การสร้างสมการอุปสงค์ของการท่องเที่ยวเชิงนิเวศในอุทยานแห่งชาติภูจองนายอย จังหวัดอุบลราชธานี ของประเทศไทย โดยการใช้สารสนเทศทางภูมิศาสตร์เชื่อมโยงความสัมพันธ์เชิงพื้นที่ของตัวแปร

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MODELING DEMAND FOR THAI NATIONAL PARK ECOTOURISM:
A GIS-LINKED SPATIAL DEPENDENT MODEL FOR PHU JONG NA YOI
NATIONAL PARK, UBON RATCHATHANI, THAILAND

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A Dissertation Submitted in Partial Fulfillment of the Requirements
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บุญช่วย บุญมี : การสร้างสมการอุปสงค์ของการท่องเที่ยวเชิงนิเวศในอุทยานแห่งชาติภูจองนายอย จังหวัดอุบลราชธานี ของประเทศไทย โดยการใช้ระบบสารสนเทศทางภูมิศาสตร์เชื่อมโยงความสัมพันธ์เชิงพื้นที่ของตัวแปร (Modeling Demand For Thai National Park Ecotourism: AGIS-linked Spatial Dependent Model For Phu Jong Na Yoi National Park, Ubon Ratchathani, Thailand. อ. ที่ปรึกษา: ผศ. ดร. จาริต ติงศภัทิย์, รศ. ดร. สิตานนท์ เจษฎาพิพัฒน์, 100 หน้า.

การศึกษาการสร้างสมการอุปสงค์ของการท่องเที่ยวเชิงนิเวศในอุทยานแห่งชาติของประเทศไทย ที่อุทยานแห่งชาติภูจองนายอย จังหวัดอุบลราชธานี มีวัตถุประสงค์ 3 ประการ คือ 1) เพื่อประยุกต์ใช้ระบบสารสนเทศทางภูมิศาสตร์ (GIS) เชื่อมโยงความสัมพันธ์เชิงพื้นที่กับปัจจัยอื่นที่มีผลกระทบต่ออุปสงค์ของการท่องเที่ยวในอุทยาน 2) เพื่อกะประมาณแบบจำลองสมการอุปสงค์ของการท่องเที่ยวในอุทยาน ด้วยการใช้ GIS สนับสนุนสมมุติฐานที่ว่าความสัมพันธ์เชิงพื้นที่มีอิทธิพลต่อการกะประมาณสมการอุปสงค์แบบเดิม (conventional recreational demand) 3) เพื่อประเมินค่าทางเศรษฐกิจจากการใช้ทรัพยากรธรรมชาติของอุทยานเพื่อประโยชน์ของนักท่องเที่ยวโดยใช้การเก็บรวบรวมข้อมูลด้วยแบบสอบถามจากนักท่องเที่ยวจำนวน 620 คน และสัมภาษณ์เจ้าหน้าที่ของอุทยาน 25 คน

ผลการศึกษาแสดงให้เห็นว่า GIS สามารถใช้คำนวณหาค่าถ่วงน้ำหนักโดยการวัดระยะทาง และใช้กะประมาณแบบจำลองอุปสงค์ของการท่องเที่ยวด้วยวิธี Travel Cost Model และพบว่าการใช้การถ่วงน้ำหนักแบบระยะทางถดถอย ซึ่งอาศัยการวัดระยะทางด้วยการคำนวณทางแผนที่ภูมิศาสตร์ร่วมกับวิธีการ Spatial Autoregressive ช่วยทำให้สมการอุปสงค์น่าเชื่อถืออย่างมีนัยสำคัญทางสถิติมากขึ้น โดยมีค่า R^2 และ F-value ที่ระดับความเชื่อมั่น 95 เปอร์เซ็นต์ในการนำไปใช้พยากรณ์ และสมการที่ได้นำไปใช้ประมาณมูลค่าของการท่องเที่ยวในอุทยาน จากการประเมินพบว่ามีค่าประมาณ 56.29 บาทต่อคน หรือประมาณ 1.89 ล้านบาทต่อปี

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BOONCHAUY BOONMEE: MODELING DEMAND FOR THAI NATIONAL PARK ECOTOURISM: A GIS-LINKED SPATIAL DEPENDENT MODEL FOR PHU JONG NA YOI NATIONAL PARK, UBON RATCHATHANI, THAILAND
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The objectives of this research are 3 folds: (i) it is to investigate the role of GIS linked spatial dependence and other factors that affect ecotourism demand in Phu Jong Na Yoi National Park, Ubon Ratchathani, Thailand. (ii) it attempts to estimate a recreational demand model for the park by using GIS as a tool to support the hypothesis that spatial dependence influences the estimated conventional recreation demand for ecotourism in the park. (iii) the study measures the economic value of the use of natural resources in the park to provide tourism benefits for visitors. Data were collected in 2005 and 2006 by using a designed questionnaire from a sample of 620 park visitors. Twenty five park officers were also interviewed.

The results show that GIS can be used to create a distance weight to be used in estimating the Travel Cost Model. The estimated spatial autoregressive model shows validity and robustness with the significant R^2 and F Values at 95% confidence interval. The estimated model is used to evaluate the economic value of the park tourism. The estimated park consumer surplus is around 56.29 baht per person or 1.89 million baht per year.

Field of study Economics
Academic year 2006

Student's signature....................
Advisor's signature....................
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TABLE OF CONTENTS

Abstract (In Thai)		iv
Abstract (In English)		v
Acknowledgements		vi
Table of Contents		vii
List of Tables		ix
List of Figures		xi
Chapter I	Introduction	1
	1.1 Introduction	1
	1.2 Justification and Contribution	2
	1.3 Specific Objectives	3
	1.4 Organization	3
Chapter II	Literature Review	4
	2.1 GIS and Tourism Development	4
	2.1.1 Existing Sustainable Tourism Development and Indicators	4
	2.1.2 GIS Application in Tourism Planning	6
	2.1.3 Limitation of GIS	8
	2.2 GIS Support Spatial Analysis and Modeling	9
	2.2.1 GIS and Spatial Analysis	9
	2.2.2 GIS Spatial Modeling	10
	2.3 How GIS Support Spatial Econometrics	12
	2.4 Spatial Dimensions of Ecotourism	13
Chapter III	Description of the Study Area	15
	3.1 Phu Jong Na Yoi National Park	15
	3.2 Problems of the Park Operation	17
	3.3 Nature-based Tourism in the Park	18
	3.4 Problems of the Park Nature-based Tourism	19

Chapter IV	Methodology and Data Use	23
	4.1 GIS-Application to Ecotourism Area	23
	4.1.1 Data Used for GIS Study	23
	4.2 Modeling Demand for Ecotourism in the Study Area	26
	4.2.1 Model Specification	26
	4.2.1.1 Model Specification without Spatial Dependence	26
	4.2.1.2 Model Specification with Spatial Dependence	29
	4.2.1.3 Specification Test and Interpretation	30
	4.2.2 Suitability of Demand Model for National Park Ecotourism	32
	4.2.3 Determining Related Variables	33
	4.2.4 Data Consideration	35
	4.2.4.1 Sampling Design	35
	4.2.4.2 Measuring Travel Distances and Costs	37
Chapter V	Results and Discussion	38
	5.1 Results	38
	5.1.1 Preliminary Statistical Analysis	38
	5.1.1.1 Visitor's Profile	38
	5.1.1.2 Descriptive Statistics of Variables	51
	5.1.2 Estimation of Economic Value of Tourism in the Park.	59
	5.2 Discussion	59
Chapter VI	Conclusion	64
References		66
Appendices		70
	Appendix A	71
	Appendix B	80
	Appendix C	84
	Appendix D	86
	Appendix E	98
Biography		100

LIST OF TABLES

Table		Page
Table 3.1	Phu Jong Na Yoi Human Resources Staff in 2004......................	16
Table 4.1	Description of Variables and Their Expected Signs.....................	35
Table 5.1	Visitors' Residency..	38
Table 5.2	Visitors' Gender and Age..	39
Table 5.3	Visitors' Gender and Level of Education.................................	39
Table 5.4	Visitors' Gender and Nationality..	40
Table 5.5	Visitors' Gender and Religion...	40
Table 5.6	Visitors' Gender and Marital Status......................................	41
Table 5.7	Visitors' Gender and Career..	41
Table 5.8	Visitors' Gender and Transportation......................................	42
Table 5.9	Visitors' Gender and Over-night Stay at Park...........................	42
Table 5.10	Visitors' Gender and Types of Visitors..................................	43
Table 5.11	Visitors' Gender and Overall Visiting Satisfaction......................	43
Table 5.12	Visitors' Gender and Park Conservation Learning......................	44
Table 5.13	Visitors' Gender and Vehicle Fee..	45
Table 5.14	Visitors' Gender and Thai Visitor's Entrance Fee......................	45
Table 5.15	Visitors' Gender and Housing Fee...	46
Table 5.16	Visitors' Gender and Housing Fee...	46
Table 5.17	Visitors' Gender and Local People Participation.........................	47
Table 5.18	Summary of Visitors' Demographic and Economic Results...........	48
Table 5.19	Visitors' Media Sources for Park Information...........................	49
Table 5.20	Visitors' Expenditure at Nearby Substitute Sites (Outside the park)...	50

Table		Page
Table 5.21	Descriptive Statistics of Variables…………………………………...	51
Table 5.22	Model 1 Summary……………………………………………………	52
Table 5.23	Model 2 Summary……………………………………………………	53
Table 5.24	Model 3 Summary……………………………………………………	54
Table 5.25	Model 4 Summary……………………………………………………	55
Table 5.26	Comparison of Estimated Results……………………………………	56
Table 5.27	Consumer Surplus for Model Estimations…………………………...	57
Table A1	Capabilities of a GIS…………………………………………………	71
Table A2.	Common tourism-related issues and GIS applications………………	71
Table E1	Total Number of Visitors and Park Revenues from 2000 to 2006…..	98
Table E2	Entrance Fee and Service Charge of National Park for Person……...	98
Table E3	Entrance Fee for Bicycle, Motorcycle, and Automobile…………….	99

LIST OF FIGURES

Figure | Page

Figure 3.1 Map of Ubon Ratchathani Province.................................... 21

Figure 3.2 Map of Phu Jong Na Yoi National Park................................ 22

Figure 4.1 Map Location of Phu Jong Na Yoi National Park...................... 25

Figure 4.2 The Travel Cost Demand Curve and Consumer Surplus................ 28

CHAPTER I

INTRODUCTION

1.1 Introduction

In general, national parks or protected areas are rich and unique in environmental characteristics and biodiversities that differently accumulated from time to time. The areas are used for a variety of purposes such as preservation of fauna, flora and landscapes (biodiversity), research, human habitation, protection of watersheds, food security for local communities, water supply, and recreation which provides an important ecological service for human. These are all economic and social benefits from national parks.

Recently, ecotourism, a type of nature-based tourism, is an alternative to mass tourism as a means of economic development (e.g. poverty reduction) and environmental conservation. Its role is to protect the environment, generating revenue and education to the local people and pleasure for tourists. The tour encourages an understanding of the impacts of tourism on the natural, cultural, and human environments. It seeks decision-making among all segments of society, including local community and the whole nation, so that tourism and other resource users can coexist. It also incorporates planning and zoning which ensure tourism development appropriate to the carrying capacity of the ecosystem (Wearing and Neil, 2000). However, there are many impacts that ecotourism generates to the parks.

For Thai national parks, there is a conflict over preservation and use. Tourism in the parks is still incompatible with such a preservation of national ecosystems. National parks and protected areas have recently come under pressure from the market force of mass tourism. Protected area agencies have found themselves pressured to be more commercial, and to open more preserved areas for tourists. Environmental management under market-based management in the form of ecotourism is attractive and it encourages many environmentalists to search for the optimal way which is appropriate for tourism in the parks.

Tourism activities in the Thai national parks should be activities that preserve the ecosystems and environment of the parks. For example, bird watching and nature interpretation activities are nature-based, ecologically concerned, educational, and enjoyable. These benefits are valuable assets in that people can enjoy flows of services. Government's public policies and the actions of individuals can lead to changes of the services. Looking at an opportunity of economically potential outdoor recreation, ecotourism could help sustain local economies. While it is clear to policy makers, park officers, local officials, and users that national parks are an important resource, little is known about the economic value those visitors place on parks. Knowing the value of park use could help both Government and local officials decide whether or not to open parks' pristine land to public use, how much to spend on park maintenance each year, or how much capital to invest on park amenities like parking lots, restrooms, and housing services.

