clearly understand those benefits through joining education talks and streaming TV programmes while 5.6% of respondents via attending trainings and lectures from formal education (Table 4). Almost all of the respondents stated that they have never been the members of organizations related with conservation of forest ecosystems whereas only a few number of participants resided in mountain ranges are members of community forest user groups.

In terms of tangible benefits of forest ecosystems, the respondents listed as charcoal, firewood, timber and household utensils, bamboo, thatch, wild vegetables and fruits, medicinal plants, orchids, resins, roots and mushroom. For intangible benefits generated by forest ecosystem, the common responses include climate regulation, provision of clean air and regulation of water resources, supporting as wind barrier, habitats for wildlife, biodiversity richness, recreational values for tourism, and protection from soil loss and sedimentation.

5.3 Knowledge, Perceptions and Attitudes towards Inle Lake

The results showed differences in people's opinions on their dependence on Inle Lake for their livings; change in areas of water bodies of the lake; and degree of their perceptions on relation between Inle Lake and watershed forests, depending on three different locations. Most of the people resided within Inle Lake and lowland areas believed that their livings strongly depend on the existence of Inle Lake whereas only some people (58.2%) from highland mountain ranges supposed their livelihoods are related with existence of Inle Lake (Table 5). Almost all of the respondents resided within Inle Lake water bodies and lowland areas mentioned that the areas of water bodies of the lake became shrunk compared with that in previous water bodies. In contrast to them, some respondents (15.4%) from mountain ranges perceived that the area of water bodies enlarged. We also added open questions for factors causing shrinkage of water bodies of Inle Lake. The responses were sedimentation

because of deforestation of watershed areas, drought, increasing numbers of floating gardens, growing population of hyacinth plants, infrastructure development and rubbish dump. There is no difference in people's perception for changes in water qualities within lake among three different locations as almost all of the respondents observed that the water qualities of Inle Lake changed time by time. Common causes of water pollution revealed by the respondents include uses of chemical fertilizers and pesticides for tomatoes cultivation in floating gardens; sedimentation; dump of debris and wastes and in water; less hygiene and no sewage system, unsystematic streamflow and uses of plastics.

Table 5. Summaries of people's opinions on existence of Inle Lake related with watershed forests

Variables	No. of respondents (%)			Total	X^2	P
	Within lake (n=29)	Lowland areas (n=54)	Highland mountains (n=80)			
1. Is your **living (livelihood) related** with the existence of Inle Lake?						
My living is not related with Inle Lake (=0)	10.3	25.9	58.2	38.9	26.193	0.000
My livelihood is related with Inle Lake (=1)	89.7	74.1	41.8	61.1		
2. What is your opinion on the **area of water bodies in the Inle Lake** compared with that in previous five years?						
Not changed (=1)	0	0	1.3	0.6	20.722	0.002
Water area expanded compared with that 5 years ago. (=2)	0	0	15.4	7.5		
Water area shrunk compared with that in 5 years ago.	96.6	98.1	73.1	85.7		
no idea	3.4	1.9	10.2	6.2		
3. How do you think **water qualities in Inle Lake** have changed?						
Not changed (=0)	0	1.9	8.8	4.9	7.407	0.116
Yes, water qualities have changed.	96.6	96.3	85.0	90.8		
No idea	3.4	1.9	6.2	4.3		
4. How about your opinion on existence of **Inle Lake depending on its watershed forests**?						
Existence of Inle Lake is not related with nearby watershed forests.	3.7	9.6	5.3	6.5	13.648	0.034
I have ever heard from others existence of Inle Lake is related with watershed forests.	3.7	11.5	18.7	13.6		
As my idea, I think existence of Inle Lake is related with watershed forests.	37.0	32.7	50.7	42.2		
It is sure that existence of	55.6	46.2	25.3	37.7		

Inle Lake totally depends on nearby watershed forests.						
5. How about your opinion on the **conditions of watershed forest areas** around Inle Lake?						
Forest areas increased more than that in previous 5 years.	3.6	3.7	6.5	5.0	3.878	0.693
Forest conditions are the same with that in previous 5 years.	3.6	1.9	7.8	5.0		
Forest areas became less compared with that in previous 5 years.	85.7	85.2	80.5	83.0		
Forested areas changed to other types of landuse.	7.1	9.2	5.2	7.0		

