

**The Effects of Environmental Knowledge, Environmental
Attitude and Socio-Demographic Factors on Proenvironmental
Behavior in Mandalay**

Research Report

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The Effects of Environmental Knowledge, Environmental Attitude and Socio-Demographic Factors on Pro-environmental Behavior in Mandalay

Kyaw Soe Hlaing

Abstract

The primary purpose of this study is to investigate the effects of environmental knowledge, environmental attitude and socio-demographic factors on pro-environmental behavior in Mandalay, Myanmar. This study also attempted to develop the Myanmar version of the Pro-Environmental Behavior Scale based on a translation of the Xiao and Hongs' (2010) original instrument. This study examined the effects of environmental knowledge, environmental attitude and socio-demographic factors on pro-environmental behavior by surveying a sample of 280 (162 women and 118 men) respondents from the townships of Chanayetharzan, Chanmyatharsi, Aungmyaetharzan and Mahaangmye in Mandalay. A multiple regression analysis model was employed to investigate the association between pro-environmental behavior and environmental knowledge, environmental attitude and socio-demographic factors. As hypothesized, women's engaging in private environmental behaviors was even significantly higher than that of men. Results indicated that older respondents engaged more in public environmental behaviors but less in private environmental behavior. Moreover, education and income were significantly correlated with the pro-environmental behaviors. The pro-environmental behavior was significantly and strongly correlated with the environmental attitude. However, employment status, married and environmental knowledge were not significantly correlated with pro-environmental behavior.

Keywords: environmental knowledge, environmental attitude and socio-demographic

Introduction

Environmentalism emerged as a global phenomenon in the late 1960s and early 1970s (Buttel 2002; Merting et al. 2002). Since then, scholars have recognized the fundamental importance of exploring how knowledge, beliefs, and attitudes influenced human response to ecological degradation and pollution (Maloney et al. 1975). This awareness led to less public support for the human exemptionalism paradigm (HEP), the notion that humans are free to do as they please because they are exempt from the laws of nature (Catton & Dunlap, 1978a; Dunlap & Michelsom, 2002). Endorsing the HEP implied thinking:(1) humans are separate from environments, (2) environments have only instrumental value, (3) environmental resources are inexhaustible, and (4) humans can control environments

(Dunlap & Michelson 2002). Environmental sociologists suggested a New Environmental Paradigm (NEP) was emerging among the USA public (Dunlap et al. 2000). The NEP addresses five aspects of an environmental worldview: the realization of limits to growth, anti-anthropocentrism, belief in the fragility of the balance of nature, rejection of human anti-exemptionalism and belief in future ecocrisis. Accepting the NEP was consistently related to pro-environmental behavior (Dunlap et al. 2000).

Attitude towards the environment has been commonly found to be an antecedent to pro-environmental behavior (Moloney and Ward, 1973). Attitude is to help social group and individuals acquire a set of value and feelings for the environment and the motivation for actively participating on environmental improvement and protection (UNESCO, 1978). Allport (1935, P-810) stated that “an attitude is a mental and neutral state of readiness, organized through experience, exerting a directive or dynamic influence on individual’s response to all objects and situations with which it is related”.

Several socio-demographic factors may also be correlated with pro-environmental behavior. Females are more likely to engage in pro-environmental behavior due to cultural and social-structural factors that make them on average more aware of the interconnections between causes and consequences of environmental harm (Stren et al. 1993; Hunter et al. 2004). More educated people are more likely to engage in pro-environmental behavior because they are exposed to more information about environmental harm through schooling (Scott & Willits, 1994). The relationships between income, environmental attitudes and behaviour have been important topics within environmental sociology. Early research suggested a positive relationship between people's income and pro-environmental attitudes and behaviour because environmental quality was often considered a luxury good for which people have more degrees of freedom to emphasize when their material needs are well satisfied (Van Liere & Dunlap, 1980; Scott & Willits, 1994).

However, citizens of poorer countries may have similar or even more pro-environmental attitudes and may be willing to make similar or larger economic sacrifices for environmental protection partly because they more likely have direct experiences with the consequences of environmental degradation. Mixed results regarding the relationship between people's age and pro-environmental behaviour have also been reported (Scott & Willits, 1994; Stern et al. 1995; Tindall et al. 2003).

Researchers have long suggested that behavioral intention arise based on consumer's knowledge and attitudes which stems from the theory of reasoned action (Ajzen and Fishbein, 1980). These links been explored in a range of areas over the years including environmental knowledge, attitudes and intentions (Diamantopouls, Schlegelmich, Sinkovics, and Bohlen, 2003; Kaiser, Wolfing, and Fuhrer, 1999; Maloney, ward and Braucht, 1975; Schlegelmilch, Bohlen, Diamantopoulos, 1996). Ajzen and Fishbein (1980) proposed the theory of reasoned action (TRA), where behavior is influenced by behavioral intentions, which are formed from attitudes towards a particular act and one's subjective norms. The models have proposed that for an attitude to be formed individual factual knowledge is a precondition (Kaiser, Wolfing and Fuhrer, 1999).

Environmental knowledge can be general in nature such as awareness of environmentally friendly products or more specific knowledge on issues such as recycling. However, several studies found no direct relationship between factual environmental knowledge and environmental behavior (Maloney and Ward 1973; Schahn and Holzer 1990. Schahn and Holzer (1990) proposed that applicable knowledge should have a moderating effect on the relationship between attitudes and self-report behavior. Building on the TRA, we propose in this research that knowledge (e.g., general environmental knowledge or carbon offset knowledge) has a positive impact on pro-environmental attitude and consequently specific behavior in regards to pro-environmental behaviors.

Kollumuss and Agyemann (2002) also suggested that "Environmental Knowledge," influences pro-environmental behavior in an indirect way. The task of "Knowledge" is to affect the factor "Environmental Attitudes and Values" and this leads to positive or negative environmental behavior. The variable "Knowledge" is often used in campaigns to improve environmental awareness or behavior. The model of Fietkau and Kessel, however, reports that knowledge has no direct influence. According to Schahn and Giesinger (1993), although there is no direct influence of knowledge, it is a necessary variable because pro-environmental action is only possible if people know what they can or could do. Without this knowledge, there will be no chance to act in an environmentally friendly way.