1.2 Justification and Contribution

Unfortunately, measuring values of ecotourism at national parks are not properly interacting in markets because of their public good characteristics of non-excludable and non-rival consumption (Tietenberg, 2006). Especially, for Thai national parks, economic evaluation of park ecotourism is rarely conducted by researchers. Most research studies of tourism in small national parks have often neglected valuations of tourism benefits as being small money for the whole economy or not a hot agenda debated by political arena, for example the economic evaluation of Khao Yai national park and Kaeng Sue Ten dam project studied by Thailand Development Research Institute in 1995 and 1997. However, most people, especially local communities, could gain benefit of using small national parks, for example ecosystem study or experiment stations for students and community training. Also, interest in valuation of resource use for tourism in the park could be an important implication for local administrative policy on environmental and natural resource management in the future.

Government agencies and many research organizations often need to estimate economic values of natural resource services for benefit-cost analysis or to facilitate natural resource policy and management decisions in general. Estimates of values depend on the accuracy of measurement of variables considered in the demand function. Problems regarding the correct measurement of variables, especially explanatory variables, are addressed in many econometric studies. Measurement of travel distance is an important step toward recreation demand function estimation. Many previous studies report the influence of spatial effect on outdoor recreation demand studies (Smith and Kopp, 1989; and Kerkvliet, 1999). Spatial dependence in model variables can severe the standard assumption on correlation of error term in classical econometric demand model and lead to prediction problem. This study uses Geographical Information Systems (GIS) which provides an efficient method of spatially referencing geographic and economic information. A GIS approach to the measurement of travel distance from visitor origin to a recreation site is illustrated and applied as a weight to a spatial econometric travel cost demand model. Comparing a model improvement from spatial dependence on estimation with a conventional Travel Cost Model, in this study, an effort is made to use the estimated models to measure the economic value of ecotourism in a small remote national park. Also, an attempt is made to provide policy implications for park tourism management and general recommendations for benefit results.

1.3 Specific Objectives

The objectives of this research are 3 folds: First, it is to investigate the role of GIS linked spatial dependence and other influential factors that incorporate on ecotourism demand in the Phu Jong Na Yoi National Park in Ubon Ratchathani Province, Thailand. Second, it attempts to estimate an ecotourism demand model for the Phu Jong Na Yoi National Park by using GIS as a tool to support the specification of spatial dependence with a hypothesis that influences on the estimated conventional recreation demand for ecotourism in the park. And third, the study measures the economic value of the used natural resources in the park for providing the benefits to visitors. Also, policy implications for the park tourism management are discussed.

1.4 Organization of the Study Report

The report is generated into 6 chapters as follows: Chapters 1, 2, and 3 are introduction, literature review, description of the study area, Chapters 4 and 5 are methodology and data use, results and discussion, respectively. Finally, Chapter 6 is conclusion.

CHAPTER II

LITERATURE REVIEW

This part covers literatures related to this research study. It covers issues concerning GIS and tourism development, GIS-supported spatial econometrics and spatial dimensions of ecotourism, respectively.

2.1 GIS and Tourism Development

This part of the literature review is performed on the topic of GIS applications in tourism and discusses some potential as well as problems of GIS applications in tourism planning, with a link to Thailand's tourism environment. The limitations of the uses of the tool would be considered. The review identifies the capabilities of GIS for application in tourism development.

2.1.1 Existing Sustainable Tourism Development and Indicators

Danchuk and Woodley, Parks Canada, (undated), stated that understanding the sustainability of national parks, national historic sites and national marine conservation areas in a tourism context needs more science to provide information and meet monitoring requirements. This includes science about the resource and science about the tourist. How to provide the sustainable tourism conceptually? The definition of sustainable development in the context of tourism needs to be clarified. The original definition of sustainable development[1] is a much more complex definition. The alternative meaning should be defined as "Tourism which is in a form that can maintain its viability in an area for an indefinite period of time" (Wearing and Neil, 2000).

Also, they specified that sustainability of any kind must be based on the sustainability of the ecosystem and, as a result, tourism like any other industry must be monitored in this sense. Tourism in protected heritage areas has, in the past, often used the ecosystem merely as a backdrop. If protected heritage area tourism is to be

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[1] Definition of sustainable development: Development that meets the needs of the present without compromising the ability of future generations to meet their own needs (Butler, 2002).

sustainable in the future, it must balance economic return in consideration of the existing ecosystem limits in a culturally acceptable fashion.

To achieve ecosystem sustainability, we must use indicators as measures and in this case, tourism related specific indicators. Before we have indicators however, there must first be clear objectives, sufficient knowledge, and responsible power to manage the activity. They also proposed that in choosing goals and the resulting indicators the following should be considered:

a. Indicators of sustainability must account for ecosystems as hierarchies and be established for all levels to be comprehensive;
b. Indicators must account for an ecosystem's function and structure;
c. Ecosystem management must deal in parts and think in wholes;
d. It must be adaptive;
e. Ecosystem boundaries must be established, with the realization that these rarely coincide with park boundaries.

Sustainable tourism should be an understanding and appreciation of the ecosystems. For tourists, satisfaction, enjoyment, education-learning, attitude-belief change, behavior-lifestyle change and for natural environment, minimize disturbance, improve-habitat protection, and long term health & viability, there are the outcome indicators that should be considered (Oram, 1995). It should also promote the limits to both the scale and type of tourism activities.

The primary goal of the Thai national park is to conserve the land in a natural state, while providing opportunities for education and recreation. Ecotourism has the most potential to meet these goals, comparing with other types of tourism. It is clear evidence from the ecotourism research of Hvenegaard and Dearden, 1996, on bird watching at Doi Inthanon in the northern part of Thailand. The results indicated that ecotourists are distinct from conventional tourists and have different -- and often more beneficial -- environmental, social, and economic impacts on protected areas. They also concluded that birding is a popular form of "ecotourism", an activity that may ultimately help governments improve their management of natural resources. Ideally, ecotourists visit sites such as Doi Inthanon National Park to observe wildlife and spend money in the area. As a result, the government and locals have economic incentives to maintain these areas in a natural condition to ensure continued visits by ecotourists. Ecotourism is therefore promoted as a tool for biodiversity conservation and rural development.

There is a susceptible issue to tourism development in the Thai national parks. The "Thailand's case" reported by Tourism Investigation & Monitoring Team, 2002, raised (see Appendix A) questions about international funding toward Thailand tourism planning and development. They claimed that there are many worse cases against using the oversea fund in tourism development, especially the use of the Fund could be harmful to the nature and the national heritage. This includes invaluable local culture and ethnic. The changes of local peaceful way of life toward the capitalist economy catalyzed rapidly by the Thai Government seem to make the people more concerned about their future generation. Heavy use of the natural resource and environment in the recent period needs to have technology that can support a balanced and long -term tourism resource and environmental management.

However, as such positive and negative evidences in Thailand tourism development toward sustainability, GIS comes to match with the need of the planning and its decision supporting system.

2.1.2 GIS Application in Tourism Planning

There is a related characteristic between tourism and GIS. Many disciplines and application areas are shared by the relationship of the tourism interests, for example economists, geographers, environmental planners, anthropologists, and archaeologists. Managing, analyzing, and displaying large volumes of diverse data pertinent to local and regional tourism planning activities increase the use of GIS technical tool. The goal for the achievement of sustainable tourism development is very impressive as GIS is user friendly (Joerg Schaller, 1995; and McAdam, 1994).

Once tourism destinations are categorized, the three different landscape features will be characterized to points, lines, and polygons. Individual tourist attractions, for example a natural sculpture or a historic site along the road, are point features. Riverfront, coastal beach lines and resorts show a linear pattern, while natural parks and protected areas are characteristics of a polygon theme. These locational attributes are essential to a geographic information system (Goodchild, et. al., 2000).

To illustrate and provide examples of the role of GIS application, Bahaire and Elliott-White (1999) briefly described the various applications of GIS in tourism planning (see Table A1, in Appendix A). Capabilities of GIS can be identified as follows:

1. Tourism resources inventories: to include information on natural resources, tourism and other infrastructure, demographics, etc. and to provide information about tourist destinations over the internet;
2. Location suitability: to identify locations suitable for tourism development according to specified criteria in each case, considering all conflicting or complimentary land uses and activities, infrastructure availability, and natural resources;
3. Measuring/ monitoring tourism impacts: to monitor the desired parameters (indicators) over time and across space, and to measure the impacts of tourism activities;
4. Visitor management/ flows: to determine the best way, e.g. the shortest path, on the basis of diverse criteria, and/ or the way that combines passing through various points;
5. Analyzing relationships associated with resource use: to undertake pattern detection to identify phenomena, their occurrence and their distribution, using impact analysis and environmental justice (related to the equity of the distribution among various population groups of the costs and benefits resulting from the location of certain activities);
6. Assessing potential impacts of tourism development: to analyze the development and evaluation of different scenarios, using visual impact analysis, and also, to involve the community participation.

With the capabilities of GIS, some of its applications are shown in Table A2 (see Appendix A). Some research in Thailand and nearby countries utilized the capabilities of GIS. For example, Angkor World Cultural Heritage site in Cambodia under UNESCO project was zoned by using GIS tool with tourism resource database in the area. The results of zoning and environmental management plan (ZEMP) could identify the sustainable development principles for application to the region (Wager, 1995).

Also, Boonyobhas (1996) studied tourism planning concept for Koh Samui. By GIS applications, the result showed that sustainable environmental development approach could be used for tourism planning. The impact identification and establishment of guidelines for development to minimize the impacts were identified.

2.1.3 Limitation of GIS

The above examples illustrate the advantages of GIS capabilities. However, there are some arguments that reflect the limitations of GIS as well. Referring to the study of Yianna and Poulicos (1999), the following arguments may indicate the GIS limitations;

1. It is not a solution to complex issues such as tourism in which human values, emotions and behavior are often far more important than quantitative data. Thus, it does not ensure fairness, equity and compatibility with sustainability principles;
2. It may be manipulated to support policies of certain interests, especially promoting the interests of particular groups having access to technology;
3. The limitations rise from the concept of sustainable development itself, as claimed in the previous section by Butler that the definition is still complex, thus data for planning and management are not available in most cases;
4. Maps can often be misleading and they will much depend on how the GIS analyst presents the data to the practitioners.

Normally, GIS applications in tourism have been concentrated on recreational facility inventory, tourism-based land management, visitor impact assessment, and recreation-wildlife conflict. To do research on tourism in Thai National Park, the use of GIS application needs to specify the problem as illustrated in Table 2, for instance.

Moreover, sustainable tourism development planning requires more comprehensive database that allows several types of analysis. For example, GIS-based recreational facility studied by Boonyodhas(1996), the database for supply analysis of recreational facilities in Koh Samui was conducted. The facility supply analysis involved defining a geographic region (Island) and using the database to tally the supply of facilities in the Island, and also used site suitability analysis, involved identifying sites for new tourism development. The example could be extended to other locations such as in national parks.

At this point, it is recognized that GIS has tremendous potential for application in tourism planning in Thai national parks. However, due to the general lack of tourism databases and inconsistencies in data, its applications are limited. For example, there is very little site-specific information about sources of visitor origin and destination, travel motivation, spatial patterns of recreation and tourism use, visitor expenditure patterns, levels of use and impacts, and suitability of sites for recreation/tourism development--all of which are suitable application areas of GIS. This research, therefore, conducts an on-site specific database from field survey.

2.2 GIS Support Spatial Analysis and Modeling

2.2.1 GIS and Spatial Analysis

The advantage that a GIS can provide, reported in "Spatial analysis & modeling (Krishna, 1995), is the capability of representing spatial data in order to answer user specified queries. Such presentations of transformation of spatial data are often referred to as "Data Analysis" capabilities in a GIS context. Analysis is the process to resolve and separate the reference system into its parts to illuminate their nature and inter-relationships, and to determine general principles of behavior.

Results of geographical data analysis can be communicated with maps and reports or both. A map is used to display geographical relationships whereas a report is most appropriate for summarizing the tabular data and documenting any calculated or analyzed value.

GIS provides special facilities for storing and manipulating spatial data. Much of the functionality offered by GIS software is shared with conventional database software. Indeed most GIS systems have at their core the conventional database management system (DBMS). The main aim of spatial analysis is to generate information that better supports a decision maker.