For the question about the relation between existence of Inle Lake and nearby watershed forests, 55.6% of respondents residing within the lake strongly believed that sustainability of Inle Lake totally depends on the existence of its watershed forests followed by respondents from lowland areas (46.2%) and those from highland mountains (25.3%). About 50.7% of respondents from highland mountains assumed that existence of Inle Lake depend on watershed areas while 37.0% from the lake areas and 32.7% of respondents from lowland areas also offered the same belief. No statistically significant difference was found among the perceptions of respondents from three locations concerning the conditions of watershed forests around Inle Lake as most of the respondents confirmed that deforestation and forest degradation had happened in those areas (Table 5). Driving factors of deforestation and forest degradation were farmland expansion, firewood and charcoal production, infrastructure development, lack of reforestation and forest conservation programme, forest fire, shifting cultivation, and weak law enforcement.

5.4 Perceptions and attitudes towards Inle Lake watershed forest conservation

To explore the people's perceptions on conservation and rehabilitation of watershed forests of Inle Lake, we raised three questions (Table 6). People from three different locations have more or less similar perceptions on the requirement for watershed conservation as most of them showed strong agreement on conservation activities. Despite all respondents resided within the lake supposed that all stakeholders should contribute on conservation and rehabilitation activities whereas a few number of respondents from other two locations perceived that only FD has responsibility and some believed that FD and other authorities should collaborate and implement conservation activities.

Table 6. People's perceptions on conservation and rehabilitation of watershed forests around Inle Lake

Variables	No. of respondents (%)			Total	X^2	P
	Within lake (n=29)	Lowland areas (n=54)	Highland mountains (n=80)			
1. How do you think it is **necessary to conserve watershed forests** for sustainability of Inle Lake?						
Strongly not necessary	0	0	0	0	7.733	0.258
Not necessary	0	1.9	2.5	1.9		
Neutral	0	0	5.1	2.5		
Necessary	13	44.4	54.4	49.6		
Strongly necessary	15	53.7	38.0	46.0		
2. If so, do you **agree the activities of watershed forest conservation** conducted by Forest Department (FD) and other stakeholders?						
Strongly disagree	0	0	0	0	11.383	0.077
disagree	0	0	1.2	0.6		
Neutral	0	0	3.8	1.9		
Generally agree	57.1	55.6	72.5	64.2		
Strongly agree	42.9	44.4	22.5	33.3		
3. How is your opinion on the **responsibility of the stakeholders** on watershed forest conservation?						
Only FD has responsibility.	0	1.9	9.0	5.0	13.112	0.011
FD and other line organizations, NGOs INGOs should collaborate.	0	7.4	16.7	10.6		
All stakeholders (including local people, private companies, CSOs, NGOs, INGOs and Government Departments) should collaborate.	100	90.7	74.3	84.4		

5.5 Determinants of knowledge, perceptions and attitudes of local people

5.5.1 Determining factors influencing on people's perceived knowledge on ecosystem services

We observed the determining factors for local knowledge, perceptions and attitudes towards conservation of watershed forests around Inle Lake. Because of detecting multi-collinearity among the response (independent) variables, we reduced some variables for computing binary logistic regressions. Consequently, the tested response variables to determine the factors influencing perceived knowledge of local people on forest ecosystem services included five socio-demographic factors (gender, education, location, natives/migrants, and age) and two cognitive factors (their perception of relationship between

their livelihoods and Inle Lake, and previous experience of joining education talks). Among the tested factors, age, education and talk experience were treated as ordinal (continuous) variables while other factors were categorical factors. For categorical variables, the first category was set as the reference group to detect the different influences of the categories. The dependent variable related with knowledge was dichotomous variable (No=0, and Yes=1) and the question raised to the respondents was "Have you ever known intangible benefits provided by forests?"

Among the observed responses variables, the logistic regression model showed that location, livelihood related with Inle Lake and experiences of joining talks significantly contributed to the likelihood of perceiving knowledge on ecosystem services by the respondents. According to Hosmer and Lemeshow test, non-significant value (P=0.520) confirmed that the model fitted the data with 69.6% correct prediction (Table 7). Highest Wald value (5.446) indicated that respondents' experience of joining education talks was the most important variable for the probability of perceiving knowledge (P<0.05). The model results indicate that lake dwellers were likely to perceive knowledge on ecosystem services rather than people residing in highland areas (P<0.10) whereas no significant difference was found between lake dwellers and people living in lowland areas. In addition, people who considered that their livelihood was related with Inle Lake resulted in the likelihood perceiving knowledge (P<0.10). The detailed results of binary logistic regression were shown in Table 7.

