Model of Factors Affecting Forest Conservation
รูปแบบตัวแปรที่ส่งผลต่อพฤติกรรมการอนุรักษ์ป่าไม้

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Abstract

The research objectives were to study levels of forest knowledge, environmental knowledge, attitude, participation, and forest conservation behavior, and to study effects of independent variables comprising of forest knowledge, environmental education and inspiration of public mind affecting forest conservation behavior. This survey research used questionnaire to gather 350 undergraduates from population of undergraduates of Roi et Rajabhat University. Multiple regression analysis was used for predicting the factors affecting forest conservation. The results shown that in holistic view of forest knowledge, environmental education comprising environmental knowledge, attitude, participation, and forest conservation behavior level was at most level. Moreover, independent variables of forest knowledge, environmental education comprising environmental knowledge, attitude, participation, and inspiration of public mind comprising role model, event, environment and media reception affected to dependent variable of forest conservation behavior of undergraduate with 37.20 percent of power prediction (Adjusted R^2 = 0.365). The forest knowledge was the highest effect with 0.247.

Keywords: forest knowledge, environmental knowledge, attitude, participation, behavior, forest conservation

บทคัดย่อ

วัตถุประสงค์งานวิจัย เพื่อศึกษาระดับความรู้ด้านป่าไม้ ความรู้ด้านสิ่งแวดล้อม เจตคติ การมีส่วนร่วมในการอนุรักษ์ป่าไม้และพฤติกรรมการอนุรักษ์ป่าไม้ และเพื่อศึกษาปัจจัยความรู้ป่าไม้ ความรู้สิ่งแวดล้อม เจตคติ การมีส่วนร่วมในการอนุรักษ์ป่าไม้ที่มีอิทธิพลต่อพฤติกรรมการอนุรักษ์ป่าไม้ของนักศึกษามหาวิทยาลัยราชภัฏร้อยเอ็ด การวิจัยนี้เป็นการวิจัยเชิงปริมาณซึ่งเป็นการวิจัยเชิงสำรวจ เก็บรวบรวมข้อมูลโดยใช้แบบสอบถาม กลุ่มตัวอย่าง จำนวน 350 คน จากนักศึกษามหาวิทยาลัยราชภัฏร้อยเอ็ด และใช้สถิติการถดถอยเชิงเส้นตรงเพื่อทดสอบสมมติฐานของการวิจัย ผลการวิจัย พบว่า ความรู้เรื่องการอนุรักษ์ป่าไม้ สิ่งแวดล้อมศึกษาประกอบไปด้วย ความรู้ป่าไม้ ความรู้สิ่งแวดล้อม เจตคติ การมีส่วนร่วมในการอนุรักษ์ป่าไม้ และพฤติกรรมการอนุรักษ์ป่าไม้อยู่ในระดับปานกลางทุกด้าน ในจำนวนนักศึกษาร้อยละ 37.20 แต่มีอำนาจในการพยากรณ์ ร้อยละ 36.5 (Adjusted R^2 = 0.365) อย่างมีนัยสำคัญทางสถิติที่ระดับ 0.01 โดยปัจจัยอิสระการมีส่วนร่วมในการอนุรักษ์ป่าไม้มีอิทธพลสูงสุดเท่ากับร้อยละ 24.7

คำสำคัญ: ความรู้ด้านป่าไม้, ความรู้ด้านสิ่งแวดล้อม, เจตคติ, การมีส่วนร่วม, การอนุรักษ์ป่าไม้

