ตัวแบบของปัจจัยที่มีผลต่อพฤติกรรมการอนุรักษ์สิ่งแวดล้อมของนักเรียนมัธยมศึกษาตอนปลาย

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บทคัดย่อ

เพื่อพัฒนาแบบจำลองปัจจัยที่มีผลต่อพฤติกรรมการอนุรักษ์สิ่งแวดล้อมของนักเรียนระดับมัธยมศึกษาตอนปลายในการลดโลกร้อน การวิจัยนี้ใช้วิธีการสำรวจโดย ใช้แบบสอบถามเป็นเครื่องมือวิจัย สำหรับเก็บข้อมูลจากกลุ่มตัวอย่าง 400 คน จากประชากรที่เป็นนักเรียนชั้นมัธยมศึกษาตอนปลาย ในสังกัดสำนักงานเขตพื้นที่การศึกษามัธยมศึกษา เขต 28 (ศรีสะเกษ - ยโสธร) ภาคเรียนที่ 1 ปีการศึกษา 2557 การวิเคราะห์ข้อมูลโดยตัวแบบสมการโครงสร้าง

ผลการวิจัยพบว่ารอยเท้านิเวศมีอิทธิพลสูงสุดต่อพฤติกรรมการอนุรักษ์สิ่งแวดล้อมเพื่อบรรเทาภาวะโลกร้อน ของนักเรียนระดับมัธยมศึกษาตอนปลาย เท่ากับ 0.48 รองลงมาได้แก่แรงบันดาลใจในการอนุรักษ์สิ่งแวดล้อม มีอิทธิพลเท่ากับ 0.21 โดยทั้ง 2 ปัจจัยมีอิทธิพลต่อพฤติกรรมทางการอนุรักษ์สิ่งแวดล้อมร้อยละ32

คำสำคัญ : แบบจำลอง, รอยเท้านิเวศ, แรงบันดาลใจในการอนุรักษ์สิ่งแวดล้อม, พฤติกรรมการอนุรักษ์สิ่งแวดล้อม

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Model of Factors Affecting Environmental Conservation Behavior of High School Students

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Abstract

In order to develop model of factors affecting environmental conservation behavior of high school students, this research employed a survey approach using questionnaire for data collection from 400 students in High School Secondary Education Service Area Office 28 (Sisaket-Yasothon) in academic year 2014. Structural Equation Model (SEM) was used for model confirmation.

Research results demonstrated that Ecological Footprint (EF) had the most effect on Environmental Conservation Behavior (EBG) with an effect of 0.48, whereas Environmental Conservation Inspiration (ECI) came as another important factor with an effect of 0.21, and both factors accounted for 62 percent variation in EBG. In addition, EF influenced ECI by 32 percent.

Keywords: Model, Ecological Footprint, Environmental Conservation Behavior, Environmental Conservation Inspiration, Global warming

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Introduction

Human activities that involve the use natural resources generate different types of wastes in solid and liquid forms. The world population are rapidly growing, therefore global consumption of natural resources increases which can eventually lead of resource exhaustion and unsustainable biosphere. In order to overcome this situation, it is essential to meet these demands by measuring natural capacity. The Ecological Footprint is recognized as one of the global principal measures of human demand on nature. Ecological Footprint Accounting emphasizes whether the planet is large enough to sustain the demands of humanity (McGinley, 2012; Wikipedia, 2014).

The ecological footprint is defined as the biologically productive land and water people require to produce the resources for consumption and to absorb part of the waste generated by the consumption. The focus on biologically productive land and water for humans reflects the anthropogenic perspective of the ecological footprint accounts (Wackernagel et al., 2002; Wackernagel et al., 2005; Monfreda et al., 2004). In the context of Life Cycle Assessment (LCA), the ecological footprint of a product is defined as the sum of time-integrated direct land occupation and indirect land occupation, related to nuclear energy use (Wackernagel et al., 2002; Monfreda et al., 2004) and to CO_2 emissions from fossil energy use and cement burning (WWF, 2005).

Biocapacity can then be compared with humanity's demand on nature: our Ecological Footprint. The Ecological Footprint represents the productive area required to provide the renewable resources humanity is using and to absorb its waste. The productive area currently occupied by human infrastructure is also included in this calculation, since built-up land is not available for resource regeneration. Presently, Ecological Footprint is broadly used across the world as an indicator of environmental sustainability. This is usually used to survey the sustainability of food, shelter, transportation, medicine, cloth and housing. Thus it determines private lifestyles, institutes, goods and services, industry sectors from regions and nations all dimensions of consumption since it has the purpose of educating people about their resource based on environmental consumption. Sometimes, it triggers them to change their consumption pattern. In this context, development can be considered sustainable when it 'meets the needs of the present without compromising the ability of future generations to meet their own needs.' Moreover, at national level, people must be committed to mitigate and avoid breaking of environmental laws as contained in numerous international

agreements and conventions (Gautami, 2010). However, human beings depend on natural resources and environment in terms of ecological carrying capacity as a critical issue of ecological footprint (WWF, 2005).