GIS systems in reality only support three basic feature types - points, lines and areas. Spatial data modeling process, therefore, is usually to decide how best the real-world features can be represented as sets of GIS point, line and area database entities. But for better information of spatial data models points, lines, areas networks and surfaces are considered together.

Data analysis provides the means to understand spatial data and carry out analysis using the most up to date statistical methods, which have come from the areas of spatial mathematics and geostatistics.

2.2.2 GIS Spatial Modeling

Statistical models allow life phenomena to be represented in a mathematical or statistical way. The advantages of modeling real life phenomena include:

- The determination of factors or variables which most influence the behaviors of the phenomena;
- The ability to predict or forecast the long term behavior of the phenomena. The ability to predict the behaviors of the phenomena when changes are made and the factors influencing it.

Once a statistical model has been developed, simulations of the real life phenomena can be performed. The modeler can construct a wide range of scenarios by changing the influential factors. The key advantage of conducting simulations is that the phenomena's predicted behavior can be observed without placing the phenomena.

Spatial modeling is related to the vector model and the raster model as described bellow (Krishna, 1995):

a. The vector model: the spatial locations of features are defined on the basis of coordinate pairs. These can be discrete, taking the form of points (point or node data) linked together to form discrete sections of line (arc or line data); linked together to form closed boundaries encompassing an area (area or polygon data). Attribute data pertaining to the individual spatial features are maintained in an external database.

In dealing with vector data, any important concept is topology. Topology, derived from geometrical mathematics, is concerned with order, contiguity and relative position rather than with actual linear dimensions.

Topology is useful in GIS because many spatial modeling operations do not require coordinate locations, only topological information. For example, to find an optimal path between two points requires a list of the arcs or lines that connect to each other and the cost to traverse them in each direction. It is also possible to perform the same spatial modeling and interrogation processes without using stored topology, by processing the geometrical data directly by generating topology on the fly or using vector object model as and when it is required.

The following information should always be recorded when assembling, compiling and utilizing vector data. The data type includes point, line or area type of topology, which the file contains such as line, network, closed area or arc-node. It also covers details of any automatic vector processing applied to the theme (such as snap-to-nearest-node) state of the topology in the file, particularly whether it is 'clean' (topologically consistent) or contains inconsistencies that may require further intervention or processing. This is particularly important where arc-node data is concerned Projection system Co-ordinate system.

b. The raster model: the spatial representation of an object and its related non-spatial attribute are merged into a unified data file. In practice the area under study is covered by a fine mesh or matrix of grid cells and particular ground surface attribute value of interest occurring at the center of each cell point is recorded as the value for that cell. It should be noted that while some raster models support the assignment of values to multiple attribute per discrete cell, others are strict to a single attribute per cell structure.

Within this model spatial data is not continuous but is divided into discrete units. In terms of regarding where individual cells are located in space, each is referenced according to its row and column position within the overall grid. To fix the relative spatial position according to its row and column position within the overall grid i.e. to geo-reference it, the four comers are assigned planar co-ordinates. An important concept concerns the size of the component grid cells and referred to as grid-resolution.

The following information should always be recorded when assembling, compiling and utilizing raster data.

- Grid size (Number of rows and columns)
- Grid resolution
- Geo-referencing information e.g. comer co-ordinates, source projection.

In general, any geographic phenomena are visually depicted as 'static' map with 'static' spatial model. Moreover, there can be 'dynamic' spatial model as a study by Piyathamrongchai and Tripathi (1995) in "Dynamic spatial modeling using ROS and carrying capacity for ecotourism management". This paper presents how the time variable can be combined to give more information to the spatial model and how to implement the dynamic map with dynamic spatial model. The recreation opportunity spectrum (ROS) framework is a method to identify the tourism carrying capacity (CC). It is modeled spatially as well as dynamically.

For the result, sequential ROS class maps, CC exceed maps and the CC exceed level can be generated. The information obtained from the analysis in this work will be useful to control the impact of tourism on each facility of the Phuhinrongkhla National park and provide more comfort to the tourists.

So far, the last examples of GIS spatial modeling in the research on tourism development in Thailand are initially recognized. The potential of GIS applicable is being promoted and especially, to this ecotourism research in the national park.

2.3 How GIS Supports Spatial Econometrics

Because of its relation on space, according to Krishna, 1995, GIS Systems support both the vector model, the spatial locations of features are defined on the basis of coordinate pairs: three basic feature types - points, lines and areas, and the raster model, the spatial representation of an object and its related non-spatial attribute are merged into a unified data file: grid size (number of rows and columns), grid resolution and geo-referencing information e.g. comer co-ordinates, source projection. Thus, to provide better spatial information, the vector model and the raster model are considered together.

However, the data attribute of this research relates to the discrete types concerning on geo-coded socioeconomic data sets (i.e., data sets that contain the location of the observational units), the raster model could be a major consideration in the analysis. As claimed by Anselin (1999), in geographic (cross-sectional) data set, the standard econometric techniques often fail in the presence of spatial autocorrelation; therefore, the research will use a spatial autoregressive model to specify, estimate and test the presence of spatial interaction in the ecotourism demand models.

2.4 Spatial Dimensions of Ecotourism

In general, each of the grid cells in the study location or zone is covered by the particular ground surface attribute value of the spatial aspects of the ecological data (e.g. biodiversity) and socioeconomic data. The value occurring at the center of each cell point is recorded as the value for that cell. Krishna (1995) notes that while some raster models support the assignment of values to multiple attributes per discrete cell, others are restricted to a single attribute per cell structure. The spatial data are divided into discrete units. In terms of regarding where individual cells are located in space, each is referenced according to its row and column position within the overall grid. With these characteristics of raster cell in GIS, the study can design spatial dimensions of ecotourism.

Ecotourism that emerges between human (i.e. tourists, local population, etc.) behavior and ecological services, observed by socioeconomic activities, at the location and neighbors' neighbor location can view as spatial things. This can refer to a well known Tobler's first law of geography: "Everything is related to everything else, near things are more related than distant things", according to Tobler (1979) cited in Florax (2000). For example, tourist demand may be related to the distance from a gateway (i.e. town, city, and airport) to a local destination zone. The geo-ecological features of each different neighbor zone may determine demand for ecotourism.

Explicitly spatial dependence in ecological and socioeconomic data on ecotourism demand needs to deal with the statistical analysis with correlation in the data. So, introducing spatial econometrics seems to be more suitable in the study.

To consider spatial relationship, according to Anselin (1999 and 2002), and Lesage (2002) spatial dependence occurs when the value of variable y for observation i depends on the value of observation j. Formally, spatial dependence in a collection of sample data implies that observation at location i depends on other observations at locations $j \neq i$.

States: $y_i = f(y_j),\ i = 1,\ldots,n \quad j \neq i$ (1)

As in spatial autoregression, it implies that a sample contains less information than an uncorrelated counterpart. So that limits the ability to carry out statistical inference. When we have a spatial relationship that results from the different feature in each neighbor zone due to the geo-ecological process, again observed by socioeconomic activities, we have the case of spatial lag dependence. A spatial lag model can be defined as:

$$y = \rho Wy + X\beta + \varepsilon \qquad (2)$$

where y is the N by 1 vector of the dependent variable, ρ is the spatial lag parameter coefficient, W is the N by N spatial weight matrix, X is the N by K matrix of independent variables, β is the N by 1 vector of parameter coefficients, and ε is the N by 1 vector of disturbance term. Failure to estimate a spatial lag model when a spatial lag process exists may result in biased and inconsistent estimators (Anselin, 1999).

The other form of spatial effect is because of error correlation or ε_i being related to ε_j (spatial error). It occurs from measurement error, or when the omitted variables spillover spatial units. A spatial error model can be defined as:

$$Y = X\beta + \lambda W\varepsilon + \xi \qquad (3)$$

where λ is the spatial error parameter coefficient, ε is the N by 1 linear model disturbance term, and ξ is the uncorrelated and homoskedastic error term. A non-spatial model that contains spatial error will yield inefficient model estimators due to its non-spherical error covariance (Anselin, 1999).

Thus, the notion of spatial econometrics could be applied to the ecotourism demand model in the study. The expected variables relate that determine demand for ecotourism are proposed in the next section. After determining related variables, all variables will be assigned into the model, the study will consider in the following areas of interest: (a) the formal specification of spatial effects in econometric models; (b) the estimation of models that incorporate spatial effects; (c) specification tests and diagnostics for the presence of spatial effects; and (d) spatial prediction (interpolation).

CHAPTER III

DESCRIPTION OF THE STUDY AREA

This part provides background information on the study area selected for this research. The place is a unique destination for tourists. There are two types of information from the park. The first is general information of the park. The second is the details of its function and operation on forest protection and tourism.

3.1 Phu Jong Na Yoi National Park

Phu Jong Na Yoi National Park (the Park) is located in 3 districts: Buntarik, Nachaluey, and Namyuen districts of Ubon Ratchathani province, in the northeastern part of Thailand (see Figure 3.1 and 3.2). The study area is dominated by thick topical dry deciduous forest. The significant forest resources with flora and fauna and the memorable historical civil war past make it an ideal place for ecotourism development. Ecotourism development has been initiated by TAT and the Royal Forest Department (RFD, 2003).

The national park in northeast Thailand is the category II of protected area as defined by IUCN (1994): protected area managed mainly for ecosystem protection and recreation. By definition, natural area of land and/or sea is designated to (a) protect the ecological integrity of one or more ecosystems for present and future generations, (b) exclude exploitation or occupation inimical to the purposes of designation of the area and (c) provide a foundation for spiritual, scientific, educational, recreational and visitor opportunities, all of which must be environmentally and culturally compatible.

The Phu Jong Na Yoi national park was established in June 1st, 1987. The park is located at 14°25'N - 99°15'E, with altitude at 300-747 meter above the sea level, about 150 kilometers from Ubon Ratchathani. The area about 697.4 km^2 slopes gently towards the southeast and is drained by the Mekong river, which forms the border between Thailand, Laos and Cambodia. Three main vegetation types are observed in the area: dry evergreen forest, mixed deciduous forest, and dry dipterocarp forest, while lowland mixed deciduous forest predominates in Cambodia and Laos. The park also contains both terrestrial and aquatic ecosystems of regional and tigers. It may also provide a sanctuary for the Kouprey; scientists have not observed this species since 1988, but anecdotal evidence suggests that it may not be extinct. The area therefore has globally significant biodiversity value (IUCN, 1994 and Trisurat, 2003).

According to general information from the pilot survey, the national park's main responsibilities are to protect ecosystem and recreation natural resources and wildlife. The park staff includes 4 officials, 9 employees, and 90 "casual" employees to take care of all park duties in the areas. Besides main responsibilities, some 25 officers are assigned to work on park tourism services: nature interpretation, information and service, cleaning, housing, and security (by interviewing, August, 2004).

Table 3.1 Phu Jong Na Yoi Human Resources Staff in 2004.

(unit: persons)

	Official	Staffs		Total
		Government employee	Casual workers	
Male	4	5	80	89
Female	-	4	10	14
Total	4	9	90	102

Source: by field survey in August, 2004.

From the interview, most of the staff members are working and active people. Their ages are between 20 to 43 years old (by interviewing, August, 2004). The experiences of the head of the national park and his officials are more than 10 years. That is, they are ready for their hard and difficult protection duties. However, most of the staff education is high school and lower. Only the head and assistant heads of the park graduated from universities.

The perimeter of the park is approximately 215.9 km. The park itself has no human settlements in the park. The park also established a buffer zone around the park boundary in which 14 villages are located nearby the zone. Some villagers work for the park in the different duties. That is, some of staffs' families are the villagers in that area. Therefore, recent park operation gets cooperation from local people more than previous years. This local cooperation is a good sign for sustainability of tourism development in the park.

The park policy in tourism development emphasizes environmental educational activities. Most visitors are young generation and groups of families that come to visit the park all year round. Local educational institutions also support the park activities. The park is recognized as the best research, education, and recreation place for Ubon Ratchathani province and nearby areas. Also, international research institutes in many countries, i.e. England, Denmark, and Japan, use the park as the outdoor research laboratory. There are not many research topics related to the park to be reported. The park still opens an opportunity for researchers, especially Thai researchers, who are interested in the related fields (by interviewing, August, 2004).

