Understanding youth motivation for water onion (*Crinum thaianum* J. Schulze) conservation in Thailand

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ABSTRACT

Water Onion is an aquatic plant endemic to the coastal plains of southern Thailand. The species is listed as endangered on the IUCN Red List. Despite rapidly declining stocks, the species is not protected under any Thai legislation nor under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). At the local level, Water Onion is protected and conserved by young people and adults for various socio-economic reasons. The study explored the participation and underlying conservation motivations of 312 youths in Kapoe district, Ranong province. Using principal component analysis, the youth's motivation for Water Onion conservation was classified into four categories: pro-social, pro-nature, social image, and extrinsic. The results from a logit regression indicated that pro-nature is one of the key motivational factors enhancing actual youth participation in the protection and conservation of Water Onion. It is important for policy makers to understand the effects of various types of motivation on different policy mechanisms in order to craft more effective policies that can further enhance youth participation in conservation initiatives.

Introduction

The Water Onion (WO) is an aquatic plant species endemic to the coastal plains of southern Thailand. The species has been found only in isolated patches in a few streams in Ranong and Phang Nga provinces due to habitat degradation and alteration as well as species exploitation. The survey data by the International Union for Conservation of Nature (IUCN) between 2008 and 2011 reported that the area of WO declined from 17,168 m^2 in 2008 to 3,040 m^2 in 2011. The main threats to the species include exploitation for commercial purposes as aquarium plants and materials for cosmetics, habitat degradation resulting from river dredging and expanding for flood mitigation, and land conversion in upper catchment areas for rubber and oil palm plantations.

The species has become known gradually to the Thai people over the last decade, especially since the Tourism Authority of Thailand promoted ecotourism with local communities in Suksamran district, Ranong province to visit the 'Water Onions' by rafting along the Nakha Canal. Despite the ecological and economic importance of WO, the general public is not aware that it is an endangered endemic species. This knowledge is limited to biologists and conservationists. WO was identified as an endangered species on the IUCN Red List (Soonthornnawaphat, Bambaradeniya, & Sukpong, 2011), but it is not protected under either the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) or any Thai legislation, including the Plant Variety Protection Act of 1999 (B.E. 2542). Currently, the Office of Natural Resource and Environmental Policy and Planning (ONEP) has planned to safeguard its habitats in

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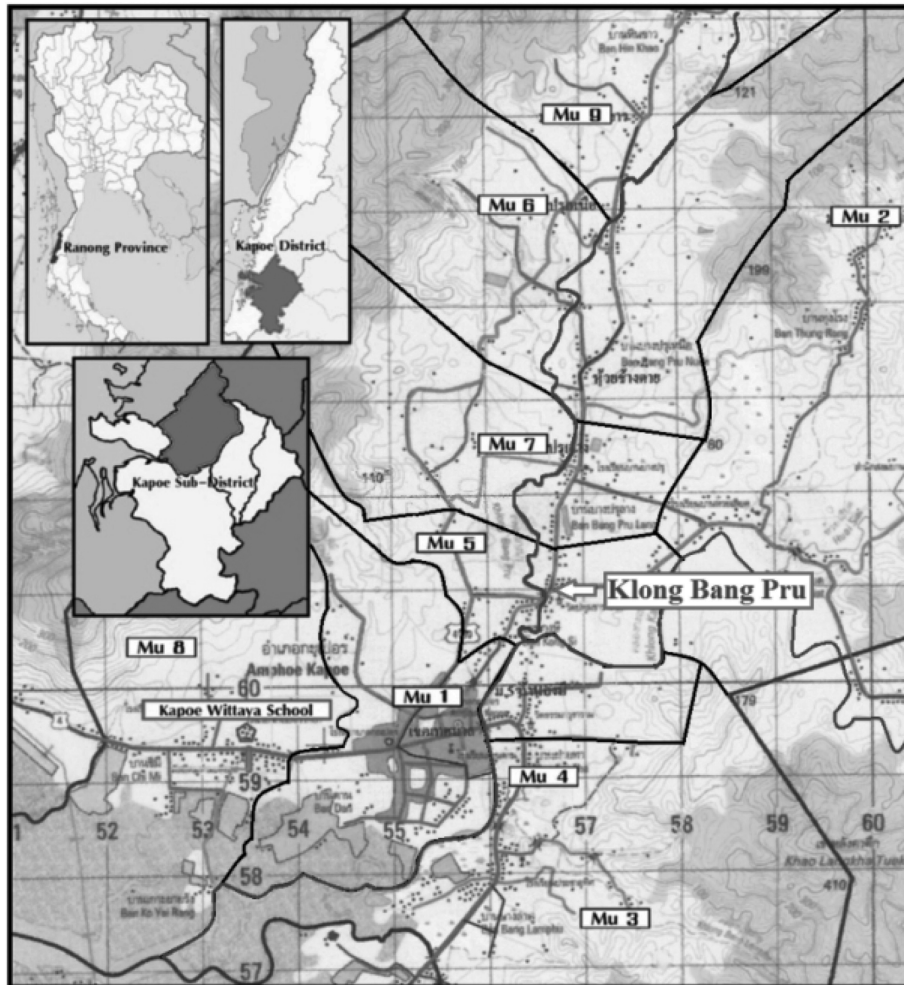*E-mail address:* penporn.j@ku.ac.th (P. Janekarnkij).