Introduction

Thailand is a country located in the tropical zone. Nevertheless, the country covers numerous fauna and flora with 15,000 species of diversity of plant life. In Thailand, there is the amount of rainfall, humidity, the height from sea level, the type of soil, and the moisture levels. These plants live in diverse territories that can be general categorized into deciduous and evergreen forests. The tropical zone has broad range of forest habitation varieties regarding Deciduous Forests and Evergreen Forests. Deciduous Forests encompasses Mixed Deciduous, Dry Deciduous, and Bamboo Forest. Evergreen Forests can be divided (principally) into 5 groups: Moist Evergreen, Dry Evergreen, Hill Evergreen, Mangrove Forest, and Pinus Forest. Moreover about 30 percent of forests are regarded as Evergreen Forests. However, there are two more definitions that are vital in describing forests; those definitions are extremely significant for explanation of forest form. Theses are primary forest and secondary forest, thus primary forest claims as untouched, immaculate forest with existing in its rooted state. Secondary forest is forest that has been disturbed in some approach of natural or unnatural situation. Hence, the forests range from mangroves to pine forests from coastal to mountain top (Wildlife of Thailand, 2012; Thiengkamol, 2009c; FRA. 2015).

At present, forest resources are still basic essential needs of global people, particularly, those livelihoods are depend on them either in terms of timber, food, medicine, herbs, or fuel wood. At the same time, Big trees and mangrove are also fence for wind preventing and soil erosion by their roots attached to the ground tightly. The Earth's surface are covered with Plant communities about 9.4 percent in diverse continentals. Moreover, their functions as territory for numerous living creatures, hydrologic flow regulators, and soil protectors. The most critical of the biological balance is forest formation, therefore, forest ecosystem takes account of main and additional species such as perennial tree, smaller plants, fungi, bacteria, and animals including physical and chemical circulations such as energy flow and nutrient cycling (Thiengkamol, 2009c; Thiengkamol, 2011e; Wikipedia, 2015; Stamets, 2005; Boon et al., 2009). Furthermore, forests provide a large number of yields in terms of timer, fruit, fiber, bamboo, floss, herbs, essential oils, and medicinal utilization. In conclusion, diverse types of trees in forests sustain human livelihood with a large numbers of products (Thiengkamol, 2009c; Thiengkamol, 2011e; Wikipedia, 2015; Wildlife of Thailand, 2015).

Particularly, Northeast region, the Korat plateau covers the area between western Phetchaboon and the southern Dongrak ranges. Comparing to other regions, the Northeast is scantily covered by vegetation. Especially, it is being the second largest region in terms of land area. The destruction of the forests or deforestation is wide-ranging. However, some compartments of tropical and evergreen forests have survived. However, Roi- et Rajabhat University located in the Roi- et Province that is situated on Korat plateau, therefore, majority of the forest in this university are tropical and evergreen forests. The forest of this university pays an important part to provide fresh air by producing oxygen and absorbing the air pollution and being cool and pleasant shady for the students who study here (Boon et al., 2009; FRA, 2015; Saisunantharom et al., 2013a; Stamets, 2005; Suebsing et al., 2013a).

However, undergraduate students are global young generations and important changing agents of the world, therefore cultivating them with consciousness of forest conservation by establishing in the environment curriculum for all classes via educational approaches including formal system, informal system, non-formal system and lifelong education systems with integration of environmental education concepts. The goals of environmental education concepts cover knowledge and

understanding, awareness raising, attitude changing, responsibility taking, constructing in decision making for environmental problem solving, participating in all types of environmental projects and activities will initiate and motivate them to change behavior in daily living for conserving natural resources and environment. This will aid to meet sustainable development through pillar of environment (Donkonchum et al., 2012b; Gonggool et al., 2012b; Mongkonsin et al., 2013b; Morrasri et al., 2012b; Pimdee et al., 2012a; Ruboon et al., 2012a; Sangsan-anan et al., 2012a; Thiengkamol, 2011e; Thiengkamol, 2011i; Udonboon et al., 2012b; WCED, 1987).