Table 7. Logistic regression determining factors influencing on the perceived knowledge on forest ecosystem services

Variables	**β**	**S.E.**	**Wald**	**P value**	**Exp(β) or Odds ratio**
Socio-demographic factors					
*Gender (Male)	-0.412	0.415	0.983	0.321	0.662
Education	0.189	0.214	0.776	0.378	1.208
*Location			5.504	**0.064**	
Lake dwellers (reference group)					
Lowland areas	-0.330	0.568	0.338	0.561	0.719
Highland mountains	-1.159	0.585	3.927	**0.048**	0.314
*Migrants	-0.271	0.637	0.181	0.670	0.762
Age	-0.109	0.160	0.465	0.495	0.896
Cognitive factors					
*Livelihood related with Inle Lake	0.705	0.407	3.002	**0.083**	2.024
Talks experiences	0.588	0.252	5.446	**0.020**	1.800
Constant	0.873	1.210	0.520	0.471	2.394

*Categorical variable, n=163; β=coefficient; S.E=standard error; Wald=Wald Statistics; Exp(β)=exponential of β. Hosmer and Lemeshow Test: χ^2=7.155, d.f=8, p=0.520; Overall percentage of correct prediction=69.6%

Note: The reference group in each category variable was not included.

5.5.2 Determining factors influencing on people's perception on loss of forests

To identify the determinants of people's perceptions on loss of watershed forests around Inle Lake, we also tested both socio-demographic factors and cognitive factors as response variables. The socio-demographic information included gender, education, location, natives/migrants, and age. Altogether six cognitive factors involved in the analysis, and those variables were people's perception of relationship between their livelihoods and Inle Lake, previous experience of joining education talks, knowledge on ecosystem services, and their perceptions on conditions of Inle lake water bodies, and water qualities. Initially the dependent variable was surveyed in categorical variable, but transformed into dichotomous variable for the feasibility of analysis. The question was their perception on loss of watershed forest areas around Inle Lake (0=no change, and 1=loss of watershed forest areas).

Among the tested variables, only one variable was found significantly contribution to the people's perception on the condition of the forests. People who realized water bodies of Inle Lake became shrinkage compared with that in previous years were more likely to suppose forest areas became lost for many reasons ($P<0.10$). The detailed results of binary logistic regression were shown in Table 8.

Table 8. Logistic regression determining factors influencing on on people's perception on loss of forests

Variables	**β**	**S.E.**	**Wald**	**P value**	**Exp(β) or Odds ratio**
Socio-demographic factors					
*Gender (Male)	-0.023	0.728	0.001	0.975	0.978
Education	0.094	0.375	0.063	0.802	1.099
*Location			0.365	0.833	
Lake dwellers (reference group)					
Lowland areas	0.190	1.001	0.036	0.850	1.209
Highland mountains	-0.295	0.983	0.090	0.764	0.744
*Migrants	0.797	0.909	0.769	0.381	2.219
Age	-0.219	0.275	0.630	0.427	0.804
Cognitive factors					
*Livelihood related with Inle Lake	-0.081	0.712	0.013	0.910	0.922
Talks experiences	-0.057	0.357	0.026	0.873	0.945
*Knowledge on ecosystem service	0.229	0.647	0.126	0.723	1.258
*Lake water bodies shrinkage	1.347	0.783	2.962	**0.085**	3.845
*Inle Lake and forest relation	0.906	1.087	0.696	0.404	2.476
Constant	0.395	2.623	0.023	0.880	1.484

*Categorical variable, n=163; β=coefficient; S.E=standard error; Wald=Wald Statistics; Exp(β)=exponential of β. Hosmer and Lemeshow Test: χ^2=13.810, d.f=8, p=0.087; Overall percentage of correct prediction=90.5%

5.5.3 Determining factors influencing on people's willingness to pay for rehabilitation of watershed forests

To detect the determining factors influencing on people's attitude of willingness to pay (WTP) for reforestation of degraded watershed forests, binary logistic regression was done. Both socio-demographic factors and cognitive factors were entered into the analysis

(Table 9). The question to check WTP for reforestation was "Could you contribute cash (20000 Kyats/year) to replant native tree species in degraded watershed forest, and this amount was equivalent to plant twenty trees as described by the norms of Forest Department to establish watershed plantations?" As response to this question about WTP, only 14.65% of the respondents mentioned that they are willing to pay in cash to rehabilitate degraded watershed forests whereas other respondents chose other options to contribute.