Figure 1 Location of water onion habitats in Kapoe sub-district, Ranong province

order to protect this specific species by proposing a "protected area system" under the Enhancement and Conservation of National Environmental Quality Act of 1992 (B.E. 2535). The Department of Fisheries, Ministry of Agriculture and Cooperatives initiated research on tissue culture and breeding of WO. The project was completed in 2014 (Pipatcharoenchai, Pongchawee, & Pradissan, 2014). The Department of Agriculture, Ministry of Agriculture and Co-operatives, organized a meeting with WO exporters on 20th January 2010 to discuss concerns over the species.

At the local level, various conservation groups have emerged and expressed their concerns over the status of WO and its habitat degradation. For example, in 2009 village leaders of Kapoe sub-district formulated conservation rules to protect WO in Klong Bang Pru and announced its habitat as a protected zone. In this sub-district, adults and young people have worked together and played important roles in conservation activities to restore and protect the species. Various conservation practices were conducted ranging from seed collecting, transplanting or replanting, and habitat restoration to multimedia production in order to promote WO conservation.

Despite an overall decline of WO as a species, its stocking has increased in some rivers located in Kapoe sub-district, particularly Klong Bang Pru, from 320 m^2 in 2011 to 720 m^2 (Thailand Institute of Scientific and Technologies Reserch [TISTR], 2013). Figure 1 illustrates the location of WO in the area. This achievement in species restoration and protection has partly resulted from the conservation commitment of youths who work actively with adults in the area (TISTR, 2013).

WO has low natural breeding capability, a low growth rate, and a long dormant period (Muhlberg, 1982; Pradissan & Pipatcharoenchai, 2008; Soonthornnawaphat et al., 2011). Today's WO conservation efforts will provide benefits in the long run to potential beneficiaries such as youths. Understanding youth's motivation for WO conservation is fundamental and significant in shaping future initiatives. To secure long-term conservation activities of WO, this study attempted to understand youth's participation in WO conservation, their motivation, and how the motivation affects their decisions for WO conservation. The study's main focus was on youth in Kapoe sub-district, aged between 15 and 25 years.

The study aimed to investigate youth's participation in WO conservation, their underlying motivation, and how the motivation affects their decisions for WO conservation at present and in the future. This information is important for policy-makers to improve mechanisms, to increase effectiveness and to reduce the cost of biodiversity management, being in line with the Biodiversity Finance Initiative (BIOFIN), introduced by United Nations Development Programme (UNDP).

Literature Review

Various scientific studies related to the WO have been conducted, especially survey research of species richness and status as well as innovation for species conservation (Changcharoen, Changtrakul, & Hongtrakul, 2014; Hutangura & Soonthornnawaphat, 2015; Lekhak & Yadav, 2012; Ounkhaw et al., 2009, 2013; Pipatcharoenchai et al., 2014; Pradissan & Pipatcha, 2008; Schulze, 1972; Soonthornnawaphat et al., 2011; TISTR, 2013). To date, no social science research on the economic aspects regarding WO conservation has been conducted.