Ecological Footprint (EF) is the dependence of humanity on natural resources, and it is used to measure the land area for production and the need of water for producing goods as well as waste in daily consumption. Fundamentally, it is the amount of the natural resources environment needed to produce the goods and services required to sustain human living (Wackernagel et al., 2002; Wackernagel et al., 2005).

The EF is emerged as one of the world's leading measures of human demand of nature to measure the natural capacity. EF embedded in the reality that all renewable resources originate from the earth. EF is currently extensively used by scientists, businesses, governments, agencies, individuals, and institutions for monitoring ecological resource use for sustainable development. It compares actual throughput of renewable resources relative to what is annually renewed. Non-renewable resources are not assessed, Since by definition their use is not sustainable (Monfreda et al., 2004; Wackernagel et al., 2002; Wackernagel et al., 2005).

The total "footprint" for a designated population's activities is measured in terms of 'global hectares.' A global hectare (acre) is one hectare (2.47 acres) of biologically productive space with an annual productivity equals the world average. Currently, the biosphere has approximately 11.2 billion hectares of biologically productive space corresponding to roughly one quarter of the planet's surface. These biologically productive hectares include 2.3 billion hectares of ocean and inland water and 8.8 billion hectares of land. The land space is composed of 1.5 billion hectares of cropland, 3.5 billion hectares of grazing land, 3.6 billion hectares of forest land, and 0.2 billion hectares of built-up land. These surfaces represent the sum total of biologically productive hectares we rely on for our survival. They represent the earth's natural capital, and their annual yield represents our annual natural capital income (Monfreda et al., 2004; WWF, 2005).

EF calculations use official statistics and peer reviewed literature to gather data. Five assumptions underpin any EF calculation by redefining progress by including most of the wastes generated and resources consumed that can be tracked. Most of these resource and waste flows can be converted into the biologically productive area that is required to

maintain these flows. These different areas can be expressed in the same unit (acres or hectares) once they are scaled proportionally to their biomass productivity. That is, each particular acre can be translated into an equivalent area of world-average land productivity. Since these areas have been standardised and stand for mutually exclusive uses, they can be added up to a total representing humanity's demand (Wackernagel et al., 2002; Wackernagel et al., 2005). This area for total human demand can be compared with nature's supply of ecological services, since it is also possible to assess the area on the planet that is biologically productive (Monfreda et al., 2004; WWF, 2005).

Inspiration of public mind for environmental conservation was hypothesized by Thiengkamol (2011a). It consists of a key person to act as a role model, an impressive environment, an impressive event and inspiration from participation of the media. As such, she and her colleagues examined an imperative approach for creating the inspiration of public mind or a public consciousness of environmental conservation. This approach was taken as most people do not recognize environmental problems in day to day living as they are challenged with more pressing primary needs, in particular to earn and so on (Thiengkamol, 2011a; Thiengkamol, 2011b and 2012a). Therefore, people will not be aware of an environmental crisis until it is at their backyards. As a result, it affects their quality of life. Only when people are confronted with serious forms of pollution, such as air pollution or water pollution and so on, they are forced to pay attention to environmental problems (Donkonchum et al, 2012; Pimdee et al., 2012; Waewthaisong et al., 2012a, Udonboon et al., 2012b; Mongkonsin et al, 2013b; Kotchakote et al., 2013). In this context, inspiration is completely different from motivation in the sense that a person who supports, acts and practices environmental conservation with the drive gained from an inspired desire will be pleased to do so in support of the local community and national population without the need for further rewards such as money, honor or admiration. The inspiration for such an act may be acquired from a leading role model, an impressive environment, an impressive event and / or inspiration from participation of the media (Thiengkamol, 2011a and b; Thiengkamol, 2012 and Hoerisch, 2002).

The purpose of this research is to introduce EF knowledge for the upper secondary school students to understand bio-capacity and carrying capacity of the world ecological system. Students are challenged for pro-environmental behavior via

environmental conservation inspiration. However, understanding the EF would help the young generations to realize the importance of ecological balance to alter their environmental behavior of consumption, energy conservation, waste management, recycling, traveling and environmental knowledge transfer. Finally, students should take parts to take responsibility for global warming alleviation. Both latent and observable variables are identified and confirmed in order to clarify the holistic view of environmental conservation behavior for global warming of upper secondary school students under Secondary Service Area Office 28 (Sisaket-Yasothon) as a model of ecological fottprint.