In more a recent study, Xiao & Hong (2010) examined the relationship between environmental behavior and environmental knowledge. In their study, education and environmental knowledge were the two strongest predictors across

models. Respondents with higher education and more environmental knowledge tended to have significantly greater participation in all environmental behaviors. Another recent study by Hong and Xiao (2007a) used a modified version of the 2000 NEP Scale and examined gender differences, using a national sample of the urban population in China. Bivariate analyses revealed higher levels of environmental concern among men, although a subsequent path analysis found that men's higher environmental concern was attributed largely to their relatively higher environmental knowledge. They also found that older and higher-educated respondents tended to be more pro-environment.

Cross-cultural and international research on the predictors of pro-environmental behavior is critical for future conservation success but is, as yet, limited in scope. Globalization has made expanding this research into international and non-western contexts absolutely essential, and Myanmar is also important place for this research. Myanmar is one of the developing countries in the world, with a population of approximately 60 million people. Myanmar is rich in natural resources (land and water, biodiversity, minerals and forest resources). However, unsustainable resource exploitation is further adding to the country's development challenges and results in severe environmental degradation, particularly in the form of deteriorating soil quality due to overuse or misuse of land, compounded by widespread deforestation. People whose livelihoods depend most on natural resources find access to them restricted and their environment increasingly degraded. In urban area, waste water and solid waste disposal practices are linked to environmental problems. (UNICEF: Child-friendly Schools in Area-Focused Townships in Myanmar, 2003).

The state of environmental degradation in Myanmar warrants a close look at factors affecting environmental behavior among Myanmar citizens. Less research has addressed predictors of pro-environmental behavior in Myanmar than Western countries, however, behavior is the ultimate concern of conservationists. Further, little is known about the effect of urban size on pro-environmental behavior in Myanmar, although people living in different size cities usually face different levels of environmental deterioration due to different stages in economic growth.

In this study, we examined the relationship between pro-environmental behavior and its socio-demographic predictors in Mandalay. In addition to the socio-demographic predictors that would be used in previous studies abroad, we assessed the impacts of attitude and knowledge on pro-environmental behavior. Our findings

may provide important implications for managing environmental challenges in Mandalay, and the approaches we used may be applicable elsewhere.

Based on of the available literature, the following hypotheses were formulated:

Hypothesis 1: Older respondents will be more likely to behave pro-environmental behaviour, compared with Younger respondents.

Hypothesis 2: Female respondents will be more likely to behave pro-environmental behaviour, compared with Male respondents.

Hypothesis 3: Respondents with higher levels of educational attainment are more likely to engage in pro-environmental behavior than respondents with lower levels of education.

Hypothesis 4: Respondents with higher levels of income are more likely to engage in pro-environmental behavior than respondents with lower levels of income.

Hypothesis 5: Unmarried respondents are more likely to engage in pro-environmental behaviour, compared with married respondents.

Hypothesis 6: Employed respondents are more likely to engage in pro-environmental behavior, compared with unemployed respondents.

Hypothesis 7: Respondents with higher environmental knowledge are more likely to engage in pro-environmental behaviour, compared with other respondents.

Hypothesis 8: Respondents with pro-environmental attitude are more likely to engage in pro-environmental behaviour, compared with other respondents.

Method

Participants

A group of 280 subjects was used for the multiple regression analysis from Chanayetharzan, Chanmyatharzi, Aungmyaetharzan and Maharaungmaye townships in Mandalay. Subjects were 162 women and 118 man with age range between 18 and above.

Procedure

Subjects were selected in a three stage stratified cluster sampling design with census blocks as primarily sampling units and households as secondary units. The original sample was stratified by socioeconomic status (lower, middle, and higher) compiled by the ward office. The sample consisting of 2013 candidates resulted in 320 cases selected by choosing every third household with participant, a process that included some cluster stages. To contact potential informants, the researcher and research assistants, after arriving in a selected community, knocked on doors, communicating their intentions. Participants were told that they could refuse the questionnaire if they wished. Almost 12.5% of these respondents, mostly high socioeconomic status participants refused to complete the questionnaire once it was started. The final sample was comprised of 280 participants, having lower and middle class household were presented.

Measures

The questionnaire packet contained three measures: the Myanmar Version of the New Environmental Paradigm Scale, the Pro- Environmental Behavior Scale and the Environmental Knowledge Scale.

Environmental Attitudes. The NEP scale (Dunlap et al. 2000) was used to measure environmental attitudes. The NEP addresses five aspects of an environmental worldview with three statements for each: the realization of limits to growth, anti-anthropocentrism, belief in the fragility of the balance of nature, rejection of human exemptionalism, and belief in future ecocrisis. Attitudes are measured with five-point Likert type scales ranging from strongly disagree to strongly agree. Among these fifteen statements, there are eight positively (pro-environmentally) narrated statements and seven negatively narrated statements. Agreement with eight positively narrated statements results in higher measures, while measures of the seven negatively narrated statements are reversed so that disagreement with them results in higher

measures. The NEP scale aggregates all fifteen statements and scores can range from 15 to 75. The reliability was found to be .50 for (NEP) Scale.

Environmental Behavior. Environmental behaviour was measured with the Pro-Environmental Behaviour Scale developed by Xiao & Hong (2010). They formed three behavioral indices using ten survey items. Respondents are asked to indicate whether in the past year they had never, occasionally, or often taken ten different environmentally oriented actions (see Appendix). Judging by the face validity and results of a preliminary principle component analysis, they combined items 1,2,3,4 and 6 to create a private environmental behavior index (the “private index”) and then items 5,7,8,9 and 10 to form a public environmental behavior index (the “public index”). For conceptual and comparison purposes, they also created a combined environmental behavior index (the “combined index”) with all ten items. The alpha of this scale was .72.

Environmental Knowledge. Environmental Knowledge was measured with the Environmental Knowledge Scale developed by Hong and Xiao (2007a). Respondents were asked to indicate what extent they agree with 10 dichotomous items about environmental knowledge. The reliability was found to be .70 for the Environmental Knowledge Scale.