Hence, searching the mean to alter environmental behavior, it needs to research on the factors of forest knowledge, environmental knowledge, attitude, and participation affecting forest conservation behavior of undergraduate students of Roi- et Rajabhat University who play important role for forest conservation, therefore, understating the factors affection forest conservation behavior of undergraduate of Roi- et Rajabhat University will be able to manage their conservation behavior. Thus, the administrators of university must arrange the projects and activities to let them have a chance to participate for forest conservation and increase their forest and environmental knowledge including altering their attitude and behavior of forest conservation. In order to accomplish the sustainable development goal, it should understand the levels of their levels of forest knowledge, environmental knowledge, attitude, participation and forest conservation behavior as well (Suebsing et al., 2013a; Lawan et al., 2012; Phinnarach et al., 2012a).

Objectives

1. To study levels of forest knowledge, environmental knowledge, attitude, participation of forest conservation, and forest conservation behavior of undergraduate students of Roi- et Rajabhat University.

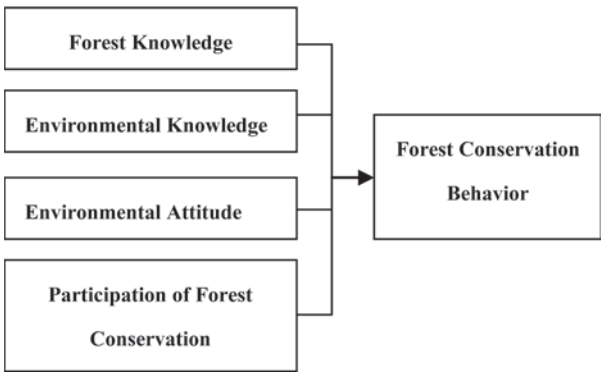
2. The effects of independent variables comprising of forest knowledge, environmental knowledge, attitude, participation of forest conservation affecting forest conservation behavior of undergraduate students of Roi- et Rajabhat University.

Research Hypothesis

The independent variables comprising of forest knowledge, environmental knowledge, attitude, participation of forest conservation positively affecting forest conservation behavior of undergraduate students of Roi- et Rajabhat University.

Conceptual Framework

The independent variables comprising of forest knowledge, environmental knowledge, attitude, participation of forest conservation positively affecting forest conservation behavior of undergraduate students of Roi- et Rajabhat University as followings.



The research was conducted as following:

Population and Sample

The populations were 2224 undergraduate students of the second semester of academic year 2014 of Roi- et Rajabhat University. Sample of 350 undergraduate students were collected from different faculties by simple sampling method. The number of sample was defined by opening the table of Krejcie & Morgan (Krejcie & Morgan, 1970).

Research Tool

Questionnaire was constructed by data and information from concepts theories and related literatures including the forest knowledge, environmental education and forest conservation behavior. After the 5 experts returned the results of item objective congruent, the item value with more than 0.5 would be selected to use in questionnaire (Rovinelli & Hambleton, 1977) and it was tried out with undergraduate students of Rajabhat Maha Sarakham University. The reliability was determined by Cronbach co-efficient (Cronbach, 1951). The reliability of whole questionnaire was 0.960.

Data Collection

The questionnaire was used to interview with 350 undergraduate students of Roi-et Rajabhat University. The 350 questionnaires were examined for correctness and completeness before coding.

Data Analysis

Description Statistics of Frequency, Percent, Mean and Standard Deviation were employed for analysis. Multiple Regression Analysis was conducted for determine the effect and relationship among variables (Hair, et al., 2010).

Results

1. Results of Forest Knowledge Level

The results of Forest Knowledge Level of 350 undergraduate students had total mean score at moderate level with 3.50 while considering on each aspect, it was revealed that Forest resources means tree and other things in social tree that is able to give the benefit to humans was at more level with 3.77 was the highest mean and subsequence were Forest in Act of Forest means land that can't occupy by anyone and Mixed, deciduous dipterocarp, and savanna forest are Deciduous Forest with 3.67, and 3.62 respectively as presented in Table 1.