Non-significant P value (P=0.132) resulted by Hosmer and Lemeshow Test indicated that the model fitted the data with 84.8% correct prediction (Table 8). Among the factors, location, experiences of joining education talks and areas of their land holdings significantly contributed to the people's WTP to rehabilitate degraded watershed forests. People resided in lowland areas were less likely to pay in cash for rehabilitation compared with the lake dwellers ($P<0.05$), although no significant difference was found between people in highland areas and lake dwellers. One surprising finding was the negative relationship between people's experiences of joining education talks and their WTP ($P<0.01$). Despite it, people who own more areas of croplands are more willing to pay in cash to rehabilitate watershed forests ($P<0.05$).

Table 9. Logistic regression determining factors influencing on the willingness to pay by local people

Variables	**β**	**S.E.**	**Wald**	**P value**	**Exp(β) or Odds ratio**
Socio-demographic factors					
*Gender (Male)	-0.981	0.680	2.083	0.149	0.375
Education	0.446	0.315	2.006	0.157	1.562
*Location			6.850	0.033	
Lake dwellers (reference group)					
Lowland areas	-1.972	0.822	5.761	0.016	0.139
Highland mountains	-0.384	0.743	0.267	0.605	0.681
*Migrants	1.840	1.233	2.229	0.135	6.298
Age	0.058	0.246	0.056	0.813	1.060
Landholdings (acre)	0.137	0.069	3.920	0.048	1.147
Cognitive factors					
*Livelihood related with Inle Lake	-0.113	0.627	0.033	0.856	0.893
Talks experiences	-1.463	0.557	6.896	0.009	0.231
*Knowledge on ecosystem service	0.801	0.576	1.939	0.164	2.229
*Lake water bodies shrinkage	0.120	0.817	0.022	0.883	1.128
Constant	-3.946	2.120	3.465	0.063	0.019

*Categorical variable, n=163; β=coefficient; S.E=standard error; Wald=Wald Statistics; Exp(β)=exponential of β. Hosmer and Lemeshow Test: χ^2=12.467, d.f=8, p=0.132; Overall percentage of correct prediction=84.8%

5.5.4 Forms of participation in rehabilitation of degraded watershed forests

The question to response people's attitude towards contribution to rehabilitation of watershed forests, we initially raised multiple choice question (categories). We mentioned five choices: pay in cash; in kind; in tax; in land; and planting trees in their farmland/home gardens. We got responses from 148 respondents from 163. Among those respondents who complete that question, 14.65% of respondents chose WTP in cash whereas other respondents chose other options. Although we added one option as contribution of some part of their lands to plant forest trees for watershed areas, no respondent chose that option. Other options chose by the respective percentage of respondents was shown in figure 3. In total, 56% of the respondents chose the option of contribution in kind followed by planting trees in their owned lands (39%). People's attitudes towards contribution pattern were different among three different locations (P<0.01). Despite most of the lake dwellers and people in lowland areas chose the option of in-kind contribution, most mountain dwellers chose the option of planting forest tree species in their owned lands (Figure 3).