Research Objective

The objective of this research was to develop a causal relationship model of ecological footprint for global warming alleviation of high school students under Secondary Service Area Office 28 (Sisaket-Yasothon) in Northeastern region, Thailand.

Methodology

The research method was conducted step by step as follows:

1. Population and Sample

Population was 36,009 high school students under Secondary Service Area Office 28 (Sisaket-Yasothon) of Northeastern region of Thailand in second semester of academic year 2014.

Sample was 400 high school students that gathered with Cluster Random Sampling technique.

2. Research tool

The content and structural validity of questionnaire were proved by Item Objective Congruent (IOC) from 5 experts in the fields of ecology, environmental education, social science and social research methodology. The reliability was tried out by conducting with the sample group of 40 high school students who had the same characteristics with sample group. The reliability was determined by Cronbach's alpha formula. The questionnaire was composed of items on ecological footprint, environmental conservation inspiration and environmental conservation behavior for global warming alleviation. The alpha coefficients for the respective aspects were 0.816, 0.804, and 0.954 respectively.

3. Data Collection

The Cluster Random Sampling technique was employed for sample selection for data collecting of 400 high school students under Secondary Service Area Office 28 (Sisaket-Yasothon) of Northeastern region of Thailand. The research instrument was the questionnaire and it was used for data gathering.

4. Data Analysis

The descriptive statistics used for analytical purposes were frequency, percentage, mean and standard deviation. Structural Equation Model (SEM) was used for model confirmation with LISREL version 8.30. Significant level of chi-squre was set at level of 0.01 or Chi-Square/df value with less than or equal to 5, RMSEA (Root Mean Square Error Approximation) and RMR (Root Mean Square Residual) values less than 0.05. GFI (Goodness of Fit Index) and index level of model congruent value, AGFI (Adjust Goodness of Fit Index) between 0.9-1.00.

Results

As demonstrated in Figure 1 and Table 1, the Ecological Footprint (EF) and the Environmental Conservation Inspiration (ECI) had effects on the Environmental Conservation Behavior for Global Warming Alleviation (EBG) as follows:

1) EF directly affected ECI with a statistically significant level of 0.05 and with an effect of 0.40, and EF directly affected the EBG with a statistically significant level of 0.01 and with an effect of 0.48 and indirectly affected the EBG with a statistically significant level of 0.05 and with an effect of 0.06.

2) ECI directly affected the EBG with a statistically significant level of 0.01 and with an effect of 0.21.

3) EF and ECI affected the EBG by 62.00 %. The structural equation can be written as shown in the following equation (1).

EBG = 0.21*ECI+ 0.48*EF .....(1)