Table 1

Forest Knowledge Level

	Forest Knowledge Level	$\overline{X}$	SD	Level
1.	Forest resources means tree and other things in social tree that is able to give the benefit to humans.	3.77	1.17	more
2.	Forest in Act of Forest means land that can't occupy by anyone.	3.66	1.02	more
3.	Mixed, deciduous dipterocarp, and savanna forest are Deciduous Forest.	3.62	1.11	more
4.	Tropical Evergreen Forest or Rain Forest and mangrove are evergreen forest.	3.63	1.19	more
5.	Difference of type of forest depends on the distribution of rain and can be classified into 4 types.	3.27	1.12	moderate
6.	The population growth is a cause of forest reduction.	3.13	1.38	moderate
7.	Forest resources make the rain to properly fall and it is indirect benefit.	3.21	1.19	moderate
8.	Forest resources have direct effect of prevention of soil erosion.	3.57	1.13	more
9.	Major problem of forest destruction is occurred from wrong value.	3.63	1.16	more
	Total Mean	**3.50**	**1.16**	**moderate**

2. Results of Environmental Knowledge Level

The results of Environmental Knowledge Level of 350 undergraduate students had total mean score at moderate level with 3.41 while considering on each aspect, it was revealed that Forest resources play important roles in ecosystem by function as producer and balance ecosystem was at more level with 3.61 was the highest mean and subsequence were Forest resource is a source of air purification by function as carbon dioxide absorption which is an greenhouse gas, Deforestation is recognized as main factor of climate change and Use things in daily life make of substitute material of forest resources is a way of forest conservation with 3.56, 3.56and 3.41 respectively as presented in Table 2.

Table 2

Environmental Knowledge Level

	Environmental Knowledge Level	$\overline{X}$	SD	Level
1.	Forest resources play important roles in ecosystem by function as producer and balance ecosystem.	3.61	1.11	more
2.	Forest conservation refers use the forest resources with highest benefit regardless to environment.	3.37	1.08	moderate
3.	Use things in daily life make of substitute material of forest resources is a way of forest conservation.	3.41	1.01	moderate
4.	Deforestation is not a cause of climate change.	2.94	1.32	moderate
5.	Forest resource is a source of air purification by function as carbon dioxide absorption which is an greenhouse gas..	3.56	1.18	more
6.	Deforestation is recognized as main factor of climate change.	3.56	1.13	more
	Total Mean	**3.41**	**1.14**	**moderate**

3. Results of Environmental Attitude Level

The results of Environmental Attitude Level of 350 undergraduate students had total mean score at moderate level with 3.28 while considering on each aspect, it was revealed that You know that the forest area decrease to the critical point and it needs to urgently solve the problem was at more level with 3.66 was the highest mean and subsequence were You realize values of all living creatures are should be conserve and You agree that mean of rehabilitation forest should be done by reforestation with 3.61and 3.59 respectively as presented in Table 3.

Table 3

Environmental Attitude Level

	Environmental Attitude Level	$\overline{X}$	SD	Level
1.	You feel boring when you visit forest.	2.74	1.447	moderate
2.	You realize values of all living creatures are should be conserve.	3.61	1.167	more
3.	You favor for conserving the environment because it makes better quality of life.	3.50	1.099	moderate
4.	You intend to do not destroy forest to protect the balance of forest ecosystem.	3.52	1.114	more
5.	You know that the forest area decrease to the critical point and it needs to urgently solve the problem.น	3.66	1.143	more
6.	You agree for forest encroachment to let people have a place to earn.	2.81	1.411	moderate
7.	You agree that forest resources are renewable, thus deforestation doesn't destroy the ecosystem.	2.79	1.372	moderate
8.	You realize to importance of forest reduction is a cause of soil erosion.	3.33	1.170	moderate
9.	You agree that mean of rehabilitation forest should be done by reforestation.	3.59	1.149	more
	Total Mean	**3.28**	**1.23**	**Moderate**

4. Results of Participation of Forest Conservation Level

The results of Participation of Forest Conservation Level of 350 undergraduate students had total mean score at moderate level with 3.50 while considering on each aspect, it was revealed that student participated in forest conservation will make benefit for next generations was at more level with 3.70 was the highest mean and subsequence were The others material is used for wood substitution is a forest conservation and You hold the sufficiency principle without conceited live by following the king's remark with 3.54 and 3.51 respectively as presented in Table 4.