Although understanding and analyzing the conservation of biological diversity are vitally important, they are relatively understudied by economists (Polasky, 2009). Various economic studies on the contribution of public goods in general can be found (see Table 1). In previous studies, the demographic background of respondents, such as household income, location, age, gender, education, household size, or knowledge about those public goods have been found to be significant factors in public good contribution (Agarwal, 2009; Atmiş, Daşdemir, Lise, & Yildiran, 2007; Bartczak, 2015; Brekke, Kverndokk, & Ngborg, 2003; Cappellari & Turati, 2004; Mulder, Schacht, Caro, Schacht, & Caro, 2009; Saraburin, 2008; Schlegel & Rupf, 2010; Turpie, 2003; Wossink & van Wenum, 2003; Zanella, Schleyer, & Speelman, 2014).

Many studies found that voluntary participation is induced by motivation (Andreoni, 1990; Cappellari & Turati, 2004; Frey & Stutzer, 2008; Gneezy, Meier, & Rey-Biel, 2011; Kaiser, Wolfing, & Fuhrer, 1999; Primmer, Paloniemi, Similä, & Tainio, 2014; Rode, Gómez-Baggethun, & Krause, 2014; Werff, Steg, & Keizer, 2013). Motivation is broadly classified into intrinsic and extrinsic types (Frey & Stutzer, 2008; Frey, 1997). It is an "intrinsic motivation" or inner feeling when a person performs an activity for its own sake rather than the desire for some external intervention. In contrast, "extrinsic motivation" occurs when a person is motivated to engage in an activity in response to the incentives applied from outside. Rode et al. (2014) intrinsic motivation for conservation into the categories of pro-nature and pro-social. While pro-nature refers to those actions that relate to values attributed to or relationships with the natural world, pro-social is defined as those actions that relate to social relations with other people or the larger community.

We consider pro-social motivation if people relate their goal to others (for example, co-operation, trust, equity, fairness, altruism). When the goal relates to themselves (for example, image, reputation, warm glow), we define this as self-image motivation which is similar to the definition

Table 1
Literature review on the determinants of participation in conservation

Determinant	Andreoni (1990)	Kaiser et al. (1999)	Cappellari & Turati (2004)	Brekke et al. (2003)	Turpie (2003)	Atmiş et al. (2007)	Mulder et al. (2009)	Agarwal (2009)	Schlegel and Rupf (2010)	Gneezy et al. (2011)	Werff et al. (2013)	Rode et al. (2014)	Zanella et al. (2014)	Bartczak (2015)	Primmer et al. (2014)
Motivation	✓	✓	✓	✓	✓	✓	✓				✓	✓	✓	✓	✓
Moral ideal effort				✓											
Group membership								✓					✓		
Demographic															
Household income			✓		✓	✓			✓				✓		
Location			✓		✓	✓		✓	✓				✓	✓	
Age			✓		✓	✓		✓	✓				✓	✓	
Gender			✓			✓			✓				✓	✓	
Education						✓							✓	✓	
Household size						✓							✓	✓	
Leisure				✓											
Knowledge					✓		✓		✓				✓		

Source: Compiled by authors

defined by Brekke et al. (2003). The concept of pro-social motivation is defined slightly differently from Rode et al. (2014).

According to Nyborg, Brekke, and Kverndokk (2000) and Brekke et al. (2003), in making a decision for public good contribution, an individual would ask herself the following questions: what kind of a person she is?, what kind of the situation is this?, and what should a person such as she do in a situation like this? Nyborg et al. (2000) and Brekke et al. (2003) suggested that an individual considers her morally ideal effort before deciding her actual behavior of voluntary contribution. Some studies found that being a member of a conservation group is a significant factor regarding public good contribution (Agarwal, 2009; Zanella et al., 2014). In this study, youth's ideal effort was assumed to be derived from the conservation effort of a person with a close relationship such as group leaders, parents, or close friends.