The park has high potential for nature-based tourism or ecotourism. The park tourism facilities and activities are capable of supporting visitors who look for beautiful unique nature. The area not only offers excellent opportunities for the appreciation of nature, it can also provide a multinational and multicultural experience. Historical local communities are mixed, (connecting of Thais, Laotians and Cambodians), and are distinctive in the ways of life.

In the light of current enthusiasm of a new plan for regional development by the Thai government, the National Park Tourism was chosen to be a key activity for local economic development. Using the rich nature and culture together with the ability of management and local community support, the Phu Jong Na Yoi National Park would be another attractive destination for visiting tourists, both domestic and international.

3.2 Problems of the Park Operation

According to the report of Trisurat (2003) and by interviewing, the current problems of the park can be summarized as follows:

1. Some special protection needs for biodiversity: cross-border poaching and trade of plant and animal parts. The area needs to have close cross-border cooperation for biodiversity protection. The intervening landscapes of three countries: Thailand, Laos, and Cambodia, are

experiencing increased pressure due to cross-border poaching and trade of animal parts.

2. Lack of human resources for effective management, the area has 4 ranger stations. With one park official and 90 "casual" employees, the effectiveness of park management is a matter for concern. Especially, tourism development and protecting habitats and species need more staff.
3. Encroachment: forest in the buffer zone outside the Park is being encroached for agriculture; further forest-clearing could jeopardize the viability of already-rare large mammals. The forest is also being degraded in Laos and Cambodia, mainly due to unsustainable commercial-scale logging.
4. Landmines
5. Lack of budgets

The negative issues on the park operation give the benefit for some aspects. At least, local people recognize the nature treasure of the park that could be used as long as they can preserve it. The nature-based tourism in the park is a choice for local economic development.

3.3 Nature-based Tourism in the Park

Park authorities agree that tourism in the park gives more opportunities for increasing revenues for both local community and the park. Though there is an entrance fee to the park, park revenue is an income of the Central Government. No matter what, the revenue from tourism activities, fees will be collected to the Government, because the main objectives are the park protection. Promoting tourism is a second objective compared to the protection (by interviewing, August, 2004).

For the local community, tourism creates employment opportunities. Most casual officials are employed from local residents. However, it is difficult to say whether tourism is the main source of income for the families in the villages. Most of them get income from working in the city and selling their agricultural products.

By observation, it could believe that tourism helps promoting local development. With new roads villagers can easily access town or other villages. They can get more goods and services and new jobs in the city. Most local residents depend on agriculture production. Therefore, tourism in the park could provide a good opportunity for local economy.

3.4 Problems of the Park Nature-based Tourism

The field survey indicated that:

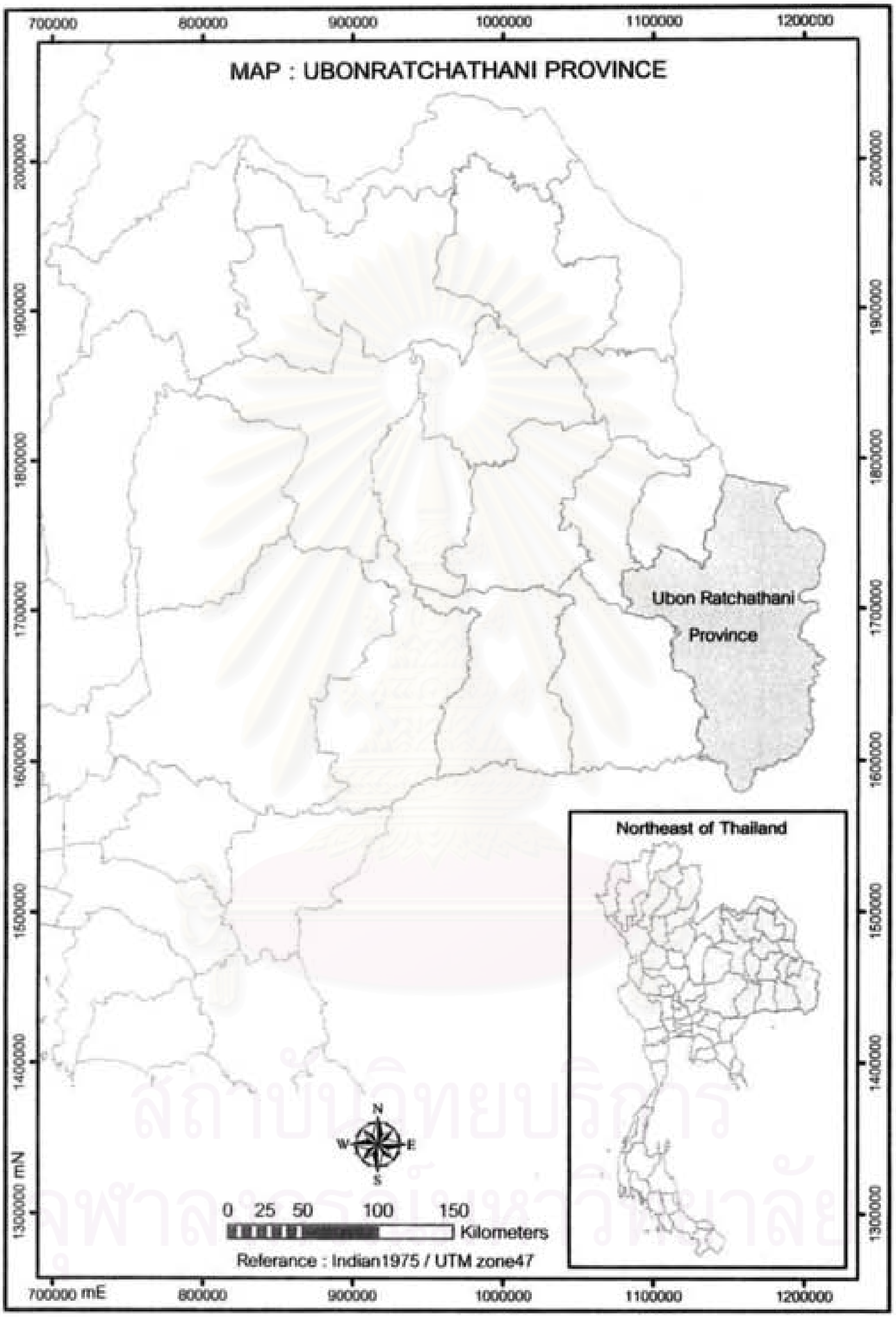
1. Tourism impacts the park environment and tends to disturb ecological system in the crowded visiting area such as the great waterfall. Most visitors choose the waterfall as the first destination. The park concerns about waste generation and negative visual impacts, while the degradation of forests due to tourism activities is not considered to be severe;
2. Nature trails for ecological education are very attractive for visitors. Going on nature trails gives the visitor an opportunity to learn about nature by the park interpretation. But there is the limitation of number for this tourism activity because of the small number of the park interpretation officers;
3. Park tourism planning must include attention to the adjacent area in Laos and Cambodia. Greater cross-border cooperation in removing landmines and curb illegal activities would be a transboundary approach to promote ecotourism in the park;
4. The park has a limitation on its service facilities. Especially, in the high season, housing, bathrooms, and space are not enough.

Tourism should be a part of broader development plans for the Phu Jong Na Yoi National Park. Tourism promotion should emphasize sustainable forest tourism. Sustainable tourism is described as an opposite concept to mass tourism. Issues of small-scales, locality, equity, authenticity, environmentally friendly traveling, ecological and physical impacts, social and cultural impacts and education of hosts and tourists are the characteristics of sustainable tourism (Creaco and Querini, 2001).

For recent park situations, sustainable forest recreation is an element of forest management, for instance promoting environmental education for students and visitors. Increasing participation with local villagers and a soft collaboration on Laos and Cambodia border authorities reduce the problems of the park operation. The protected area includes several measures in their management plans in order to encourage environmental protection in their boundaries, as well as to minimize the negative impacts of tourism.

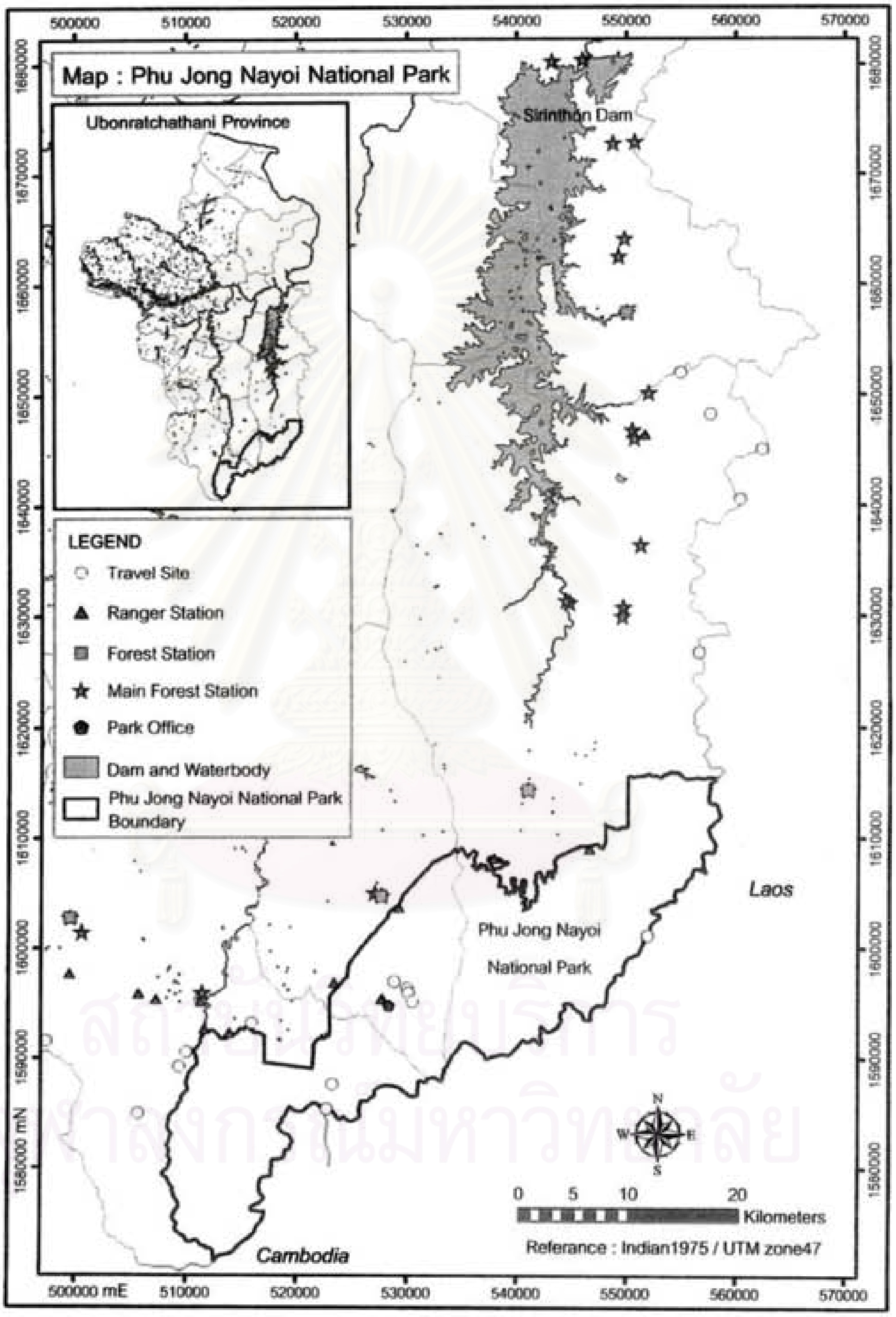
By observation, general visitors were not interested in all tourism activities that the park provided. Most visitors were attracted to only the beauty of nature, such as the waterfall and scenic places. However, other tourism activities such as nature interpretation, over-night stay, and etc. are increasing its popularity (by interviewing, August, 2004).