Table 4

Participation of Forest Conservation Level 1

	Participation of Forest Conservation Level	$\overline{X}$	SD	Level
1.	You participate in activities of environmental campaign of knowledge sharing for global warming alleviation.	3.50	1.14	moderate
2.	You hold the sufficiency principle without conceited live by following the king's remark.	3.51	1.10	more
3.	You reduce plastic use by using recycling one such as cloth bag.	3.39	1.10	moderate
4.	You is a person who join to cultivate tree in the holiday.	3.36	1.18	moderate
5.	You ask your neighbor to cultivate tree together.ป่า	3.49	1.28	moderate
6.	The others material is used for wood substitution is a forest conservation.	3.54	1.18	more
7.	People participation in forest conservation will make benefit for next generations.	3.70	1.14	more
	Total Mean	**3.50**	**1.16**	**Moderate**

5. Results of Forest Conservation Behavior Level

The results of Forest Conservation Behavior Level of 350 undergraduate students had total mean score at moderate level with 3.70 while considering on each aspect, it was revealed that Forest cultivation aids moisture and origin water resources was at more level with 3.99 was the highest mean and subsequence were Forest cultivation aids for soil humidity, Natural water resource is properly conserved that will sustain forest and Forest resource conservation aids to have water for consumption with 3.91, 3.85 and 3.85 respectively as presented in Table 5.

Table 5

Forest Conservation Behavior Level

	Forest Conservation Behavior Level	$\overline{X}$	SD	Level
1.	Natural water resource is properly conserved that will sustain forest.	3.85	1.23	more
2.	Forest resource conservation aids to have water for consumption.	3.85	1.08	more
3.	Forest cultivation aids moisture and origin water resources.	3.99	1.07	more
4.	Participate in afforestation helps to increase water in natural resources.	3.82	1.02	more
5.	Forest is able to increase by itself without cultivation.	2.99	1.38	moderate
6.	Forest aids to proper rain falling.	3.69	1.10	more
7.	Deforestation is a cause of sudden flood.	3.69	1.16	more
8.	Forest cultivation aids for soil humidity.	3.91	1.02	more
9.	Deforestation is cause of water shortage.	3.82	1.10	more
10.	Forest aids to reduce soil erosion and decrease the wind strength.	3.83	1.07	more
11.	Forest protection is a duty of ranger or governmental officers only.	3.01	1.36	moderate
12.	Forest is a source of food and drug.	3.60	1.13	more
13.	Forest encroachment is a cause of dryness.	3.79	1.16	more
14.	Reduction of forest area impacts to ecosystem and plant species.	3.75	1.04	more
15.	The main cause o forest reduction is due to deforestation. agriculture, and urban expansion.	3.78	1.09	more
16.	Lost of forest area is a main cause that impacts to plant and animal habitats.	3.77	1.09	more
17.	Reduction of forest resources quantity is a cause of reduction of biodiversity.	3.77	1.11	more
	Total Mean	**3.43**	**1.18**	**moderate**

6. Results of Factors Affecting Forest Conservation Behavior

The relationship between independent variables of Forest Knowledge, Environmental Knowledge, Attitude, and Participation affecting dependent variable of Forest Conservation Behavior of undergraduate students as presented in table 6 and 7.