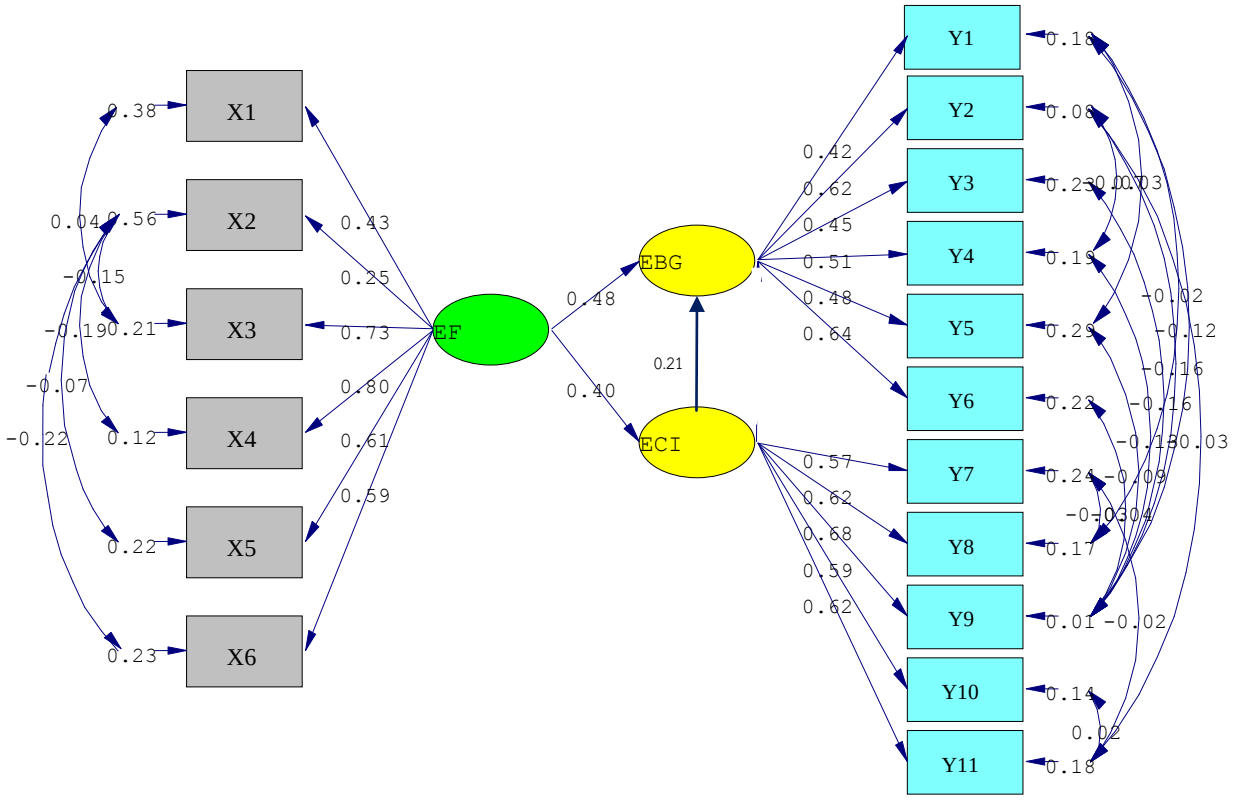
R^2 = 0.62

In equation (1), both EF and ECI significantly affected EBG. While EF was more important than ECI, both accounted for 62 present variation in EBG.

4) The effect of EF on ECI was 0.40 which accounted for 32% variation in ECI. The structural equation can be written as the following.

ECI = 0.40*EF .....(2)

R^2 = 0.32



Chi-Square=185.14, df=96, P-value=0.00000, RMSEA=0.048

Figure 1 Model of Ecological Footprint for Global Warming Alleviation

Table 1 Direct and Indirect Effects of EF on EBG via ECI

Causal variable	Result variables					
	ECI			EBG		
	TE	IE	DE	TE	IE	DE
EF	0.30* (0.059)	-	0.30* (0.059)	0.48** (0.05)	0.06* (0.001)	0.54** (0.05)
ECI	-	-	-	0.21** (0.033)	-	0.21** (0.033)
χ^2 = 185.14;	df = 96		CN = 262.50		χ^2/df = 1.929	
GFI = 0.95	AGFI = 0.92		RMSEA = 0.048		RMR = 0.023	

TE : Total Effect, IE : Indirect Effect, DE: Direct Effect

Discussion

EF plays an important role to change the environmental conservation behavior for global warming alleviation that was predicted by Environmental Knowledge Transferring Behavior, Energy Conservation Behavior, Recycling Behavior, Traveling Behavior, Waste Management Behavior, and Consumption Behavior.

The results pointed out that EF is an essential factor that should be put into action for enhancing pro-environmental behavior of upper secondary school students so that they could act as significant change agents to transfer their environmental knowledge to their acquaintants such as friends, family members, and others people in community and society. The students should exhibit their Energy Conservation Behavior, Waste Management Behavior, Traveling Behavior, Recycling Behavior, and Consumption Behavior as a good role model for others too. The results were consistent with those found by Thiengkamol (Thiengkamol, 2011a; Thiengkamol, 2011b) and her colleagues (Udonboon et al., 2012; Waewthaisong, et al., 2012; Donkonchum, et al, 2012; ; Kotchakote et al., 2013; Mongkonsin et al., 2013; Saisunantharom et al., 2013; Suebsing et al., 2013).

Moreover, the Environmental Conservation Inspiration (ECI) had a direct effect on the EBG with an effect of 0.21while ECI was measured by Self-Public Mind (Y7), Role Model Impression (Y8), Event Impression (Y9), Environment Impression (Y10), and Media Reception (Y11). The finding was similar to those reported by Thiengkamol (Thiengkamol, 2011) and her colleagues (Kotchakote et al., 2013; Pimdee et al., 2012; Saisunantharom et al., 2013; Suebsing et al., 2013; Udonboon et al., 2012; Waewthaisong, et al., 2012). In adtition, Inspiration of Public Consciousness or public mind influenced pro-environmental behavior i.e. consumption behavior, energy conservation, waste management behavior, recycling behavior, traveling behavior and knowledge

transferring and supporting for environmental conservation.

Suggestions

School administrators and teachers can use the principles of ecological footprints in teaching-leaning process by using environmental conservation inspiration to challenge and inspire the upper secondary school students to take responsibilities to play roles as a changing agent via environmental educators or trainers to convey their environmental knowledge and understanding, with public mind and devotion to conserve the natural resources, and exhibit environmental conservation behavior since they are the new generations who must be looked after for maintaining the ecological system and conserving environmental quality to accomplish sustainable development and to alleviate global warming for better life quality.

Presently, ecological footprints are recognized as environmental measures to mitigate the global warming. The governmental and private sectors should cooperate to support ecological footprints knowledge through various media and formal educational systems so that it is distributed to each and everybody for better quality of life.

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