Methods

Conceptual Framework

The reviewed studies presented in Table 1 are related to public good conservation. The genes and knowledge of WO species itself are non-rival and non-excludable. This study delineated factors influencing voluntary participation in WO conservation from previous studies. Those factors were classified into three groups including demographic and psychological backgrounds. Variables in the demographic background included gender, family background, WO knowledge, location, leisure, and youth group membership. Psychological background refers to the motivation variables classified as intrinsic and extrinsic motivations. It was assumed that the youth's conservation participation varies with the external conditions associated with the policy or institutions. Thus, youth's participation in WO conservation is determined by factors including demographic, psychological, and ideal effort as presented in Figure 2.

The participation model in this study was developed mainly from the economic model of moral motivation for voluntary contribution as presented by Nyborg et al. (2000) and Brekke et al. (2003). Based on the utility model, individuals make a trade-off between spending for leisure and participating in WO conservation depending on its associated benefit and cost. Finally, the model of youth's participation (e_i) is simply determined by leisure (l_i), morally ideal effort (ec_i), motivation (m_i), and demographic background (z_i) as presented in Equation (1):

$$e_i = e(l_i, ec_i, m_i | z_i) \tag{1}$$

where e_i is an individual i's conservation effort, l_i is leisure required by individual i, ec_i is a variable representing morally ideal effort, m_i is motivation of individual i, and z_i is a vector of demographic background of individual i.

Data Collection

The study was carried out in Kapoe sub-district, Kapoe district, Ranong province in September 2015. The current number of youths was not available. To determine the sampling size, power analysis was employed to control both type I and type II errors. The required sampling size was 287 observations, which was calculated specifically for Multiple Regression. The data collection in this research comprised two stages.

In the first stage, two focus group interviews were conducted with three and five participants per focus group including group leaders, village headmen, and school teachers. The primary survey was conducted in the area with 30 youth representatives. The data in this initial stage were collected as qualitative information, such as the type of conservation activities, perceived benefits of WO, existing and potential management mechanisms, to elicit a broad range of opinions and motivations for WO conservation. The open-ended answers from the question "What led you to participate in WO conservation last year?" provided inputs that were developed into 12 motivation items in the questionnaire as presented in Table 2.

The study selected 312 respondents from public places in Kapoe district, such as public gardens, high schools, and colleges. The female proportion of respondents was 58
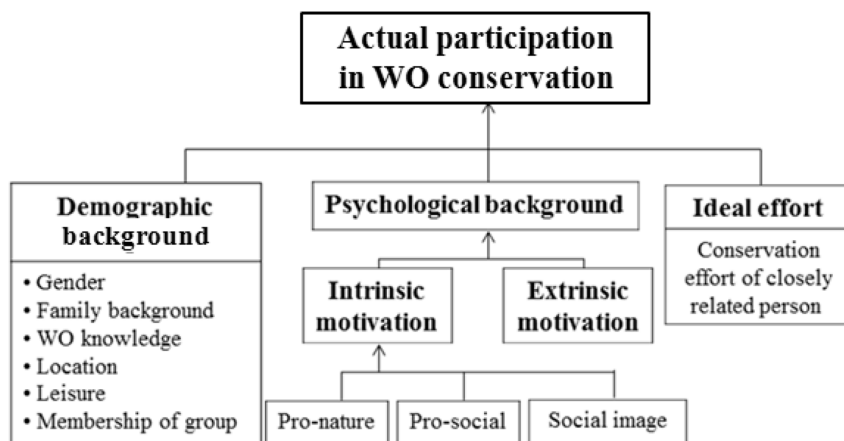

Figure 2 Conceptual framework of the study

Table 2
Motivation items and their associated questions

Motivation item	Code	Question: "Does the following reason motivate you to conserve WO?"
1. Social norm/rules	Mo_Norm	It is a community agreement/rule to conserve WO
2. Cooperation	Mo_Coop	I like to work with other people
3. Moral duty	Mo_Duty	It is a common obligation to conserve endangered species
4. Social image/reputation	Mo_Socimg	Conserving WO gives me a better social image
5. Altruism -Warm glow	Mo_Altruism	It makes me satisfied with myself
6. Trust	Mo_Trust	I trust the person/people who organize the WO conservation activities
7. Improve local ecosystem	Mo_ES	I want to improve our local ecosystem
8. Bequest benefit	Mo_Bequest	I want to conserve WO for the next generation
9. Existence benefit	Mo_Existence	I do not want it to become extinct
10. Amenity benefit	Mo_Beauty	I like the beauty of WO
11. Selling purpose	Mo_Selling	I may use it for selling purposes
12. Eco-tourism purpose	Mo_Tourism	I may use it for eco-tourism purposes