Table 6

Result Analysis Prediction Power of Forest Knowledge, Environmental Knowledge, Attitude, and Participation affecting dependent variable of Forest Conservation Behavior

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.610	0.372	0.365	0.463

a. Predictors: Constant, Forest Knowledge, Environmental Knowledge, Attitude, and Participation

b. Dependent Variable: Forest Conservation Behavior

Table 7

Multiple Linear Regression Analysis between Forest Knowledge, Environmental Knowledge, Attitude, and Participation Affecting Forest Conservation Behavior

Model		Sum of Squares	df	Mean Square	F	Sig.
2	Regression	43.893	3	10.973	51.066	0.000**
	Residual	74.134	345	0.215		
	Total	118.027	349			

a. Predictors: Constant, Forest Knowledge, Environmental Knowledge, Attitude, and Participation

b. Dependent Variable: Forest Conservation Behavior

Table 8

Multiple Linear Regression Analysis between Forest Knowledge, Environmental Knowledge, Attitude, and Participation Affecting Forest Conservation Behavior

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
3	Constant	1.611	0.152		10.605	0.00**
	Forest Knowledge	0.247	0.041	0.293	5.963	0.00**
	Environmental Knowledge	0.167	0.044	0.210	3.789	0.00**
	Attitude	0.000	0.045	0.000	0.001	0.99
	Participation	0.186	0.037	0.269	5.005	0.00**

a. Predictors: Constant, Forest Knowledge, Environmental Knowledge, Attitude, and Participation

b. Dependent Variable: Forest Conservation Behavior

From Table 8, linear regression equation, it was revealed that independent variables of Forest Knowledge, Environmental Knowledge, and Participation affecting dependent variable of Forest Conservation Behavior of undergraduate students with statistical significance at level of and 0.01, except Attitude is not statistical significance at 0.05 level. Independent variables of Knowledge, Forest Knowledge, Environmental Knowledge, Attitude, and Participation are able to predict Forest Conservation Behavior of undergraduate students, therefore, the equation 1 can be written as the following.

$y = a+b_1x1+b_2x2$ ……..……..…. (1)

When

y = Forest Conservation Behavior as Dependent Variable

a = constant value

b_1 = Coefficient relation of Forest Knowledge

x_1 = Forest Knowledge as Independent Variable

b_2 = Coefficient relation of Environmental Knowledge

x_2 = Environmental Knowledge as Independent Variable

b_3 = Coefficient relation of Attitude

x_3 = Attitude as Independent Variable

b_4 = Coefficient relation of Participation

x_4 = Participation as Independent Variable

Therefore, the prediction equation of relationship between independent variables of Forest Knowledge, Environmental Knowledge, Attitude, and Participation affecting dependent variable of Forest Conservation Behavior. It can be explained that forest Knowledge was the most effect to Forest Conservation Behavior with 24.70 percent with statistical significance at level of 0.01. Subsequences were Participation and Environmental Knowledge with 18.60 percent and 16.70 percent with statistical significance at level of 0.01 as the following equation 2.

$$Y = 1.611 + 0.247X_1 + 0.167X_2 + 0.000X_3 + 0.186X_4 \ldots(2)$$

Discussion

1. The result of study revealed that level of Forest Knowledge was at moderate level. This is pertinent to the study Temtumnan, K. (2006), who researched about "Transferring knowledge of Forest Resource Conservation of Forest Protection Voluntary People in Changwat Maha Sarakham", the findings showed that the people who had not been trained had Forest Knowledge at moderate level. But it is not pertinent to the study Artwanichakul et al., (2012a), titled "Structural Model of Dengue Fever Prevention and Control Behavior", it was found Knowledge of Dengue Fever Disease (KL) at more level. But this finding is not associated to the study of Traithip, T. (2008), titled on: The Development of Training Model for Community Environmental Leader on Forest Resource Conservation according Economy Sufficiency Philosophy", the finding indicated that Community Environmental Leader had Forest Resource Conservation according Economy Sufficiency Philosophy at good or more level because the Community Environmental Leader who is a person who has public mind and he prefer to devote for environmental conservation including forest resource but in this study sample group is undergraduate student who has no direct experience and knowledge on forest conservation.