Demographic Variables. Four demographic variables (gender, age, education, and income) traditionally studied in association with NEP and pro-environmental behavior (Scott & Willits, 1994, Gong & Lei, (2007) were used in this study. In addition, one occupational variable (employment status) was included, because people’s occupational status may represent differences in social classes that may influence pro-environmental behavior (Van Liere & Dunlop 1980. Marital status was also included, because family responsibilities may reduce discretionary time available for participation in pro-environmental behavior.

Results

Respondents of the survey had a mean NEP score of 42.21 and mean environmental knowledge score of 7.68 (Table 1). The sample was 58% female, mean age was 39 and the mean education level was 2.41 corresponded to a level between high school and postgraduate. Most respondents (55%) were married and the average one month income was about 150000 Kyats. Most respondents had jobs (65%).

Among respondents in the sample, more than half reported often engaging in recycling (55%), environmental talk (64%), bring their own shopping bag (65%) and environmental maintaining (57%), while less than half of them reported engaging in recycling bags (44%), environmental donation (50%), environmental education (47%), environmental campaigning (44%), environmental volunteering (47%) and environmental litigation (47%).

Table 1 Summary statistics of pro-environmental behavior, environmental attitude, environmental knowledge and socio-demographic conditions of respondents

Variables	Description	Mean	SD
PK	Aggregation of responses to 8 PK questions	7.68	3.70
NEP	Aggregation of responses to 13 NEP questions	42.21	4.69
Gender	Female=1; Male=2	1.49	1.22
Age	Years	39.32	13.37
Education	Years	2.41	1.04
Marital status	Single=1; married=2	1.55	0.50
Income	One month about 150000 Kyats	1.67	0.67
Employment status	Unemployed=1; Employed=2	1.65	0.48
Recycle	Never=1, Occasionally=2, Often=3	2.00	0.67
Environmental talk	Never=1, Occasionally=2, Often=3	2.01	0.60
Bring bag	Never=1, Occasionally=2, Often=3	2.54	0.69
Recycling bags	Never=1, Occasionally=2, Often=3	2.16	0.84
Env-donation	Never=1, Occasionally=2, Often=3	1.75	0.67
Env-education	Never=1, Occasionally=2, Often=3	2.40	0.61
Env-campaigning	Never=1, Occasionally=2, Often=3	1.69	0.69
Env-volunteering	Never=1, Occasionally=2, Often=3	1.66	0.70
Env-maintaining	Never=1, Occasionally=2, Often=3	1.56	0.71
Env-litigation	Never=1, Occasionally=2, Often=3	1.78	0.69

SD= standard deviation , PK= Pro-Environmental Knowledge, NEP= New Environmental Paradigm

Differences between older and younger respondents concerning pro-environmental behavior

T-test was employed to examine whether the pro-environmental behavior of older and younger differed significantly. Figure 1 shows that older respondents had a higher pro-environmental behavior than younger respondents. Older respondents were significantly more likely to engage in environmental maintaining ($t=-2.56$, $p<.05$), environmental volunteering ($t=-2.16$, $p<.05$) and environmental education ($t=-2.92$, $p<.01$) than younger respondents. However, older respondents were significantly less likely to engage in recycling bags than younger respondents ($t=2.34$, $p<.05$). For the other variables, no significant differences were found between the two groups.

Differences between male and female respondents concerning pro-environmental behavior

As shown in Figure 2, female respondents were significantly more likely to engage in recycling bags ($t=3.01$, $p<.01$) and bringing bags ($t=2.42$, $p<.05$) than male respondents. However, female respondents were significantly less likely to engage in environmental volunteering ($t=-2.36$, $p<.05$) than male respondents. For the other variables, no significant differences were found between the two groups.

Differences between respondents with higher level of education and respondents with lower level of education concerning pro-environmental behavior

Figure 3 shows that respondents with higher levels of education attainment were significantly more likely to engage in sorting garbage than respondents with lower levels of education ($t= -3.23$, $p <.01$). Further, respondents with higher levels of education attainment were significantly more likely to engage in recycling bags than respondents with lower levels of education ($t=-2.88$, $p<.01$). However, respondents with lower levels of education attainment were significantly more likely to engage in environmental maintaining ($t=2.54$, $p<.05$). For the other variables, no significant differences were found between the two groups.

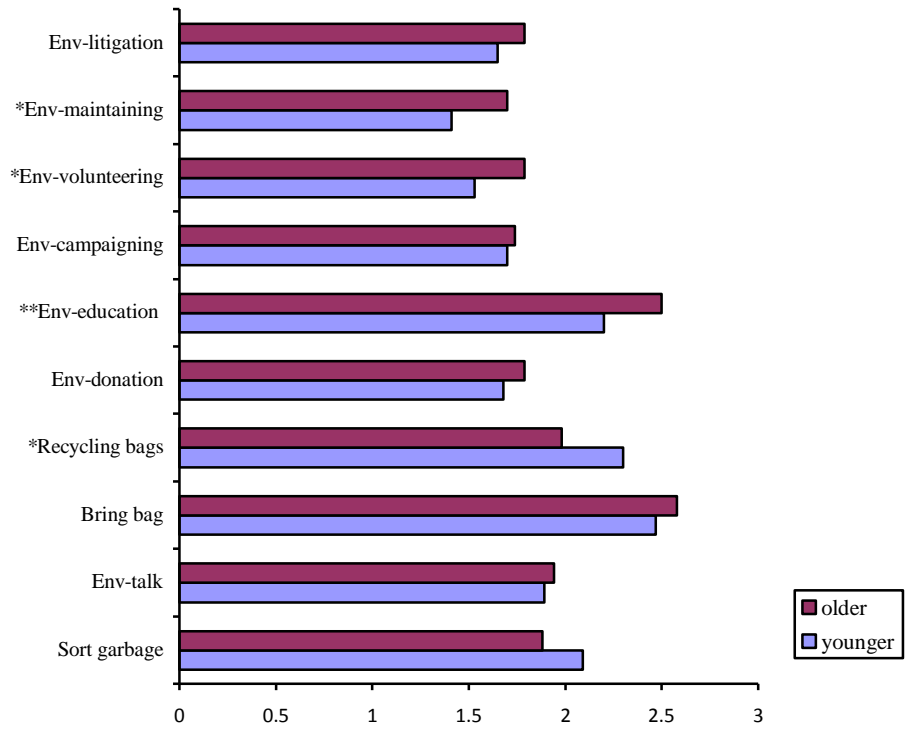


Figure 1: Differences between older and younger respondents pro-environmental behavior