percent, which is slightly larger than that of the general female population in Kapoe district of 50 percent. The respondents were surveyed using structured survey forms. After receiving instructions and the necessary information from the interviewer, respondents filled out the questionnaire individually. Four sets of questions were included: (1) knowledge of WO, (2) participation in WO conservation activities, (3) motivation for WO conservation, and (4) demographic background.

Variable Measurement and Data Analysis

This section describes the measurement of the key variables from our conceptual framework. It includes youth's knowledge of WO, actual participation, and motivation in WO conservation.

1) Actual participation in WO conservation (*Ac_par*). WO conservation activities were classified into production activities (seed collecting, cultivation, transplanting and replanting, and habitat restoration) and support activities (meeting, conservation presentation, and multimedia production). This variable represented the youth's participation in WO conservation activities over the last year (October 2014 to September 2015). In the questionnaire, frequencies of participation in each type of activity were judged using a five-level scale from "never" to "always".

Initially, the participation index was generated using principal axis factoring (PAF) in order to represent individual participation. However, the participation variable that provides better results in the regression analysis is a dichotomous form. A value of one represents the respondent's participation in any of WO conservation activity, while a zero value represents no participation at all in any conservation activity.

2) Knowledge on water onion (*WOKnow*). At the beginning of the interview, each respondent was given a quiz with 10 questions, comprised of both binary-choice and multiple-choice questions. These questions were designed and verified with experts and official

references. The respondent received one point for each question if answered correctly. Youth's knowledge about WO is presented in Figure 3.

3) Motivation for WO conservation. Initially, 12 items were presented to indicate the respondent's motivation to participate in WO conservation activities (Table 2). As the motivation variables were not directly observable, the researcher employed exploratory factor analysis (EFA), a variable reduction technique, to identify the underlying motivational types of those items. The Varimax rotation technique, under principal component analysis (PCA), was then used to determine the dimensionality of the considered variables. By rule of thumb, presented by North, Bell, and Cahalan (1982), factors with eigenvalues greater than one are extracted and factor loadings above .5 are retained. After the component factors were determined, a least squares regression approach was used to predict the factor scores, which were used as values for the motivation variables in the study's empirical model. The factor scores were standardized to a mean of zero, with a standard deviation equal to one (Distefano, Zhu, & Mîndrilă, 2009) and there was no correlation between factors.

Factors Determining youth's Actual Participation

The binary regression model was used to identify the factors affecting youth participation in WO conservation. The model of youth's actual participation is expressed in Equation (2):

$$
\begin{aligned}
\text{Ac\_par} = {} & \beta_0 + \beta_1 Prosocial + \beta_2 Pronature + \beta_3 Extrinsic \\
& + \beta_4 SocImg + \beta_5 Member + \beta_6 CPeffort \\
& + \beta_7 WOKnow + \beta_8 Location + \beta_9 Gender \\
& + \beta_{10} FamBG + \beta_{11} TAstudy
\end{aligned}
$$

(2)

where β_i is a vector of the unknown parameters to be estimated.

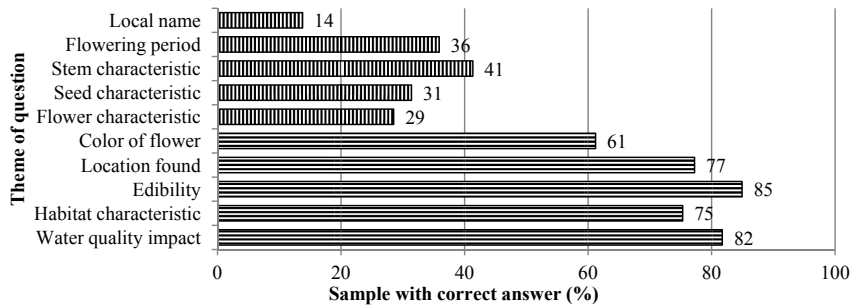The first four explanatory variables represented youth's conservation motivation and consisted of *Prosocial,*