Figure 3.1 Map of Ubon Ratchathani Province



Source: by author

Figure 3.2 Map of Phu Jong Na Yoi National Park



Source: by author

CHAPTER IV

RESEARCH METHODOLOGY

There are two parts of methodology. First, GIS application to ecotourism will be used to provide spatial information and database for site ecotourism. Further, the specific ecotourism demand will be generated by using the single site Travel Cost Model with GIS linked spatial dependence variables. They include data and supporting theoretical ideas. The details are as follows:

4.1 GIS Application to Ecotourism Area

4.1.1 Data Used for GIS study

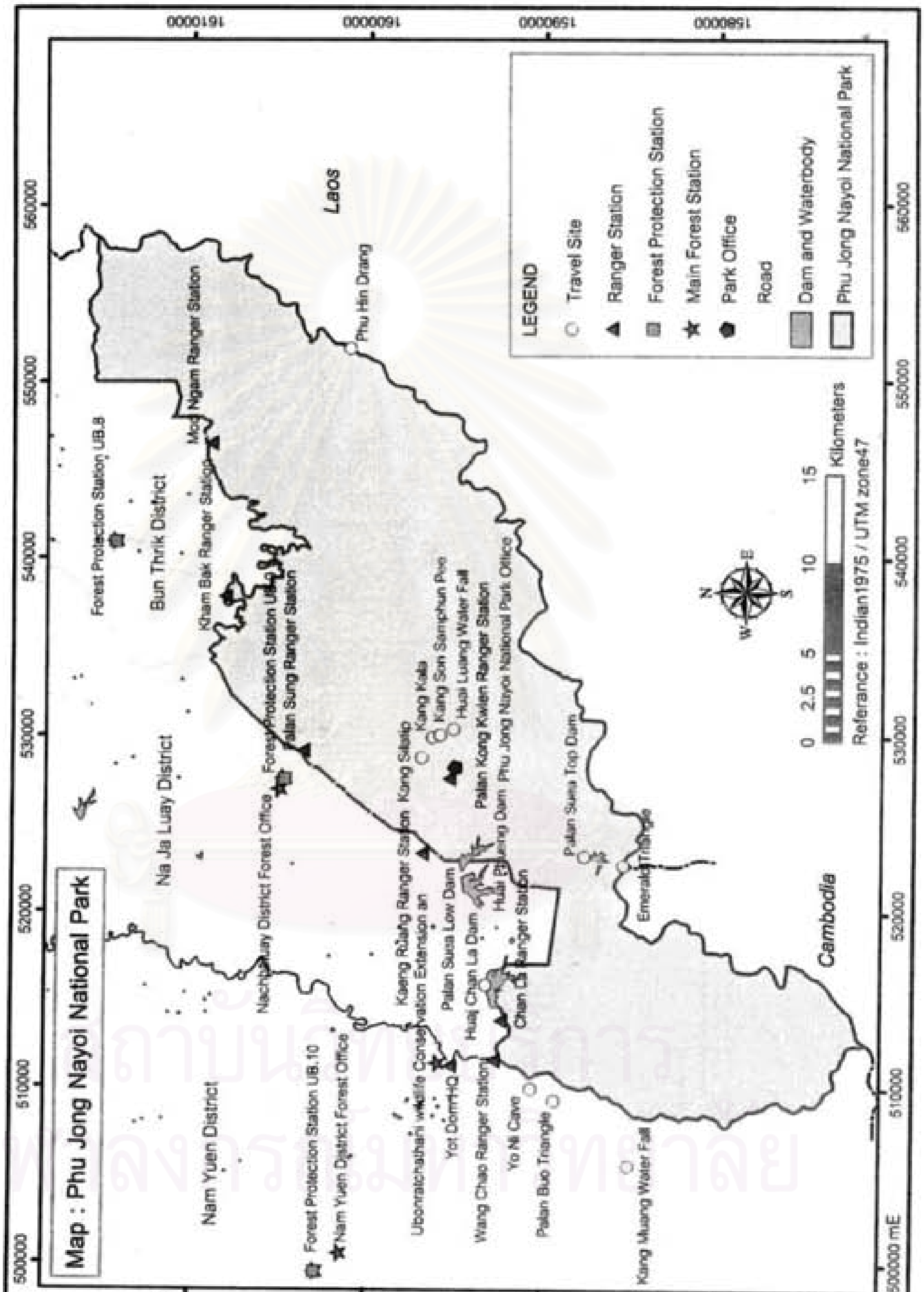
The study uses GIS as a tool for relating a spatial influence into an economic model. The following GIS databases and information are used as input to create output maps of the park and construct the distance weighted variable for economic model analysis. The input maps and database are as follows (RFD, 2003)

1. The study utilized the satellite data from LANDSAT-5 TM for the Northeast Thailand,
2. Geographic Maps of the Northeast 1:50,000 series L7018 from Military Mapping Department,
3. National Park Zoning Maps for Phu Jong Na Yoi National Park 1:250,000 from Forestry Department,
4. Road Network Maps of Ubon Ratchathani 1:250,000 from the Office of Rural Rapid Developing Department, and
5. Other maps from Tourism Authority of Thailand, used as input data for geographical database. ArcGIS software for GIS was used for the analysis. The results are the digital maps containing all databases of ecotourism sites. The data can be retrieved and used in the potential ecotourism map analysis.
6. Recent 2006 Census Data.

The above GIS database has been used to create a specific output map, as shown in Figure 3.1. Because the research focuses on spatial distance weight, the accurate lattice on the map was reproduced along with the coordinate given by the related to the travel path of visitors. A modified distance function is used to create spatial weight function as shown in Eq. 12.

Following the ideas on spatial econometrics, next, the modeling ecotourism demand with GIS linked spatial dependence and socio-economics factors can be resembled.

Figure 4.1 Map Location of Phu Jong Na Yoi National Park



4.2 Modeling Demand for Ecotourism in the Study Area

4.2.1 Model Specification

4.2.1.1 Model Specification without Spatial Dependence

In this section, ecotourism demand model under spatial dependence will be proposed by modifying the single site travel cost model (TCM) that is widely used in literature reviewed by several researchers. The travel cost technique relies on data collected from surveys of park visitors. By using information provided by visitors, the travel cost method is known as a "revealed" preference technique. The method links information on the distance people travel to visit the park to information on how many times they visit the park each year, and other variables. Data on these variables for a sample of visitors is used to estimate a demand function for the number of trips to the park. The resulting demand function provides an approximate value of a visit to the park. The brief review of the single site TCM model has been given by Parson (2000) as follows:

Theoretically, the TCM model assumes that recreation is a complex good that can be described by its attributes. The attributes enter directly into the consumers/ visitors' utility function. The consumers' problem is conditioned upon the fact that the consumer already has decided to make a visit and restricted to a single choice occasion (i.e., the choice of sites is independent of past or future site choices). Formally the visitors' maximization problem is to maximize utility with income and time constraint, as follow:

$$\text{Max } U(r, s, z, d) \qquad (4)$$

$$\text{s.t. } wH = z + (tr_r \cdot r) + (tr_s \cdot s)$$

$$T = H + (tm_r \cdot r) + (tm_s \cdot s)$$

where r = number of trips to the site of interest, s = a vector of number of trips taken to substitute sites (eg., other parks or beaches), z = a composite of other goods and services, and d = a vector of demographic variables believed to capture differences in preferences across the population. The units of goods are defined such that its price is one. The individual then chooses recreation trips and other goods and services to maximize the utility subject to the two constraints shown.

The first constraint is income, where w = the hourly wage, H = hours worked over the season, tr_r = the travel cost, entrance fee, and any other out-of-pocket expenses necessary to make the trip to the site of interest, and tr_s = a vector of similar costs for each substitute site. Therefore, individuals spend all of their income on recreation trips and other goods and services which cannot have expenditures in excess of their income.

The second constraint is over time, say that the individual divides time between work and leisure during the season, tm_r = time spent traveling to and from the site and on-site necessary to make one trip possible and tm_s = a similar vector for each substitute site. This constraint simply says that the individual divides time between work and leisure (where recreation is the only form of leisure in this model), and the time spent cannot excess the available time over season.

Rewriting the time cost constraint as $H = T - tm_r \cdot r - tm_s \cdot s$, substituting into the income constraint, and rearranging terms give a simpler form for the utility maximization problem

$$\text{Max } U(r, s, z, d) \qquad (5)$$

$$\text{s.t. } wT = z + (tc_r \cdot r) + (tc_s \cdot s)$$

where $tc_r = (tr_r + w \cdot tm_r)$ is the total trip cost of reaching the site and $tc_s = (tr_s + w \cdot tm_s)$ is a vector of trip costs for the substitute sites. All other terms are the same as above. Total trip costs tc_r is the individual's surrogate price of visiting the site and is composed of all out-of-pocket expense necessary to complete the trip (tr_r) plus time cost ($w \cdot tm_r$). An hour is valued at an individual's wage rate.

To maximize utility, one chooses r, s, and z for demand function. The general form of that demand function is (see figure 4)

$$r = f(tc_r, tc_s, y, d). \qquad (6)$$

A negative relationship, like any demand curve, exists between the quantity demand (trips) and price (trip cost). Income and the demographics work as typical demand shifters. Common shifters are age, education, gender and number of trip days.

The unit of observation for the analysis then is an individual. The sample size is the number of completed surveys. Each person's trip cost (to the study site and its substitutes is estimated by measuring the distance to and from the site multiplied by a reasonable per hour travel cost. To estimate the time cost component of trip cost, we measure the round trip time to and from a site and multiplied by a reasonable cost per hour estimate.

The two most common forms used in estimating equation (6) are the semi-log and linear models. The following models were used for the study analysis.

Semi-log: $ln(r) = \beta_r tc_r + \beta_s tc_s + \beta_y y + \beta_d d + e$ (7)

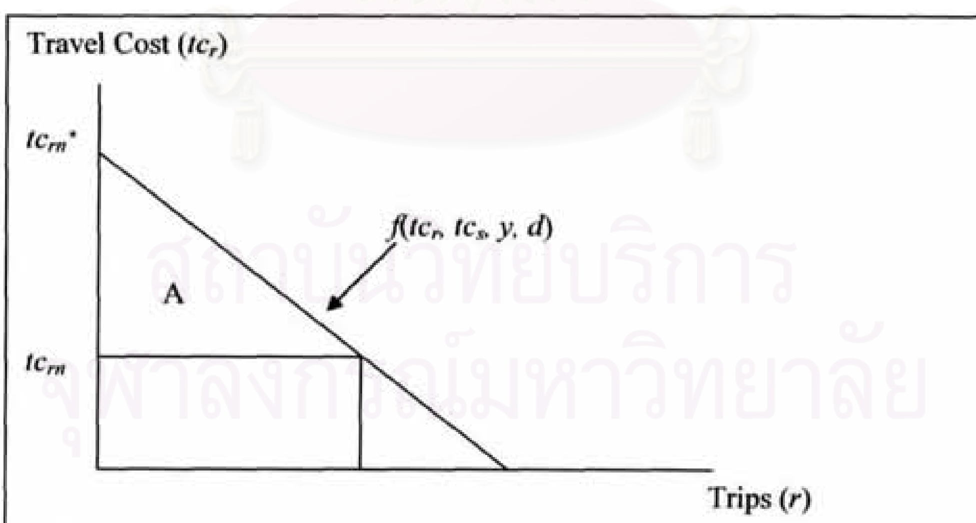
Linear: $r = \beta_r tc_r + \beta_s tc_s + \beta_y y + \beta_d d + e$ (8)

Valuing of access to a site—policies or situations where an entire site is lost or gained-- is a person's total consumer surplus for the site, calculated by integrating the demand function in the previous section from tc_{rn} to tc_{rn}^*, where tc_{rn} is the trip cost to individual n and tc_{rn}^* is the trip cost at which the number of trips taken in the estimated demand function go to zero. The consumer surplus for individual n (area A in Fig. 4.2) then takes the form

$$cs_n = \int_{tc_{rn}}^{tc_{rn}^*} f(tc_{rn}, tc_{sn}, y, d)\,dtc_{rn} \quad (9)$$

Eq. (9) is the total willingness to pay to have access to the site for the season. Notice in Figure 4.2 and equation 9 that as trip cost rises, all else constant, access value declines.

Figure 4.2 Travel Cost Demand Curve and Consumer Surplus



Note: Modified from Parsons, 2000

For a sem-ilog (Eq. (7)) or linear (Eq. (8)) demand function is estimated. It can calculate the consumer surplus for individual n in Eq. (9) as follows (see more details in Appendix E):

$$cs_n\,(semilog) = \frac{r_n}{(-\beta_r)} \tag{10}$$

$$cs_n\,(linear) = \frac{r_n^2}{(-2\beta_r)} \tag{11}$$

where r_n is the number of trips by person n and β_r is the coefficient on trip cost in demand function. Both equations were used to measure the economic value of the park tourism.