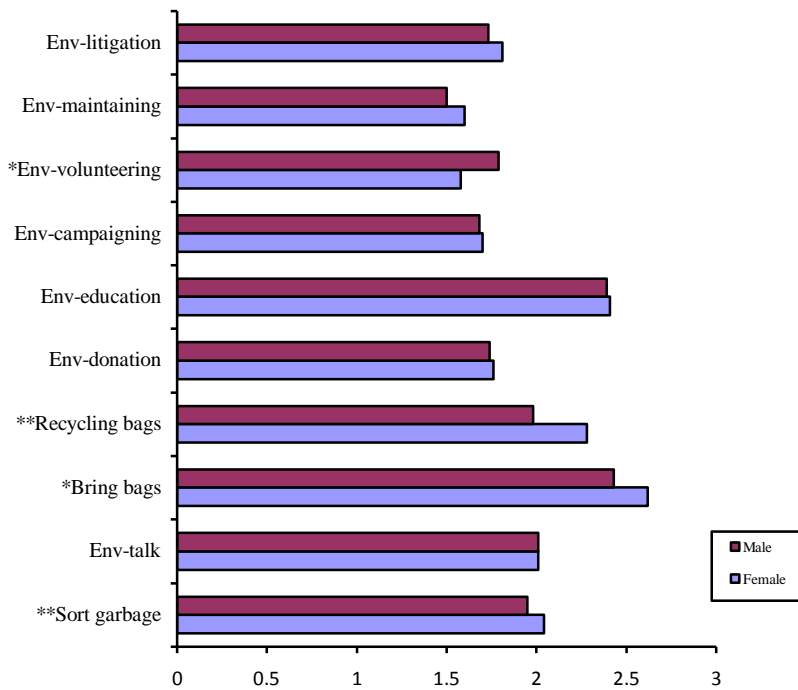


Figure 2: Differences between male and female respondents pro-environmental behavior

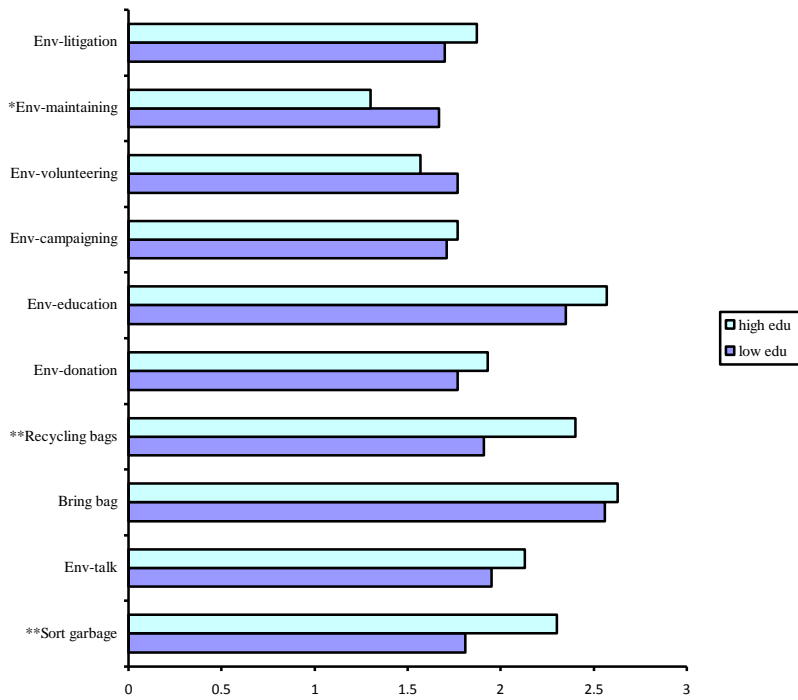


Figure 3: Differences between respondents with higher level of education and respondents with lower level of education pro-environmental behavior

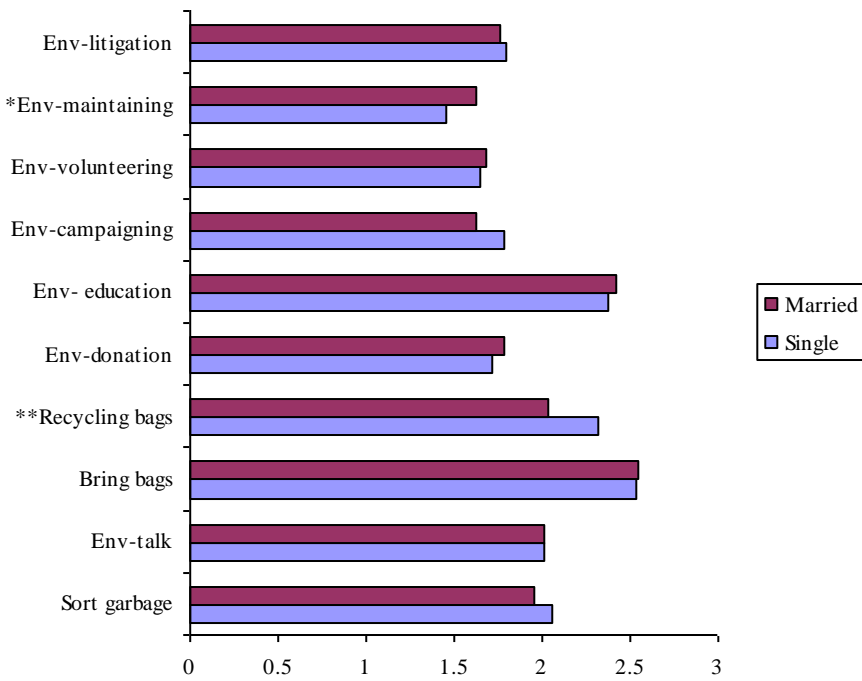


Figure 4: Differences between married respondents and single respondents pro-environmental behavior

Differences between married respondents and unmarried respondents pro-environmental behavior

Figure 4 shows that single respondents were significantly more likely to engage in recycling bags than married respondents ($t = 2.97, p < .01$). But, single respondents were significantly less likely to engage in environmental maintaining ($t = -1.98, p < .05$). For the other variables, no significant differences were found between the two groups.