Figure 3 Youth's knowledge about WO from binary-choice (vertical hatching) and multiple-choice (horizontal hatching) questions

Pronature, Extrinsic, and *SocImg* (social image). The values of these variables were generated by the PCA in the previous step. The fifth variable, *Member*, indicated whether a respondent was a member of any conservation group. The next variable, *CPeffort*, referred to the effort of closely related persons, with a value of one if that particular person participated in WO conservation. The next explanatory variable was the respondent's knowledge of WO (*WOKnow*), which was a discrete number from zero to five. The last set of explanatory variables were the respondent's demographic background including *Location, Female*, and *FamBG*. All were dummy variables, where *Location* s represented respondents who lived in Kapoe Sub-district, *Female* represented female respondents, and *FamBG* represented what the respondent's family did in agricultural work. To participate in WO conservation, respondents must invest their available time. The original formula used time for leisure but this study used the number of hours for study (*TAstudy*) instead because it provided better statistical results.

Results and Discussion

Of the 312 respondents, about 54 percent lived in Kapoe sub-district, where most of the WO can be found. About 67 percent of respondents came from agricultural-based families, mostly in para-rubber and oil palm plantations. The average household income was THB 10,377 per month and the average household had 5 members. Sixty-three percent of respondents were female. The average age of all the respondents was 18 years. Of the total time per week (168 h) respondents allocated around 32 percent of their time for work, including housework, 19 percent for study, and 12 percent for leisure.

There were three youth groups actively participating in WO conservation activities in Kapoe district, namely 'Won Too Tee', 'Rak Klong Bang Pru', and the 'Kapoe Children Council'. The first two groups were initiated by local communities, and both focus on natural resources and environmental conservation, with 'Rak Klong Bang Pru' specifically focusing on WO conservation. The last group, Kapoe Children Council, was initiated by the Royal Thai Government, which works on general children activities such as monthly council meetings, children's day events, mangrove planting, and WO breeding and planting. About 53 percent of respondents had participated in WO conservation activities during the past year. Of the total, about 42

percent had participated in habitat restoration activities during their semester break. Youth who were members of those conservation groups accounted for 33 percent of respondents and could be a member of one or more groups. The data on youth participation and membership were rechecked by the conservation leaders in the study area to ensure data reliability, as the official records were not available in the study area.

Youth Motivation on WO Conservation

The results from the rotated component matrix (Table 3) identified four factors, which could explain 52.59 percent of the variance of the initial motivational items. The first factor, pro-social motivation, was comprised of the social norms or rules variables: cooperation, moral duty, altruism or warm glow, and trust which refer to the social relations with other people or the community. The second factor, pro-nature motivation, was comprised of the following

Table 3
Rotated component matrix of youth motivation on WO conservation

Motivation item	Factor 1	Factor 2	Factor 3	Factor 4
	(Pro-social)	(Pro-nature)	(Extrinsic)	(Social image)
Cooperation	**.684**			
Moral duty	**.657**	.269		−.250
Social norm/rules	**.643**		.238	
Altruism -warm glow	**.520**	.276		.237
Trust	**.510**			.408
Ecosystem improvement		**.664**		.284
Bequest benefit	.218	**.652**		
Existence benefit		**.639**	.225	
Eco-tourismpurpose			**.789**	
Selling purpose			**.651**	.298
Amenity benefit		.470	**.544**	−.299
Social image/reputation				**.806**
% of variance	22.45	11.16	9.95	9.04
Cumulative % of variance	22.45	33.61	43.55	52.59

Note: Extraction Method: Principal Component Analysis. Rotation Method: Varimax
Kaiser-Meyer-Olkin (KMO): .726, Cronbach's alpha: .794
Factor loadings between −.2 and .2 are suppressed
Factor loadings over .5 appear in bold which represent motivation items in each factor

variables: ecosystem improvement, bequest benefit, and existence benefit which refer to the relationship between oneself and nature. The third factor, extrinsic motivation, was comprised of the following variables: amenity benefit, eco-tourism purposes, and selling purposes. These variables are incentive-based mechanisms under the concept of wise use for conservation purposes. The stock can be sustained if the harvesting rate is below the regeneration rate of a renewable resource such as WO. The last factor, social

image, was comprised of only one variable, being social image or reputation.