There is evidence that researchers use spatial econometric for the model estimation. For example, Pattanayak and Butry (2001) used the spatial aspects of ecosystems and ecological process, such as spatial interdependence, to estimate demand for a weak complement to the ecosystem services-farm labor. The results showed that including spatial dependence into the estimated economic models had theoretically expected properties that are robust across all different specifications. A distance metric was a key element of spatial models of the spatial weight matrix that captures the extent of 'neighborliness' of observations, by constructing a row-standardized, inverse distance spatial weight matrix to test and model the spatial processes in the data (details about a spatial weight matrix are in Appendix B).

4.2.1.2 Model Specification with Spatial Dependence

In this study, the functional relationship between the trip of each individual and the socio-economic characteristics of the visitor (independent variables) has been analyzed by implementing a distance-based weight as a spatial effect within the model estimated. As claimed by Lesage (2001), the distance vector along with a distance decay parameter (geographically weighted regression, GWR) could be used to produce locally linear regression estimates for every point in space. To construct the weight function (W_i), the study used a modified initial function form,

$$W_i = \frac{1}{\left(d_i/\theta\right)^2} \tag{12}$$

where θ is a decay or bandwidth parameter, d_i in this study is a distance along lattice of the visited site to visitor's residence. A single value of the bandwidth parameter θ is determined using a cross-validation procedure often used in locally linear regression methods. A score function takes the form:

$$\sum_{i=1}^{n}\left[y_i - \hat{y}_{\neq i}(\theta)\right]^2, i = 1 \text{ to n}, \qquad (13)$$

then the function goes to error sum of square which can take minimization as in ordinary least square (OLS). We can write the simple spatial autoregressive model (SAR) with weighted distance decay variable like as Eq.(2). Eq. (7) and Eq. (8) can be changed from a general model to weighted regression within Travel Cost model as follows:

$$Ln(r) = \rho W_i y + \beta_r tc_r + \beta_s tc_s + \beta_y y + \beta_d d + e \qquad (14)$$

$$r = \rho W_i y + \beta_r tc_r + \beta_s tc_s + \beta_y y + \beta_d d + e \qquad (15)$$

In Eq.(14) and Eq.(15), the ρ is a vector of parameters to be estimated which is conditional on θ. That is, changing θ will produce a different set of SAR estimates. Under Ordinary Least Square (OLS) estimation, as in Eq.(7) and Eq.(8) when spatial dependencies are present, the estimated parameters are biased and/or inefficient. Spatial dependencies affect the studied models from either structural relationship among the observation (lagged dependency) or from the omission of spatially correlated explanatory variables that impact the spatial dependency among the error term. These spatial dependence can be solved with the models in Eq.(14) and Eq.(15). The models were used for analysis and result comparison.

4.2.1.3 Specification Test and Interpretation

According to Anselin 1999, the commonly used specification test for spatial autocorrelation is derived from a statistics developed by Moran as the two-dimensional analog of test for univariate time series correlation. In matrix notation, Moran' I statistic is

$$I = \left(N / S_0\right)\left(e'We / e'e\right) \qquad (16)$$

where e is a vector of OLS residual and $S_0 = \Sigma_i \Sigma_j w_{ij}$, a standardization factor that corresponds to the sum of the weights for the non-zero cross-products. The distribution for Moran's I follows the standard z distribution can be used to test spatial dependence, where:

$$z = I - E(I) \Big/ \sqrt{Var(I)} \qquad (17)$$

A high Moran's' I (as I approaches 1) indicates the present of positive spatial dependence, whereas a low value (as I approaches -1) signifies negative spatial dependence. No spatial dependence is found when Moran's I approaches its expected mean (-1/(n-1)) -which asymptotically approaches 0. The Moran statistic test shows that the result of the test is similar to Durbin-Watson test. Therefore, this study utilizes Durbin-Watson test as an indicator for autocorrelation.

However, there is an alternative way, when spatial regression models are estimated by maximum likelihood. Inference on the spatial autoregressive coefficients may be based on Wald or asymptotic t-test (from the asymptotic variance matrix) or a likelihood ratio test (Anselin, 1999).

This study purposes to model the ecotourism demand in the Phu Jong Na Yoi national park. GIS is used to measure distance along the coordinate lattice of visitors' travel path to visit the park, a link of spatial distribution on geography. The distance was used to create a geographically weighted function as a distance decay weight and applied into spatial autoregressive Travel Cost Model.

Comparing between Travel Cost models with and without spatial dependence gives a clarified idea for the relationship of the model specification. Spatial dependence is a matter for doing an analysis. The hypothesis of spatial dependence was tested. The estimated ecotourism demand models were implemented to evaluate an economic benefit of the park tourism.

The dependent variable, number of trips, and explanatory variable, total trip cost to site, income, and the rest are key variables for this study. The hypothesis for the study is that conventional Travel Cost Model fail to deal with spatial pattern of the relationship between trip frequency and distance. As claimed on previous literatures, Lesage (2002) and Smith and Kopp (1989), the results of spatial dependence lead to loss of the sample information. Conventionally, estimated model can not be used to efficiently measure the demand for trips. This study attempted to prove this suppression in conventional Travel Cost Model. Because spatial dependence involves with correlation in the error term, this is similar to time-series case of serial dependence but it much more difficult to filter out spatial dependence than it is to deal with serial correlation in time series. Correlation in time-series is that correlates over time change. But, for spatial dependence, we deal with correlation over space which has more than one dimension. The goal here is to eliminate the spatial dependence in the dependent variable, number of trip, allowing us to proceed with least-square estimation in the conventional Travel Cost Model. Therefore, for the conventional model, if there exists spatial dependence, the null hypothesis test, H_0: $\rho = 0$, as $d = 2(1 - \rho)$ for Durbin-Watson d statistic could be used as follows (Gujarati, 1995):

1. H_0: $\rho = 0$ vs. H_1: $\rho > 0$: If the estimated $d < d_u$, reject H_0 at level α, that is, there is statistically significant positive autocorrelation.
2. H_0: $\rho = 0$ vs. H_1: $\rho < 0$: If the estimated $(4 - d) < d_u$, reject H_0 at level α; statistically there is significant evidence of negative autocorrelation.
3. H_0: $\rho = 0$ vs. H_1: $\rho \neq 0$: If the estimated $d < d_u$, or $(4 - d) < d_u$, reject H_0 at level 2α; statistically there is significant evidence of autocorrelation, positive or negative.

As claimed by Lesage (2001), the similar prove of spatial autocorrelation with in Durbin-Watson test, alternative hypothesis test is Moran I statistic.

Therefore, this study utilizes this Durbin-Watson test for spatial dependence in the travel cost demand estimation.

4.2.2 Suitability of Demand Model for National Park Ecotourism

The Travel Cost Model should be appropriate in the study since there is a single purpose of visiting the site of interest. The research used on-site survey data and interest centers on a single site. At the study area, there are a few nearby substitution sites, following the difference of physical and geographical characteristics and site attributes including park ecology and environment, because the park is remotely located in a border area of the country.

The effects of substitute site and system demand should not be a concerned. As argued by Hof and King (1982) and Caulkins, Bishop, and Bouwes (1985), cited in Phaneuf and Smith (2004), it is not necessary to estimate a system model to account for the effects of substitute site prices and quality measure in benefit estimates when interest centers on a single site. However, this study included total cost of visiting substitute sites in the model as an explanatory variable to capture the substitution effect, if any.

Implementation of a single equation demand model involves two areas of economic judgment: variable definition and measurement along with demand function specification and estimation. In the first areas the most important decisions involve the opportunity costs of time, the role of on-site time and trip cost. Judgment on specification and estimation relate to the evolution of a single site model to a spatially aggregated model. Due to the fact that this research introduces a spatial dependence variable into the model, the spatial influence should be more concerned. That is GIS-linked spatial dependence in the demand model to have a hypothesis test. Again, spatial econometrics takes its role.

Concerning about the value of time, there are still controversies both about the opportunity cost of time and on-site time. For the purpose of this research, The value of time is defined as the value of access to the site by using the costs associated with getting to the site. This way requires that the resources, given up in travel, are for the single purpose of visiting the site of interest.

4.2.3 Determining Related Variables

The following factors are expected to have an influence on tourists to visit the national park (modified from Loomis & Walsh 1997, Lindberg 1998 cited in Worboys, G.L., De Lacy, T., Lockwood,M. 2000):

1. Socioeconomic characteristics of tourists, including demographic characteristics: income (before- tax income), education, age, gender, ethnicity and so on;
2. Tastes and preferences of tourists (various behavioral preferences associated with person i, such as the activities they like to undertake while in the park): preferences for active versus passive activities, natural versus developed settings, social versus solitary experiences, the number of nights spent camping during the trip to the park by person i, and so on;
3. Cost of gaining access to the site for person i;
4. Costs of accessing facilities and opportunities within the site;
5. Travel time (for example, the travel time to the park for person i);

6. Characteristics of the site such as environmental quality, attractiveness (the number of visits made per year to a given park by person i, for instance), available facilities, and so on;
7. Image and profile of the site, for example attitude held by person i such as their views on conservation issues like the person's opposition or support for resort developments in the park, and so on;
8. Availability and prices of competing attractions (substitute sites), for example visitors may simply substitute other sites when environmental quality at a preferred site is reduced;
9. Congestion or crowding ; and
10. Distance the individual travels in to the site, for example the distance from the site attraction to the zone that the individual allocated, by GIS analysis.

Theoretically, the demand for trip as a dependent variable has a negative relationship with travel cost (price), a negative sign for coefficient, and positive or negative relationship with other travel costs of the substitute site and visitor's age. There is a positive relationship with visitors' income and number of days to visit. Demographic variables, gender, and education, indicate a shift on the demand for the trip. There are other independent variables that can be used, for example, site quality, visitors' attitude toward the site of interest which can be included in the analysis depending on the purpose of the study. This study used variables in Table 4.1 for analysis on spatial relationship in Travel Cost Model.

For this study, from the above concepts of determined variables, 10 data variables were selected for the model analysis, in Eq. (7), (8), (14), and (15). The variables are defined as follows (see Table 4.1):

Table 4.1 Description of Variables and Their Expected Signs

Variables	Description	Units	Expected Sign
Dependent variable			
v_trip	Number of trips to the site of interest	times	~
Independent variables			
t_cost	Total cost of gaining access to the site	baht	(-)
t_cost_sub	Total cost of gaining access to the substitute site	baht	(+/-)
inc_year	Income per year (before tax)	baht	(+)
v_day	Number of days to visit	days	(+)
sex	Gender (1=female, 0=male)	~	(shifter)
edu	Level of education (0 = null, 1 = elementary, 2 = high school, 3 =vocational, 4 = university).	~	(shifter)
reage	Real age	year	(+/-)
local_part	Local people participation in park tourism (0 = no, 1 = yes)	~	(+/-)
satisfied	Visitors' opinion on the park tourism both facilities and services (overall, 1 = poor, 2 = fair, 3 = good, 4 = very good)	~	(+/-)

Source: Modified from Worboys, G.L., De Lacy, T., Lockwood,M. 2000):

4.2.4 Data Consideration

4.2.4.1 Sampling Design

There are two parts of data sampling from field surveys. Firstly, for the park officer interview, the study used the questionnaires on pre-survey to collect the opinions on park activities from 92 staff members who work for the park; 20 samples were received. This first part was done in May 2005. The data were collected at the park office. The researcher asked for help from the Head of the national park. The data were general information and the operation of the park. The questionnaire covered official attitudes toward activities of forest protection and tourism, working, and income, as follows:

1. Current important activities provided by the park are forest products (non timber), recreation/ tourism, forest conservation, and wood product that appeared in the highest scores are the most important activities. The lowest scores are business, store, and sport activities.
2. Tourism is very important to the park in a positive aspect such as an improvement of the park landscape. Tourism also contributes negatively to the park such as pollution. All of the aspects related to the environment, economic, and social impacts.

Moreover, the park officers also gave many suggestions for improvement of both forest resource and tourism activities such as facilities, staff training, etc.

Secondly, for visitors' part, the study distributed 750 set of questionnaires to collect data from on-site visitors at the park during November 2004 to April 2005. 620 samples were returned and the total of completed 604 questionnaires were used for analysis. The questionnaire was designed to capture the visitors' socio-economic characteristics and attitude toward visiting the national park.