Differences between higher levels of income respondents and lower levels of income respondents pro-environmental behavior

T-tests were employed to examine whether the pro-environmental behavior of higher levels of income respondents and lower levels of income respondents differed significantly. Figure 5 shows that there were no significant differences between the two groups.

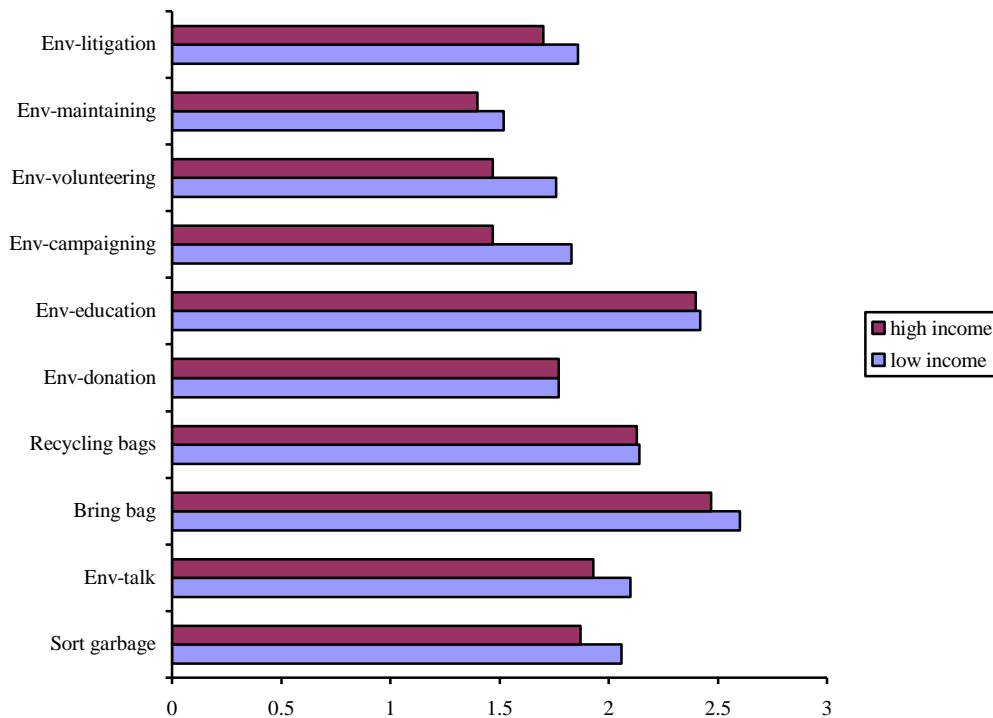


Figure 5: Differences between respondents with higher level of income and respondents with lower level of income pro-environmental behavior

Differences between employed respondents and unemployed respondents in pro-environmental behavior

Figure 6 shows that employed respondents were significantly more likely to engage in environmental-talk than unemployed respondents ($t=-2.53, p<.05$). For the other variables, no significant differences were found between the two groups.

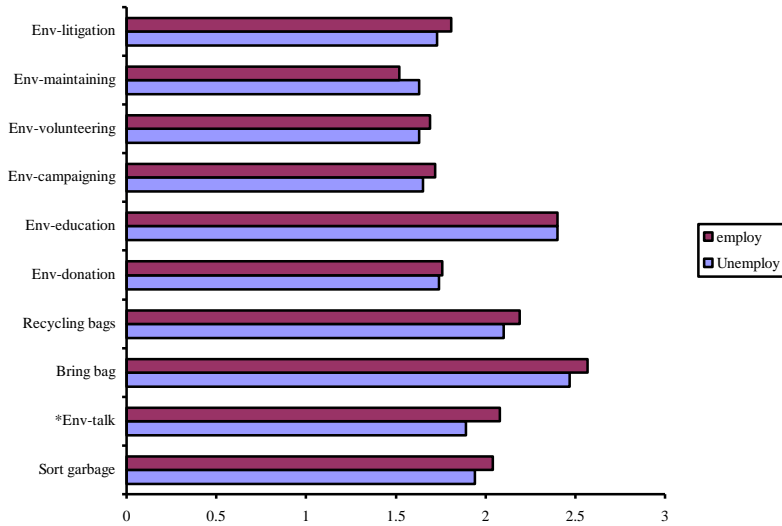


Figure 6: Differences between employed respondents and unemployed respondents concerning pro-environmental behavior

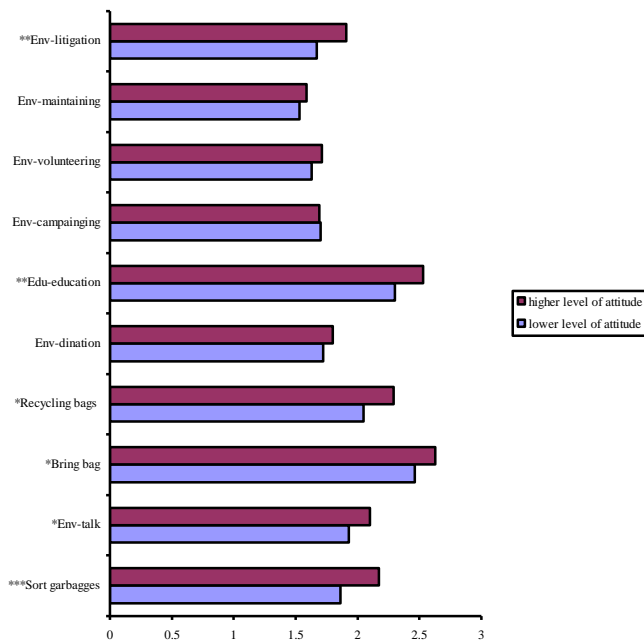


Figure 7: Differences between the respondents with higher levels of pro-environmental attitude and the respondents with lower levels of pro-environmental attitude

Differences between the respondents with higher levels of pro-environmental attitude and the respondents with lower levels of pro-environmental attitude

Figure 7 shows that respondents with higher levels of pro-environmental attitude were significantly more likely to engage in sorting garbage than respondents with lower levels of pro-environmental attitude ($t = -3.97, p < .001$). Respondents with higher levels of attitude were significantly more likely to engage in Env-Education ($t = -3.15, p < .01$) and Env-litigation ($t = -3.01, p < .01$) than lower levels of attitude. Respondents with higher levels of attitude were significantly more likely to engage in environmental-talk ($t = -2.34, p < .05$) and bringing bags ($t = -2.02, p < .05$) and recycling bags ($t = -2.47, p < .05$) than lower levels of attitude. For the other variables, no significant differences were found between the two groups.