The alpha coefficient was calculated to test the reliability of the motivational questions used in the survey and the value of .794 indicated that the questions used were reliable because the cutoff value for being statistically acceptable is .7 (Santos, 1999). To test the appropriateness of using PCA, the Kaiser-Meyer-Olkin measure of sampling adequacy (KMO) was calculated (.726) which was within

Table 4
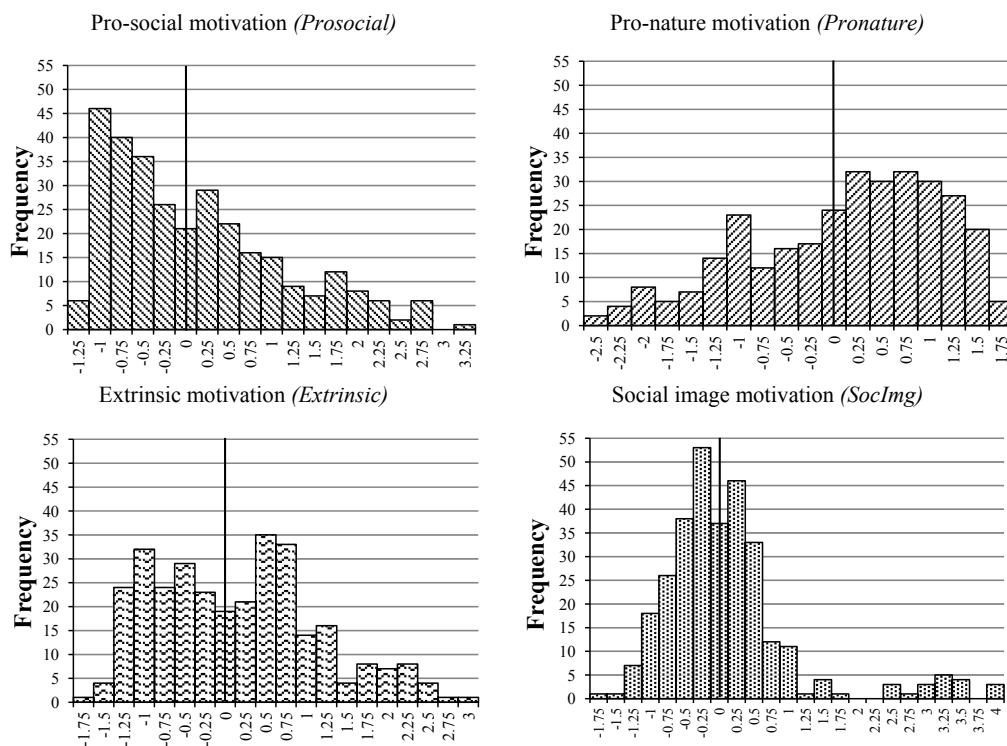Component score coefficient matrix of youth motivation on WO conservation

Motivation item	Factor 1	Factor 2	Factor 3	Factor 4
	(Pro-social)	(Pro-nature)	(Extrinsic)	(Social image)
Cooperation	.426	−.184	−.038	−.021
Moral duty	.370	.051	−.014	−.294
Social norm/rules	.373	−.145	.119	−.074
Altruism-warm glow	.245	.090	−.129	.142
Trust	.230	.025	−.073	.290
Ecosystem improvement	−.126	.438	−.085	.220
Bequest benefit	.008	.421	−.183	.003
Existence benefit	−.124	.413	.085	−.103
Eco-tourism purpose	−.014	−.094	.554	−.022
Selling purpose	−.033	−.112	.453	.230
Amenity benefit	−.062	.253	.335	−.290
Social image/reputation	−.087	−.004	.072	.681