2. The result of study revealed that level of Environmental Knowledge was at moderate level. This result is not congruent to the study of Lawan, T. (2013), who study on "Flood Disaster Prevention Behavior Integrated with Environmental Education Principles." The findings illustrated that Environmental Knowledge was at moderate level but the result is not congruent to the study of Suebsing, S. (2013). Who study on "Model Development of Forest Conservation for Undergraduate" The findings illustrated that Environmental Knowledge was at more kevel.

3. The result of study revealed that level of Attitude was at moderate level. This result is not congruent to the study of Lawan et al., (2012), who study on "Flood Disaster Prevention Behavior Integrated with Environmental Education Principles." The findings illustrated that Attitude was at more level with mean of 4.26. This might be able to explain that the sample group of Lawan et al., (2012), was local peoples realize that

flood disaster is issue make them suffer. Moreover, they must face the flood disaster closely and unavoidably. Moreover, it causes serious impact than the reduction of forest which is more slowly effects and the sample group in this study was undergraduate students who gain less knowledge and experience than local people and they live at university for shorter period than local people who has lived for longer period. Moreover the impact of forest reduction is gradually not suddenly happen.

4. The result of study revealed that level of Participation in forest conservation was at moderate level. This is not relevant to research of Temtumnan, K. (2006), who researched about "Transferring knowledge of Forest Resource Conservation of Forest Protection Voluntary People in Changwat Maha Sarakham", that revealed that the people who had not been trained have participation in forest conservation was at low level.

5. independent variables of Forest Knowledge, Environmental Knowledge, and Participation affecting dependent variable of Forest Conservation Behavior of undergraduate students with statistical significance at level of and 0.01, except Attitude is not statistical significance at 0.05 level. Independent variables of Knowledge, Forest Knowledge, Environmental Knowledge, Attitude, and Participation are able to predict Forest Conservation Behavior of undergraduate students. The findings of this research are not relevant to the study of Lawan et al., (2012), who study on "Flood Disaster Prevention Behavior Integrated with Environmental Education Principles", that the attitude had the highest effect to flood prevention behavior while in this study the participation .is the highest effect to forest conservation behavior. However, the result of environmental knowledge affected to Forest Conservation Behavior is the less effect that is similar to Lawan et al., (2012).

Suggestion

The findings of the study indicated that participation is the highest effect to forest conservation behavior and subsequences were forest knowledge and environmental knowledge affecting forest conservation behavior. Thus achieving the highest goal to encourage the student to participate in environment happen, the administrative committee should introduce the environmental projects and activity for them to participate in order to gain their more environmental knowledge to alter their attitude to practice for forest and environmental effectively. Consequently, the university administrators should arrange the subject to integrate in the curriculum for all faculties to encourage them to join for forest conservation project.

References

Artwanichakul, K., Thiengkamol, N. & Thiengkamol, T. (2012a). Structural model of dengue fever prevention and control behavior. *European Journal of Social Sciences, 32*(4), 485-497.

Boon E, Ahenkan, A. & Baduon, B. N. (2009). *An Assessment of Forest Resources Policy and Management in Ghana.* 'IAIA09 Conference Proceedings', Impact Assessment and Human Well-Being 29th Annual Conference of the International Association for Impact Assessment, 16-22 May 2009.

Cronbach, J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika, 16*(3), 297–334.

Donkonchum, S. Thiengkamol, N. & Thiengkamol, C. (2012a). Causal relationship model of environmental conservation behavior integrated with LCA knowledge. *European Journal of Social Sciences, 33*(1), 5-13.

Gonggool, D., Thiengkamol, N. & Thiengkamol, C. (2012b). Development of environmental education volunteer model through inspiration of public consciousness for sustainable development. *European Journal of Social Sciences, 32*(1), 150-160.