Different between the respondents with higher level of pro-environmental knowledge and the respondents with lower levels of pro-environmental knowledge

Figure 8 shows that respondents with higher levels of knowledge were significantly more likely to engage in Env-Education ($t = -2.52, p < .05$) and Env-volunteering ($t = -2.19, p < .05$) than lower levels of Knowledge. For the other variables, no significant differences were found between the two groups.

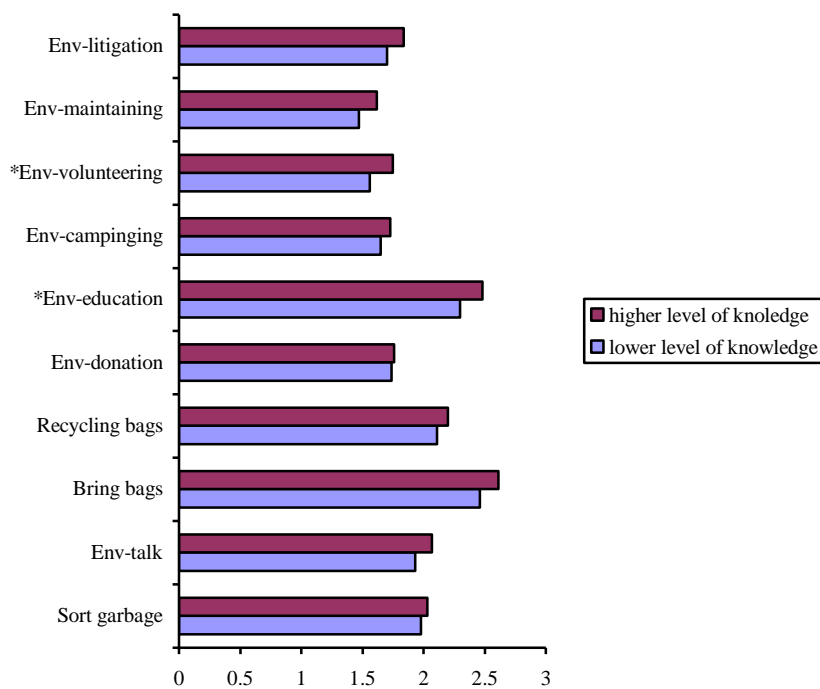


Figure 8: Differences between the respondents with higher levels of pro-environmental knowledge and the respondents with lower levels of pro-environmental knowledge

Correlation between environmental knowledge, environmental attitude and pro-environmental behavior

Correlations among the environmental knowledge, environmental attitude and pro-environmental behavior are presented in Table 10. The results indicated that environmental knowledge and environmental attitude (NEP) were significantly positive correlated with pro-environmental behaviors. Environmental knowledge was significantly positive correlated with environmental attitude (NEP).

Table 2 Showing correlation between Environmental Knowledge, Environmental Attitude and Pro-environmental Behavior

	Pro-environmental behavior	Environmental knowledge	Environmental attitude (NEP)
Pro-environmental behavior	-		
Environmental knowledge	.29**	-	
Environmental attitude(NEP)	.28**	.20**	-

*p < .05, ** p < .01

Multiple regression analysis of ten pro-environmental behavior on socio-demographic factors, environmental attitude and environmental knowledge

As shown in Table 11, age, gender, education, income and environmental attitude (NEP) were significant predictors of at least one pro-environmental behavior. Older respondents reported more participation in environmental talk and environmental education than their counterparts. Female respondents had higher scores of participating in environmental donation and environmental maintaining than male respondents. Respondents with higher levels of education attainment were significantly more likely to engage in environmental education and environmental maintaining. Respondents with higher levels of income were significantly more likely to engage in environmental maintaining than respondents with lower levels of income. Respondents in more pro-environmental attitude were significantly more likely to engage in sorting garbage and recycling bags. However, Table 11 demonstrates that after controls, environmental knowledge had no significant association with any environmental behavioral index.

Table 3 Result of multiple regression analysis with pro-environmental behavior, environmental knowledge, environmental attitude and socio-demographic

Independent Variables	multiple regression analysis (β)									
	1	2	3	4	5	6	7	8	9	10
Age	.06	.31*	.10	.03	.14	.32*	.20	.12	.21	.18
Sex	-.22	-.17	-.21	-.20	-.30*	-.02	-.02	.05	-.27*	-.13
Edu	.10	.05	.00	.24	-.05	.32*	.07	-.03	-.37*	.02
Married	-.08	-.13	.03	.02	.02	-.11	.09	.04	-.15	-.11
Income	-.01	-.14	-.12	.13	-.19	-.08	-.26	-.21	.34*	.05
Employ	.21	.15	.15	.18	.07	-.10	.15	.02	.17	-.02
Township	-.15	-.10	.08	-.08	.07	.03	.02	-.07	.01	-.04
NEP	.47***	.27	.03	.28*	-.02	.13	.14	.12	.10	.21
Pktotal	.01	-.05	.24	.02	.03	.08	.08	.05	.25	.08

Note: 1= Recycling, 2= Env-talk, 3=Bring bag, 4=Recycle bag, 5= Env-donation, 6=Env-education, 7= Env-campaigning, 8=Env-volunteering, 10= Env-Litigation

* $p < .05$, ** $p < .01$, *** $p < .001$

Discussion

Study results reveal that overall men and women participated equally in public environmental behaviors while women's participation in private environmental behaviors (environmental behaviors inside the home) was even significantly higher than that of men. This finding is consistent with the literature on environmental behaviors in Western settings (Dunlap et al. 2000). Women perform more private environmental behaviors as a part of their daily routines, much like recycling is being routinized in England. We thus suspect that the gender gap observed in private environmental behaviors in our study may be a reflection of the unequal division of domestic duties between women and men.