Collecting the data involved placing two research assistants at a site attraction, Huay Laung waterfall, and at the visiting center where most of visitors stop before doing their activities, and having them pass out surveys randomly to park visitors. In addition, several prizes were given away to respondents to help increase the response rate. The survey achieved a relatively high response rate of 82%.

The full set of results for this survey is in Chapter 5. The survey contained three sections. The first section was completed by everyone, and asked for demographic information, current day expenditure, duration of visit, distance traveled for one-way trip, travel time from their residence.

The second section of the survey was the activities that visitors get involved with during trip. And their opinions of site activities were asked.

The third section of the survey was the visitors' opinions on the park conservation learning for visitors and its tourism service such as a suitability of fee (including entrance, housing, and vehicle). Other information is the substitute site and its cost to visit.

4.2.4.2 Measuring Travel Distances and Costs

In the Travel Cost Model, a key element is the distance assumed relevant for each individual's trip to a recreation site. Measuring distance has changed rapidly with access to modern microcomputer based software such as ArcGIS packages (i.e. ArcView, ArcMap, and ArcInfo). The respondents are reasonably accurate about the distance to the recreation site they recently visit (or where they were interview, if data are collected in an intercept survey). This claim is supported by Bateman et al. (1996) study, cited in Phaneuf and Smith (2004), recently confirmed this information, suggesting that the highest resolution GIS computation are quite close (on average) to respondent reports.

The technique used in this study is to measure the distance by using geo-coordinate at point or site located on different geographic region. This was done by the map operation on computing procedure which is supported by GIS software. The measured distances were used for deriving a geographically weight function, as in Eq.(12). The weight is imported into Eq. (14) and (15) for model evaluation.

CHAPTER V

RESULTS AND DISCUSSION

This part covered the research results. The data from the survey questionnaire were analyzed by using a statistical software. The results are as follows:

5.1 Results

5.1.1 Preliminary Statistical Analysis

5.1.1.1 Visitor's Profile

The survey questionnaire contained three sections. The first section was completed by everyone, and asked for demographic information, current expenditure, duration of visit, distance traveled for one-way trip, travel time from their residence. The second section of the survey was the activities that visitors get involved with during trip. The third section of the survey was the visitors' opinions on the park conservation learning for visitors and its tourism service such as a suitability of fee (including entrance fee, housing, and vehicle). Other information was the substitute site and its cost to visit. Also their opinions of site activities were asked. The results of data analysis are as follows:

Table 5.1 Visitors' Residency

Provinces	Total visitor (%) (total 604 visitors)
1. Ubon Ratchathani	76.0
2. Udonthani	1.0
3. Khon Kean	2.6
4. Bangkok	1.2
5. Si Sa Ket	1.8
6. Amnatcharearn	0.5
7. Chon Buri	0.3
8. Roiet	15.1
9. Yasothorn	0.5
10. Samutphakran, Surin, Burirum, Mahasarakam, Kalasin, Nakhonratchasima, Pisanulok, Chiyaphum, Chiang Mai, Nontha Buri, Nakhon Naiyok, Sakonnakhon, and Ratcha Buri	1.0
Total	100

Source: by computation

The results showed that 76% of visitors originally came from Ubon Ratchathani. The rest 15%, 2.6%, 1.8%, 1.2%, and 1% were from Roiet, Khon Kean, Bangkok, Srisaket, and Udon Thani, respectively. There were a few visitors about 1% came from other provinces (see Table 5.1).

Table 5.2 Visitors' Gender and Age

(unit: persons)

Gender	Age					Total
	less than 16	16 to 25	26 to 35	36 to 45	46 to 55	
male	77	263	21	13	4	378
	12.7%	43.5%	3.5%	2.2%	.7%	62.6%
female	19	160	32	14	1	226
	3.1%	26.5%	5.3%	2.3%	.2%	37.4%
Total	96	423	53	27	5	604
	15.9%	70.0%	8.8%	4.5%	.8%	100.0%

Source: by computation

The sample information showed that visitors' age between 16 and 25 years old is about 70% of total visitors. By gender, male and female visitors are 62.6 % and 37.4%, respectively (see Table 5.2).

Table 5.3 Visitors' Gender and Level of Education

(unit: persons)

Gender	Level of education					Total
	elementary	high school	vocational college	university	non education	
male	4	291	33	48	2	378
	.7%	48.2%	5.5%	7.9%	.3%	62.6%
female	4	144	40	36	2	226
	.7%	23.8%	6.6%	6.0%	.3%	37.4%
Total	8	435	73	84	4	604
	1.3%	72.0%	12.1%	13.9%	.7%	100.0%

Source: by computation

There were 72% of visitors studying or graduated at high school level, about 48.2% was male and 23.8% was female. About 13.9%, 12.1%, 1.3%, and 0.7% of visitors were studying or graduated from university, vocational school, high school, and elementary school, respectively (see Table 5.3).

Table 5.4 Visitors' Gender and Nationality

(unit: persons)

Gender	Nationality	Total
	Thai	
Male	378	378
	62.6%	62.6%
Female	226	226
	37.4%	37.4%
Total	604	604
	100.0%	100.0%

Source: by computation

Table 5.5 Visitors' Gender and Religion

(unit: persons)

Gender	Religion		Total
	Buddhism	Others(Christian)	
Male	375	3	378
	62.1%	5%	62.6%
Female	225	1	226
	37.3%	.2%	37.4%
Total	600	4	604
	99.3%	.7%	100.0%

Source: by computation

Table 5.6 Visitors' Gender and Marital Status

(unit: persons)

Gender	Marital status		Total
	Married	Single	
Male	26	352	378
	4.3%	58.3%	62.6%
Female	28	198	226
	4.6%	32.8%	37.4%
Total	54	550	604
	8.9%	91.1%	100.0%

Source: by computation

All of visitors were Thai nationality and 99.3% of them believe in Buddhism, the rest was Christian and also 91.1% is single (see Table 5.3, 5.4, 5.5, and 5.6).

Table 5.7 Visitors' Gender and Career

(unit: persons)

Gender	Careers						Total
	Student	Agriculture	Private business	Government	Business company	na	
Male	329	6	13	23	5	2	378
	54.5%	1.0%	2.2%	3.8%	.8%	.3%	62.6%
Female	169	8	15	27	5	2	226
	28.0%	1.3%	2.5%	4.5%	.8%	.3%	37.4%
Total	498	14	28	50	10	4	604
	82.5%	2.3%	4.6%	8.3%	1.7%	.7%	100.0%

Note: na means no information
Source: by computation

Visitors' 8.3%, 4.6%, 2.3%, and 1.7% had worked on government, private business, farming, and company, respectively. The rest 82.5% were students (see Table 5.7).

Table 5.8 Visitors' Gender and Transportation

(unit: persons)

Gender	Transportation				Total
	Private vehicle	Public vehicle	Hired vehicle	na	
Male	207	18	126	27	378
	34.3%	3.0%	20.9%	4.5%	62.6%
Female	167	14	44	1	226
	27.6%	2.3%	7.3%	.2%	37.4%
Total	374	32	170	28	604
	61.9%	5.3%	28.1%	4.6%	100.0%

Note: na means no information
Source: by computation

They visited the park by private vehicles (car, motorcycle, and truck), hired cars (bus, van and truck), and public transportations (buses) by 61.9%, 28.1%, and 5.3%, respectively (see Table 5.8).

Table 5.9 Visitors' Gender and Over-night Stay at Park

(unit: persons)

Gender	Over-night stay		Total
	not stay	stay	
Male	185	193	378
	30.6%	32.0%	62.6%
Female	83	143	226
	13.7%	23.7%	37.4%
Total	268	336	604
	44.4%	55.6%	100.0%

Source: by computation

About 44.4 % were daily visitors and 55.6% stay over night at the park (see Table 5.9).

Table 5.10 Visitors' Gender and Types of Visitors

(unit: persons)

Gender	Type of visitor					Total
	Group of friends	Group tour	Group family	Others (alone, school)	na	
Male	119	140	51	64	4	378
	19.7%	23.2%	8.4%	10.6%	.7%	62.6%
Female	110	53	45	17	1	226
	18.2%	8.8%	7.5%	2.8%	.2%	37.4%
Total	229	193	96	81	5	604
	37.9%	32.0%	15.9%	13.4%	.8%	100.0%

Note: na means no information
Source: by computation

Most of visitors arrived to the park by groups. They came long with a group of friends, tours, and families about 37.9%, 32.0%, 15.9%, respectively, and 13.4% came alone or with their school mates (see Table 5.10).

Table 5.11 Visitors' Gender and Overall Visiting Satisfaction

(unit: persons)

Gender	Overall satisfying					Total
	Unsatisfied	Fair	Good	Very good	na	
Male	22	37	176	139	3	377
	3.6%	6.1%	29.2%	23.1%	.5%	62.5%
Female	7	26	112	81	0	226
	1.2%	4.3%	18.6%	13.4%	.0%	37.5%
Total	29	63	288	220	3	603
	4.8%	10.4%	47.8%	36.5%	.5%	100.0%

Note: na means no information
Source: by computation

Visitors' opinions on the park facilities and services which are roads, parking, housing, maps, restrooms, wastes, food and drink, tape water, park information and public relation, sanitary, health services, guiding or nature interpretation, safety and security. The study showed that 47.8% of visitors gave an overall satisfying in good level. The rest 36.5%, 10.4%, and 4.8% gave in very good, fair, and unsatisfied (poor) levels, respectively (see Table 5.11).

Table 5.12 Visitors' Gender and Park Conservation Learning

(unit: persons)

Gender	Park conservation learning					Total
	None	Same	More increasing	Increased very much	na	
Male	21	14	170	169	3	377
	3.5%	2.3%	28.2%	28.0%	.5%	62.5%
Female	6	11	118	91	0	226
	1.0%	1.8%	19.6%	15.1%	.0%	37.5%
Total	27	25	288	260	3	603
	4.5%	4.1%	47.8%	43.1%	.5%	100.0%

Note: na means no information

Source: by computation

The samples showed that visiting the park gave an opportunity for learning about nature environment and conservation. For example, learning about ecosystem and biodiversity of the park at the nature trail of Kerng Mae Fong waterfall, visitors learned --what does conservation mean, how is it important, and how does it practice. They had learned an importance of native plant, animal, and forest ecosystem. About 47.8% and 43.1% of visitors had been increased more and very much on their attitudes toward conservation knowledge (see Table 5.12).

Table 5.13 Visitors' Gender and Vehicle Fee

(unit: persons)

Gender	Vehicle fee		Total
	Not suitable	Suitable	
Male	85	293	378
	14.1%	48.5%	62.6%
Female	34	192	226
	5.6%	31.8%	37.4%
Total	119	485	604
	19.7%	80.3%	100.0%

Source: by computation

Table 5.14 Visitors' Gender and Thai Visitor's Entrance Fee

(unit: persons)

Gender	Thai visitor's_fee		Total
	Not suitable	Suitable	
Male	91	287	378
	15.1%	47.5%	62.6%
Female	41	185	226
	6.8%	30.6%	37.4%
Total	132	472	604
	21.9%	78.1%	100.0%

Source: by computation

Table 5.15 Visitors' Gender and Foreigner Visitor's Entrance Fee

(unit: persons)

Gender	Foreigner Visitor's Entrance Fee		Total
	not suitable	suitable	
Male	118	260	378
	19.5%	43.0%	62.6%
Female	61	165	226
	10.1%	27.3%	37.4%
Total	179	425	604
	29.6%	70.4%	100.0%

Source: by computation

Table 5.16 Visitors' Gender and Housing Fee

(unit: persons)

Gender	Housing_fee		Total
	not suitable	suitable	
Male	122	255	377
	20.2%	42.3%	62.5%
Female	62	164	226
	10.3%	27.2%	37.5%
Total	184	419	603
	30.5%	69.5%	100.0%

Source: by computation

The fee was applied to visitors before entry into the park. There are 4 types of fee applied on the visitors: vehicle, entrance fee for Thai and foreigner, and housing or room About 80.3%, 78.1%, 70.4%, and 69.5% of visitors indicated that current cost of entrance fee for vehicle, Thai visitors, Foreign visitors, and housing, respectively, were suitable(see Table 5.13 through 5.16). By observation, however, the park did not strictly collect the entrance fee for every visitor. The official at the park gate will allow local villagers who live nearby the park for free. This could be a good relationship between the park official and local people. The park has shown its sincerity and flexibility to local people.