Hair, J., Black, Jr, W., Babin, B. & Anderson, R. (2010). *Multivariate Data Analysis* (10th ed.) New Jersey: Prentice Hall.

Krejcie, R.V. & Morgan, D.W. (1970). Determining sample size for research activities. *Educational and Psychological Measurement, 30*(1), 607-610.

Lawan, T., Thiengkamol, N. & Thiengkamol, T. (2013). Flood disaster prevention behavior integrated with environmental education principles. *European Journal of Scientific Research, 104*(3), 580-591.

Mongkonsin, Thiengkamol, N. & Thiengkamol, T. (2013b). Causal relationship model of flood response behavior. *Mediterranean Journal of Social Sciences, 4*(1), 587-598.

Morrasri, P., Thiengkamol, N. & Thiengkamol, T. (2012b). Causal relationship model of little green child with environmental behavior. *European Journal of Social Sciences, 34*(2), 177-189.

Phinnarach, K., Thiengkamol, N. & Thiengkamol, C. (2012a). Causal relationship model of community strength. *European Journal of Social Sciences, 34*(3), 379-392.

Pimdee, P., Thiengkamol, N. & Thiengkamol, T. (2012a). Causal relationship model of electrical energy conservation. *European Journal of Social Sciences, 32*(3), 306-315.

Rovinelli, J. & Hambleton, K. (1977). On the use of content specialists in the assessment of criterion-referenced test item validity. *Dutch Journal of Educational Research,* 2(1), 49-60.

Ruboon, O., Thiengkamol, N., Thiengkamol, T. & Kurokodt, J. (2012a). Model of environmental education teacher with inspiration of environmental conservation for global warming alleviation. *European Journal of Social Sciences, 31*(1), 92-102.

Saisunantharom, S. Thiengkamol, N. & Thiengkamol, C. (2013a). Casual relationship model of biodiversity conservation. *European Journal of Scientific Research, 104*(3), 460-474.

Sangsan-anan, S., Thiengkamol, N. & Thiengkamol, T. (2012a). Causal relationship model of environmental education tourism. *European Journal of Social Sciences, 33*(3), 339-350.

Stamets, P. E. (2005). *Mycelium running.* Berkeley, CA: Ten Speed.

Suebsing, S., Thiengkamol, N. & Thiengkamol, C. (2013a). Causal relationship model of forest conservation integrated with psychological state. *European Journal of Scientific Research, 104*(3), 447-459.

Temtumnan, K. (2006). *Transferring knowledge of forest resource conservation of forest protection voluntary people in Changwat Maha Sarakham.* Thesis of Environmental Management Program, Graduate Faculty, Mahasarakham University.

The Global Forest Resources Assessment. (2015). *Thailand - Global Forest Resources Assessment 2015 - Country Report.* Rome: Author.

Thiengkamol, N. (2009c). *Environment and development book. (Food security).* Bangkok: Chulalongkorn University.

Thiengkamol, N. (2011e). *Environment and Development Book* (4th ed.). Bangkok: Chulalongkorn University.

Thiengkamol, N. (2011i). Development of model of environmental education and inspiration of public consciousness influencing to global warming alleviation. *European Journal of Social Sciences, 25*(4), 506-514.

Traithep, K. (2008). *The development of training model for community environmental leader on forest resource conservation according economy sufficiency philosophy.* Dissertation of Environmental Education Program, Graduate Faculty, Mahasarakham University.

Udonboon, C. Thiengkamol, N. & Thiengkamol, C. (2012b). Causal relationship model of water conservation behavior. *Mediterranean Journal of Social Sciences, 3*(11), 591-604.

Wildlife of Thailand. (2015). *Forest types in Thailand.* Retrieve from http://www.wildlifethailand.com/blog/articles-2/wildlife-articles/116-forest-types-in-Thailand

World Commission on Environment and Development (WCED). (1987). *Our common future.* Oxford: Oxford University.