Furthermore, recall that in Tindall et al. (2003) theoretic models, women were expected to more often participate in environmental behaviors because they tended to express more environmental concern, which is true inside of the home in western settings according to recent research. On the other hand, it was argued that women's greater share of domestic duties may reduce their biographical availability for environmental behaviors outside the home and, therefore, regardless of levels of concern may result in roughly equal behavioral responses across men and women. In

the case of these, our results are also similar. Specifically, we found, women to express higher levels of environmental concern. As a result, women's higher levels of participation in private environmental behaviors can be attributed to gender differences in environmental concern. Thus, our hypothesis 2 was partially supported.

We find that there are no significant differences among unemployed people and those who are employed for the sample as a whole. However, in developed countries unemployment makes people more likely to recycle and less likely to "cut back on driving a car for environmental reasons". Moreover, civil servants seem to be more worried about environmental issues and they are also more likely to take pro-environmental actions. There is an exemption; in developing countries this personal attribute plays no role. Finally, those who belong to a trade union are more concerned about the environment and they are also more likely to take a pro-environmental action and these effects seem to be stronger in developing countries. This is in line with the current literature. Thus, our hypothesis 6 was not supported.

Results also suggest that while being employed in urban Myanmar did not reduce participation in environmentally oriented behaviors, being a married person did indeed limit participation in such behaviors as we originally anticipated. In general, married people are more likely to be happy or less likely to be depressed and hence, they may show a higher willingness to participate in a social cause and also they may have a better disposition to consider the needs of other people such as the present and future generations. More specifically, in the public sphere parenthood (couples with children) was a limiting factor for both men and women, while in the private sphere only wives were constrained, husbands were not. Given women's greater share of children duty, such findings are not surprising. These results are maintained in developing and developed countries. Study results reveal that there is no significant relationship between marital status and pro-environmental behavior. Thus, our hypothesis 5 was not supported.

Chen et al., (2011) indicate that marital status should be considered in future environmental behavior studies since single respondents generally demonstrated more pro-environmental behaviour than married respondents. The additional predictive power of marital status (single respondents were younger than married respondents) over age may relate to time constraints on pro-environmental behaviour imposed by family responsibilities. Environmental-talk (an easily multi-tasked behaviour) was the behaviour with smallest participation differences between single and married respondents (Fig 4).

The result indicates that there is significant relationship between age and pro-environmental behavior. Thus, the findings support hypothesis 1. Older people tend to take environmental responsible actions more frequently than younger people. This may be related to the fact that older people could have more information and could be more conscious of the importance of taking pro-environmental actions. Moreover, older people seem to be more worried about the environment than younger people. Older people are more likely to have children and they may try to preserve the environment in the long term because their children are the ones who will enjoy a cleaner environment in the future.

Regarding educational status, we found that education was positively correlated with actively pay attention to environmental protection and information in the media. A higher educational level tends to raise the probability of taking pro-environmental actions. We clearly evidence in favor of the fact that more educated people, tend to worried about the environment and these effects are increasing in the educational level. Education plays a key role because it may not only facilitate people's understanding of environmental issues, hence improving people's environmental knowledge, but also promote individuals' realization of their own responsibility for the environment (Chen et al., 2011). There is only one exception in the case of Mandalay: those who are educated are less likely to maintain public woods and grasslands with their own money. Being educated people (however, in developing countries those people who are not more likely to be materially better-off and with a higher social standing), reduce the probability of using their own money. Thus, our hypothesis 3 was partially supported.

The study shows that income was significant correlated with pro-environmental behavior. While findings on effects of income on pro-environmental behaviour have been mixed (Scott & Willits 1994), this study showed that in Mandalay income was a relatively important predictor of maintaining public woods and grasslands with their own money. Weak correlation between income and other environmental behaviors may also reflect the fact that respondents, regardless of their income levels, have been experiencing the effects of environmental degradation in Myanmar, hence may not consider environmental quality as a luxury good that otherwise may be correlated to income. Our hypothesis 4 was also partially supported.

Interestingly, correlation analysis revealed that environmental knowledge had significant association with pro-environmental behavior. However, regression

analysis revealed that, after controlling socio-demographic variables, environmental knowledge was a relatively unimportant predictor of pro-environmental behavior. Thus, our hypothesis 7 was not supported. Although theoretical knowledge seems to play a significant role in pro-environmental behaviour, the empirical evidence is not so clear (Kaiser and Fuhrer, 2003; Laroche *et al.*, 2001; Zsóka *et al.*, 2012). Results suggest that in urban China, higher levels of environmental knowledge were clearly associated with higher levels of environmental concern; while in the West findings in this regard are ambiguous (e.g., Davidson and Freudenburg, 1996; Hayes, 2001). Some studies find no significant relationship between environmental knowledge and pro-environmental behaviour (Bartiaux, 2008; Laroche *et al.*, 2001; Maloney and Ward, 1973).

Further, results suggest that there is significance relationship between pro-environmental attitude (NEP score) and pro-environmental behavior. Thus, our hypothesis 8 was supported. The positive relationship between NEP score and pro-environmental behavior is not surprising since NEP reflects, in part, belief in future eco-crisis. The finding, however, has major implications in Myanmar where land erosion, flooding, drought and other natural disasters have boomed. In these contexts, perspectives reflecting the NEP may become more prevalent (Lo & Leung 1998; Harris 2006). Our findings suggest pervasive views reflecting the NEP would correlate with more pro-environmental behaviour.

Efforts to promote pro-environmental behavior in Mandalay could well target young, male, those with low income and less educated people, at least for the ten behaviors analyzed in this study. However, our study excluded some smaller cities and rural regions of Myanmar due to lack of data, thus these findings cannot be assumed to extend to these regions and a few provinces where the survey was not conducted. Although we identified potential mechanisms for explaining predictors of pro-environmental behavior in urban Myanmar, future studies should test those mechanisms.

Conclusion

The primary purpose of this study was to investigate the effects of environmental knowledge, environmental attitude and socio-demographic factors on pro-environmental behavior in Mandalay, Myanmar. The results of this study support the hypotheses that age, education, income and environmental attitude are positively correlated with the pro-environmental behavior.