Table 5
Logistic regression estimates of volunteering probabilities

Code	Variable	Coefficient (z-value)		Marginal effect
Prosocial	Pro-social motivation	−.23	(-1.57)	−.06
Pronature	Pro-nature motivation	.29	(1.92)*	.07
Extrinsic	Extrinsic motivation	−.02	(−.16)	−.01
SocImg	Social image motivation	.06	(.43)	.02
CPeffort	Effort of close person	1.90	(6.07)***	.46
Member	Membership	1.16	(3.37)***	.28
WOKnow	WO knowledge	.23	(1.94)*	.05
Location	Respondents' location	.54	(1.73)*	.13
Female	Being female	−.55	(-1.67)*	−.13
FamBG	Agriculture-based family	.62	(1.93)*	.15
TAstudy	Time allocated for study	−.02	(-2.41)**	−.01
	Constant	−1.05	(-1.85)*	
	Observation	308		
	Pseudo R^2	.2839		
	Log likelihood	−151.69254		

Notes: *, **, and ***, statistically significant at 90%, 95%, and 99%, respectively

Figure 4 Histogram of the distribution of motivation variables

the accepted region (statistically acceptable KMO values are $\geq .5$), which indicated that the four factors accurately represented the respondent motivations.

Furthermore, we employed the regression method to calculate the component score coefficient of each motivation (Table 4). After we combined those coefficients with observed variables, the factor scores were standardized to a mean of zero with a standard deviation equal to one (Distefano et al., 2009).

The above types of motivation represent the explanatory variables in the empirical model. Distributions of calculated values for each type of motivation and motivation variables are shown in Figure 4. The histograms illustrate that the respondents' pro-social motivations were low (positively skewed curve) and pro-nature motivations were high (negatively skewed curve). For extrinsic motivation, the distribution was bimodal, which indicated that the respondents can be separated into two groups with high and low extrinsic motivation. The distribution of the social image motivation variable was just within a normal distribution, with only a small group of respondents having extremely high social image motivation.

Factors Affecting youth's Actual Participation

To identify the factors affecting youth's actual participation, the researcher used a logit regression which provided a slightly better result than a probit regression. The results in Table 5 illustrate that being a member of a conservation group, better knowledge about WO, participation of closely related person, being pro-nature, living in Kapoe sub-district, being male, and coming from an agriculture-based family were significant factors influencing youth participation.

The marginal effects were evaluated at the mean value of the dependent variables in order to explain how those factors affected youth participation. Being a member of a conservation group will increase the probability of participation by 28 percent while the effort of a close person will increase the probability of participation by 46 percent. A higher score of WO knowledge by one will increase the probability of participation by 5 percent. Living in Kapoe sub-district, within the WO-rich area, will increase the probability of participation by 13 percent. Being female will decrease the probability of participation by 13 percent. Coming from an agricultural-based family will increase the probability of participation by 15 percent. Finally, one more hour per week allocated for studying will decrease the probability of participation by 1 percent.

Conclusion and Recommendation

This study provided insights into biodiversity conservation on endemic species and it focused on youth's voluntary participation for WO conservation in Thailand. In this study, youth motivation for WO conservation was classified into four types: pro-social, pro-nature, extrinsic, and social image motivations. Of the four motivation types, only pro-nature motivation could improve youth participation in WO conservation. In designing effective and efficient policy interventions and reforms, it is critical to understand what motivates the local people especially

those that have intrinsic pro-nature motivation, to participate in conservation initiatives.

Participation in WO conservation is also increased by improving youth knowledge about WO. Youths who live in a WO-rich area, are male, and come from an agricultural-based family had a higher probability of participation in WO conservation than others. The study also suggested promoting policy mechanisms that encourage conservation group initiation and the cohesion of members. The local environmental council or conservation group should be established and supported to increase youth participation and raise public awareness for securing long term conservation of the WO. This was also recommended in the 11th National Economic and Social Development Plan (B.E.2555–2559) of Thailand. Strategic policies that improve knowledge of this endemic species, especially through education programs in the study area, would likely increase youth participation in conservation. Further studies in the area of behavioral economics should be undertaken to investigate how and to what extent pre-existing motivations affect future policy mechanisms.

Conflict of interest

There is no conflict of interest.

Acknowledgments

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