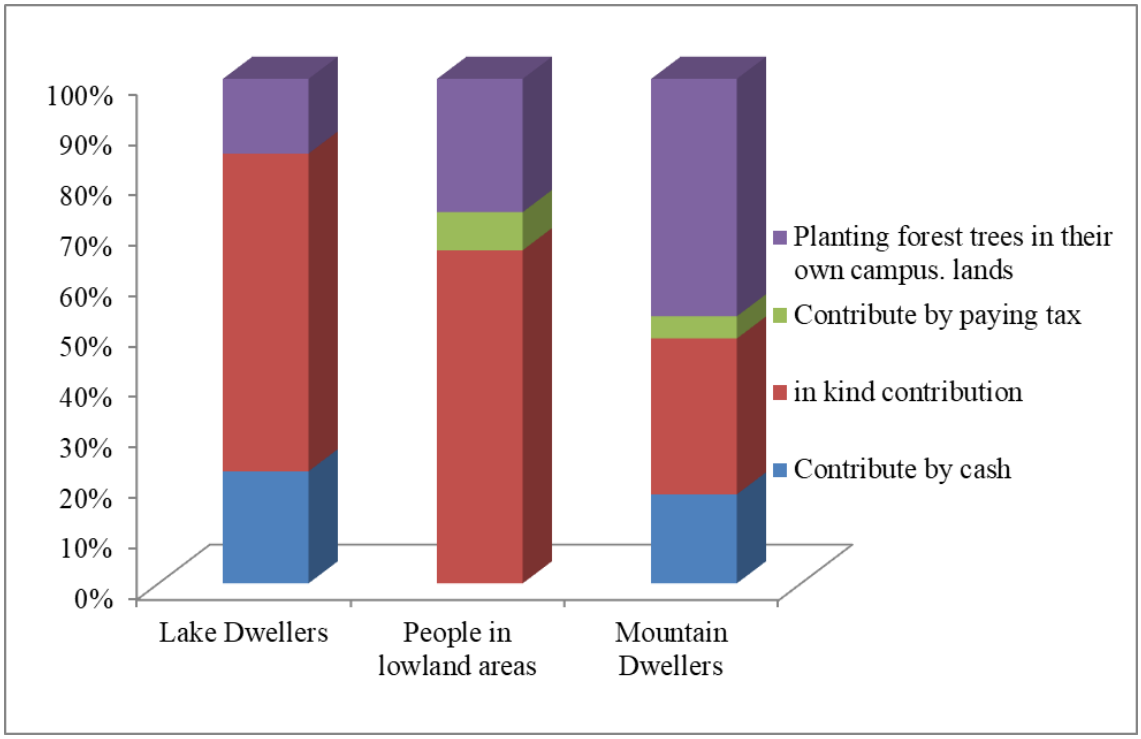

Figure 3. Forms of participation in rehabilitation of degraded watershed forests (Pearson Chi-square test: χ^2=28.539, df=6, p=0.000)

6. Discussions and conclusions

6.1 Perceived knowledge on ecosystem services

Regarding the perceived knowledge on forest ecosystem services, some respondents (67.3%) recognized the tangible benefits of the forests whereas most of the respondents have never heard about intangible benefits. In spite of having knowledge about tangible benefits, most of the respondents mentioned timber, bamboo, firewood and charcoal in common. Rarely, some people replied that they know orchids, medicinal plants, roots, fruits, mushrooms, thatch, etc,. In terms of intangible benefits, people mostly recognized the role of forests for climate regulation, water resources, and protection from soil erosion. According to

those findings, we could assume that people could not have reached in-depth understanding of even tangible benefits of forest ecosystems.

While exploring determinants of perceived knowledge by local people, we excluded some factors of having multi-collinearity. To decide which factors to include/exclude, we considered the policy implications of those factors. Example is people's experiences of attending trainings and joining education talks. Collinearity diagnosis detected high tolerance value and VIF value as those two factors showed significant correlation. Hence, we exclude factor of people's training experiences and decided to include their talk experiences with the assumption that organizing an education talk is more practically efficient and effective in cost, time, human resources and other logistic arrangements. As resulted by binary logistic regression, we found that the more experiences of joining education talks they have, the more likely they perceive knowledge on ecosystem services. For that reason, we recommend to the authorities concerned to organize education talks frequently in order to enhance people's knowledge on ecosystem services so that their attitudes towards conservation will be more positive.

People who perceived their livelihood is related with Inle Lake are more likely to be knowledgeable about forest ecosystem services. Inle Lake related livelihoods were souvenir shops, transportation services, floating islands, fishermen, grocery shops, hotels and restaurants. Some people who earn their livings by farming also recognize that their livelihood is related with Inle Lake as this area is tourism area and market for their crops became more developed compared with other areas of the region. Because of their livelihood pattern, they are more likely to perceive knowledge about ecosystem services by conversations or hearing from other knowledgeable persons or tourists or researchers. We can confirm this statement with the finding that location of the respondents also influenced on their perceived knowledge. Lake dwellers mostly depend on Inle Lake related livelihoods and they perceive more knowledge than people living in highland mountains where those areas are relatively far away from Inle Lake water bodies where researchers rarely reached.