Study results reveal that overall men and women participated equally in public environmental behaviors while women's participation in private environmental behaviors (environmental behaviors inside the home) was even significantly higher than that of men. Specifically, we found, women to express higher levels of environmental concern. As a result, women's higher levels of participation in private environmental behaviors can be attributed to gender differences in environmental concern.

Furthermore, we found that there are no significant differences among unemployed people and those who are employed for the sample as a whole. Study results reveal that there is no significant relationship between marital status and pro-environmental behavior. The result indicates that there is significant positive relationship between age and pro-environmental behavior. Older people tend to take environmental responsible actions more frequently than younger people. And then, we found that education was positively correlated with actively paying attention to environmental protection and information in the media. The higher educational level tends to raise the probability of taking pro-environmental actions. There is only one exception in the case of Mandalay: those who are educated are less likely to maintain public woods and grasslands with their own money.

Finally, the study shows that income was significantly correlated with pro-environmental behavior. While findings on effects of income on pro-environmental behaviour have been mixed (Scott & Willits 1994; Chung & Poon 2001), this study showed that in Myanmar income was a relatively important predictor of maintaining public woods and grasslands with their own money.

Further, results suggest that there is significance relationship between pro-environmental attitude (NEP score) and pro-environmental behavior. The finding, however, has major implications in Myanmar where land erosion, flooding, drought and other natural disasters have boomed.

Limitations and directions for future research

There were some limitations in this present study. First, time and financial constraints might contribute to small number of respondents selected. Although a three stage stratified cluster sampling design was used to select the sample, the subjects were chosen from Mandalay, the second largest city in Myanmar. The subjects' income and educational level were higher than the national average. Moreover, the survey did not take nationalities and religion into consideration in comprehensively explaining Mandalay populations. The findings of this study should be cautiously applied because the sample of this study might not represent the general Myanmar population. Future research should specifically consider these limitations.

In addition to the above limitations, the reader is also reminded that the current study was exploratory and that more systematic investigation of the research questions with larger sample sizes and with different age groups is warranted. Furthermore, we also emphasize that the wording of the environmental attitude items were modified. This may reduce comparability of results to prior research, but we think this is unlikely. Given that the survey was self-report and actual behaviour was not observed, it is also possible that social desirability may have influenced the results.

Future research on the determinants of pro-environmental behaviors should consider including measures of a wide variety of socio-demographic variables, social psychological constructs, and cognitions. Linkages between environmental knowledge and environmental attitude can also be explored for further understanding of environmental consciousness components. Other predictor variables are necessary to more completely explain and predict future participation in pro-environmental behaviors. Predicting pro-environmental behaviors most certainly requires a multivariate research approach that more fully accounts for the many possible determinants on pro-environmental behaviors.

It is crucial for environmental organizations to continue campaigns for certain environmental policy changes and to attempt to motivate particular private-sphere behavioural change. At the same time, it is clear that an understanding of identity campaigning points to the need to carefully review current strategies if these are to contribute more effectively to create the systemic changes that are needed and if they are to avoid counterproductive effects. Moreover, an understanding of identity campaigning leading to an appreciation of other new and important ways in which the

environmental movement could engage, and which it currently neglects. The environmental movement cannot fully contribute to creating the systemic changes needed in response to today's environmental challenges unless it understands the problems posed by values and identity, and unless it promotes environmentally beneficial aspects of identity at a societal level. Additional research concerning the impact of pro-environmental behaviors and religious orientation on the decision to engage in pro-environmental behaviors are needed to determine more clearly their role in predicting behavior.

Finally, the pro-environmental behavioral variables used (recycling, energy conservation) to create the '*willingness to sacrifice for the environment*' scale are not exhaustive, nor are they exclusive. Other measures of pro-environmental behavior may result in different conclusions. Regardless, this study has made an important contribution through cautious interpretation of results based on a general survey across Myanmar.

Implications

Drawing on a body of highly interdisciplinary research findings, the current study extends existing environmental literature by more explicitly considering the relationships of environmental knowledge, attitude and pro-environmental behaviour. While the results revealed that there was a significant relationship between environmental knowledge, attitude and pro-environmental behaviour, only the environmental attitude significantly predicted pro-environmental behaviour. In addition, pro-environmental behaviors were especially related to some socio-demographic variables. Efforts to promote pro-environmental behavior in Myanmar could well target young, male, those with low income and less educated people, at least for the ten behaviors analyzed in this study. However, our study excluded smaller cities and rural regions of Myanmar, thus these findings cannot be assumed to extend to these regions and a few provinces where the survey was not conducted. Although we identified potential mechanisms for explaining predictors of pro-environmental behavior in urban Myanmar, future studies should test those mechanisms.

More specialty, there is still no consensus about what variables most strongly influence behavior. The implications from this research, the findings do contribute to the literature for future research and also a stepping stone framework for further

studies by other researchers. In its contribution to theoretical implications, some socio-demographic variables do impact environmental knowledge, environmental attitude and environmental behaviour. These findings, combined with the results arising from the examination of the effect of the environmental knowledge, environmental attitude and socio-demographic factors, and how they may contribute to pro-environmental behaviour. However much more can be done with the data set and in future approaches to studying these issues.

According to the results, an increased understanding of the composition of pro-environmental behaviour may facilitate the development of more effective survey instruments. Improved understanding of the underlying characteristics of pro-environmental behaviours will give practitioners a keener understanding of behavioural characteristics which serve to encourage or inhibit environmentally responsible behaviour. As the human impact on the environment increases, research on the determinants of pro-environmental behavior becomes increasingly more important. Results from this research on the determinants of pro-environmental behaviors can lead to more informed public policy and educational efforts that may help to minimize or abate the impact of humans on the environment.

Pro-environmental behavior is not always consistent and that different types of behavior are influenced by different motivational variables. People may not always be aware of the environmental impacts of behaviors related to the environmental benefits of changes in these behaviors. It was shown that people are not always aware of the environmental impact of their behavior. Therefore, need to know more about the variables that influence the actual environmental impact of behavior. In an interactive process, they could then register planned (or actual) behavior changes and receive direct feedback on the potential environmental savings in which such changes would result. In this way, people could learn more about the environmental consequences of their behavior changes, which may help to reduce the actual environmental impact of households.

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