6.2 People's perceptions on Inle Lake watershed forests

During the survey, we raised several questions regarding the perceptions of people on Inle Lake water bodies, water qualities, relation between Inle Lake and watershed forests, and conditions of those watershed forests. Due to the redundancy of some factors, we applied one reliable question to be considered as dependent variable for binary logistic regression. In this case, people who recognized the change in areas of Inle Lake water bodies also perceived that watershed forests around Inle Lake became lost during five years because of many underlying factors. It means that they truly recognized the role of watershed forests for the sustainability of Inle Lake. This finding is still consistent with the people's statements resulted by Akaishi et al. (2006).

As resulted by open questions, most of the respondents mentioned that conversion to cropland is the most important factor driving to deforestation in mountain areas. The findings by (Karki et al., 2018) also confirmed that experiencing an expansion of cropland by 268 km^2 from 1989 to 2014. They also stated "cropland expansion due to increase in intensity of agriculture in the forested catchment areas, sediment load from tributaries from catchment

areas, siltation inflow to the lake and marshland transformed into agricultural areas as hydroponic expansion are major determinants of reduced wetland area in Inle Lake region. According to the results from both qualitative and quantitative data of this study, we can conclude that local people actually observed what happened in wetland areas of Inle Lake, how that change related with watershed forests, how those watershed forests changed from time to time, and factors driving deforestation. Because of their livings dependent on agriculture, those mountain dwellers were some of the actors causing deforestation unintentionally. Furthermore, those mountain dwellers mostly crop sebesten trees in their farmlands, and those leaves are needed to make dried to become finished products. Those activities lead to cut trees from nearly forests to produce firewood and charcoal, consequently, resulting in forest degradation in study area.

According to those findings, we can suggest policy implications; to deliver technologies of producing value-added products for their crops as we assume that getting higher prices because of being value-added can increase the income of farmers even from the same areas of their landholdings. By this mean, people's perceptions will subsequently change to upgrade the qualities of their products rather than to extend the areas of their croplands in order to generate more income for their livings. Moreover, law enforcement is mandatory to conserve the remnant natural forests as well as planted areas around Inle Lake in order to ensure prohibit encroachment and sustainability of watershed catchment areas.

6.3 People's attitudes towards rehabilitation of degraded watershed forests

Factors influencing people's WTP for rehabilitation of degraded watershed forests, location of the respondents showed statistically significance, resulting that people from lowland areas did not show their willingness to pay in cash compared with those from other two locations (Table 9 and Figure 3). Nevertheless, we found out that they chose other options, mostly in kind contribution. One interesting finding is people who joined education talks more frequently are less likely to pay in cash for rehabilitation activities. We supposed this finding that knowledgeable people are more likely to participate by means of in-kind contribution rather than contribution by cash. Landholdings of people also related positively with people's WTP, meaning that people who owned more farmland areas earned more money to be able to pay in cash.

While observing people's willingness to participation in rehabilitation of degraded watershed forests, we found out that about 95.6% of respondents replied they are willing to participate in restoration activities whereas differed in patterns of their participation. Apparently, people preferred to other options to contribute for rehabilitation of degraded watershed forests rather than paying in cash. This finding may relate to their socio-economic conditions as well as to their belief and affection to the forests. During survey, we also raised open question why they are not willing to pay in cash to rehabilitation programs although they clearly know the importance of watershed forests to ensure the sustainability of Inle Lake. Respondents who chose the option of in-kind contribution answered that paying in cash was not guaranteed to make sure the planting and growth of trees in degraded areas according to their experiences. In this context, they preferred planting trees by themselves in those selected areas, meaning in kind contribution. For those who chose to plant forest trees in their

owned lands claimed that they could not find time to contribute in kind for rehabilitation activities. Instead, they favored to include planting forest trees in their farmlands or home gardens.

As useful recommendations for policy makers, we could confirm that people around Inle Lake have strong willingness to pay in rehabilitation of degraded forest ecosystem although differed in forms of payments. According to those findings, we can suggest that planting campaigns should be organized regularly in that areas while rehabilitating watershed forests. In addition, agro-forestry activities should be promoted by means of technology transfer, providing seedlings so that watershed forests in those areas will be sustainable.

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