Table 5.17 Visitors' Gender and Local People Participation

(unit: persons)

Gender	Local_people participation		Total
	Ought to	Ought not to	
Male	358	20	378
	59.3%	3.3%	62.6%
Female	218	8	226
	36.1%	1.3%	37.4%
Total	576	28	604
	95.4%	4.6%	100.0%

Source: by computation

Local people participation was nominal number, given 1 = ought to participate, 0 = ought not to participate, visitors showed that local people ought to get involve with the park tourism and protection about 95.4% (see Table 5.17).

According to Table 5.18, the mean of visitors' expenditure for the trip is 1,401.36 baht per person. This amount of money was a part of the total trip cost which included with an opportunity cost of time when computed the total trip cost. The computed total trip cost was used for model analysis. The expenditures were separated by payment such as vehicle, food and drink, stuff (e.g. tent, clothes), fee, and others (e.g. films, and souvenirs). The average payments are 367.69, 577.18, 93.58, 278.73, and 84.16 baht per person, respectively.

Table 5.18 Summary of Visitors' Demographic and Economic Results

	Mean		Std. Deviation
	Statistic	Std. Error	Statistic
Distance from home (Km./visitor)	150.27	5.44	133.65
Travel time to park (hrs/visitor)	2.628	.096	2.37
Number of days to visit (days/visitor)	1.62	.034	.84
Number of visitors (persons; by visitors' information)	46.49	2.75	67.57
Visitor's expenditure(baht/ trip)			
Total actual expenditure	1494.12	142.78	3508.98
1. Vehicle expense	369.90	46.63	1145.98
2. Food and drink expense	626.69	63.21	1553.44
3. Stuff expense	93.44	21.94	539.24
4. Fee	306.66	38.72	951.65
5. Other expenses	97.43	18.86	463.55
Visiting (times/visitor)			
Total time for park visiting	2.52	.23	5.74
1. Huay Laung Waterfall	2.27	.22	5.31
2. Kaeng Kra Lao	1.25	.19	4.75
3. Kaeng Sam Pun Pe	.29	.056	1.38
4. Palan Pa Chat	.24	.034	.84
5. Phu Hin Daang	.08	.014	.35
6. Emerald Tri-angle	.14	.018	.44
7. Kaeng Silatip	.09	.04	.87
8. Narai sculpture	.04	.01	.30
9. Kerng Mae Fong Waterfall	.03	.01	.27
Visitor's activities (times/visitor)			
1. water (swimming)	1.50	.09	2.16
2. picnic	.98	.09	2.19
3. wildlife watching	.38	.05	1.19
4. trail	.58	.04	1.05
5. scenery	1.01	.08	1.86
6. photo shooting	1.33	.12	3.01
7. research	.15	.02	.39
8. bird watching	.20	.02	.59
9. camping	.16	.02	.45
10. seminar	.24	.03	.62
11. sporting	.08	.01	.35
12. conservation	.26	.03	.76
13. historical place visiting	.06	.01	.27
14. astrology learning	.11	.02	.39

Source: by computation

The second section of the questionnaire asks the activities that visitors get involved with during the trip. And their opinions of site activities were asked. The average of times to visit the park is 2.52 times. The sites of interest are Huay Luang waterfall, Kaeng Ka Lao, Kaeng Son Sam Pun Pee, Palan Pa Chat, Phu Hin Daang, Emerald Tri-angle, Kaeng Silatip, Narai Sculpture, and Kerng Mae Fong waterfall. Number of visits to there site are 2.27, 1.25, 0.29, 0.24, 0.08, 0.14, 0.09, 0.04, and 0.03 times, respectively.

Visitors spent their times to explore in many park activities. There are 14 activities as follows: water (swimming), picnic, wildlife watching, nature trailing, scenery, photographing, research working, bird watching, camping, seminar, sporting, conservation learning, historic place visiting, and astrology. Swimming, scenery, and photographing are very popular. Averages of times in these three activities are about 1.50, 1.01, and 1.03 times, respectively (see Table 5.18).

Table 5.19 Visitors' Media Sources for Park Information

(unit: persons)

Valid	Friend	Internet	Paper*	Radio	Others**
Total	453	97	79	186	113
	75%	16.1%	13.1%	30.8%	18.7%

Note: * paper is newspaper, magazine, book.
** others are previous visitors, teacher, television, and parent or relative
Total visitors are 604 persons.
Source: by computation

Visitors knew about the park from the different media. They heard from friend, internet, paper, radio, and others about 75%, 16.1%, 13.1%, 30.8% and 18.7%, respectively (see Table 5.19).

Table 5.20 Visitors' Expenditure at Nearby Substitute Sites (Outside the park)

Tourist Sites	Trip cost (baht)/ visitor
Pa Taem, Khong Jeam	48.74
Chong Mek	35
Kaeng Ta Na	20
Kaeng Lum Duan	18.30
Khao Pra Vihan	15
Sirindhorn Dam	12
Yoi Dom wildlife sanctuary	43

Source: by survey

Also, visitor gave information of nearby sites that they went or had a plan to visit. The results showed that there are places as follows: Pa Taem, Khong Jeam, Chong Mek, Kaeng Ta Na, Kaeng Lum Duan, Khao Pra Vihan, Sirindhorn Dam, and Yoi Dom wildlife sanctuary. These could be the subsititute sites if the Phu Jong Na Yoi national park was absent or closed (see Table 5.20).

5.1.1.2 Descriptive Statistics of Variables

The data used for modeling Travel Cost can be described as follows:

Table 5.21 Descriptive Statistics of Variables

Variables	Mean	Std. Deviation
Number of trip (times/visitor)	2.53	5.73
Total trip cost (baht/visitor)	3,434.60	3,902.02
Total trip cost to substituting site(baht/visitor)	119.97	2048.29
Income per year (baht/year)	46,271.79	139,613.10
Number of day to visit (day/visitor)	1.62	0.83
Gender	0.37	0.48
Level of education	2.41	0.76
Age	21.80	5.97
Local people participation	0.79	0.57
Overall satisfying	3.11	0.95

Note: 1. Gender variable is defined; 1 = female, 0 = male,

2. Level of education is defined; 0 = no education, 1 = elementary school, 2 = high school, 3 = vocational school, 4 = university,

3. local people participation in park management; 1 = ought to, 0 = not ought to,

4. Visitors' satisfaction on tourism facilities, and services as a whole; 1 = unsatisfied, 2 = fair, 3 = good, 4 = very good.

Source: by computation.

Descriptive statistics for the variables used in estimating the on-site demand Travel Cost model are given in Table 5.21. The dependent variable is number of trip (v_trip). Average of number of trip is 2.53 per visitor. Total trip cost is average 3,434.60 baht per visitor or about 1,357.55 baht per visitor per trip. Total trip cost to substituting site is 119.97 baht per visitor or about 47.42 baht per visitor per trip. Income per year is 46,271.79 baht per visitor. Number of days to visit the park is 1.62 days per visitor. Average age of visitor is 21.80 years old. Gender is nominal number as which given 1 = female and 0 = male, local people participation is nominal number as which given 1 = ought to and 0 = not ought to. The last is overall satisfaction of visitor toward park tourism facilities and services as a whole aspect given that 1 = unsatisfied, 2 = fair, 3 = good, 4 = very good. Overall satisfying is 3.11. This means it is above good level, but not yet a very good one.

The total trip cost is assumed that is the full cost of a trip to the park included travel cost, food, fee, and stuff. The total trip cost to nearby substitute sites, is an approximated value by visitors. The trip costs to substitute sites are shown on Table 5.20.

All of the purposed Travel Cost models were analyzed by using SPSS software (see outputs in Appendix D). the result of each of four estimated models are as follows:

Model 1: for eq. (7), $Ln(r) = \beta_r tc_r + \beta_s tc_s + \beta_y y + \beta_d d + e$.

$$Ln(v\_trip) = \beta_1\, t\_cost + \beta_2\, t\_cost\_sub + \beta_3\, inc\_year + \beta_4\, v\_day + \beta_5\, sex + \beta_6\, edu + \beta_7\, reage + \beta_8\, local\_part + \beta_9\, satisfied.$$

Dependent Variable: LN number of trip

Table 5.22 Model 1 Summary

Model 1	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta	Lower Bound	Upper Bound
(Constant)	.430	.189	-	2.274	.023
t_cost	-1.64E-005	.000	-.086	-1.814	.070
t_cost_sub	1.44E-006	.000	.004	.094	.925
inc_year	2.16E-007	.000	.040	.839	.402
v_day	.146	.038	.163	3.805	.000
sex	.031	.064	.020	.488	.626
edu	.000	.047	.000	-.005	.996
reage	.001	.006	.007	.138	.891
local_part	.144	.053	.110	2.716	.007
satisfied	-.107	.032	-.137	-3.359	.001

R Square	0.049
Adjusted R Square	0.035
Durbin-Watson	1.403
F df (9,594)	3.405 (sig. 0.000) at 5% level.

Model 2: for eq. (8), $r = \beta_r tc_r + \beta_s tc_s + \beta_y y + \beta_d d + e$.

$$v\_trip = \beta_1\, t\_cost + \beta_2\, t\_cost\_sub + \beta_3\, inc\_year + \beta_4\, v\_day + \beta_5\, sex + \beta_6\, edu + \beta_7\, reage + \beta_8\, local\_part + \beta_9\, satisfied.$$

Dependent Variable: Number of trips

Table 5.23 Model 2 Summary

Model 2	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta	Lower Bound	Upper Bound
(Constant)	6.152	1.461		4.210	.000
t_cost	-5.83E-005	.000	-.040	-.835	.404
t_cost_sub	4.41E-005	.000	.016	.373	.709
inc_year	9.81E-007	.000	.024	.493	.622
v_day	.394	.296	.058	1.332	.184
sex	.650	.491	.055	1.323	.186
edu	-.498	.361	-.067	-1.380	.168
reage	-.006	.048	-.006	-.125	.901
local_part	.171	.410	.017	.417	.677
satisfied	-1.017	.246	-.169	-4.136	.000

R Square	0.038
Adjusted R Square	0.023
Durbin-Watson	1.626
F df (9,594)	2.605 (sig. 0.006) at 5% level

The regressive results for model (1) and (2) which are conventional Travel Cost without spatial weighted distance decay variable regression are not satisfied because the R-square and F-test including Durbin-Watson indicated that these model are not good enough for representing the relationship of variables in functional form. They still have spatial dependence as Durbin-Watson value indicated.

However, to solve this spatial dependence in the models the study tried to improve the analysis by including spatial weighted distance decay with autoregressive variable. The number of trip, as a independent variable, was incorporated with spatial weighted distance decay into Travel Cost Model. The estimated results are shown as follows (see more results in Appendix D):

Model 3: for Eq. (14), Semi-log spatial autoregressive model (SAR),

$logr = \rho\beta_w wr + \beta_r tc_r + \beta_s tc_s + \beta_y y + \beta_d d + e.$

$Ln(v\_trip) = \rho wv\_trip + \beta_1 t\_cost + \beta_2 t\_cost\_sub + \beta_3 inc\_year + \beta_4 v\_day +$
$\beta_5 sex + \beta_6 edu + \beta_7 age + \beta_9 local\_part + \beta_{10} satisfied$

Dependent Variable: LN number of trips

Table 5.24 Model 3 Summary

Model 3	Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t Lower Bound	Sig. Upper Bound
(Constant)	-.167	.125		-1.333	.183
wv_trip	1.070	.038	.754	28.263	.000
t_cost	-8.65E-006	.000	-.045	-1.462	.144
t_cost_sub	-3.53E-006	.000	-.010	-.354	.724
inc_year	1.40E-007	.000	.026	.829	.407
v_day	.109	.025	.122	4.328	.000
sex	-.036	.042	-.023	-.864	.388
edu	.050	.031	.051	1.641	.101
reage	.001	.004	.011	.336	.737
local_part	.125	.035	.096	3.616	.000
satisfied	-.008	.021	-.011	-.398	.691

R Square	0.595
Adjusted R Square	0.588
Durbin-Watson	1.581
F df (10,593)	87.061 (sig. 0.000) at 5% level.

Model 4: For Eq.(15), Linear spatial autoregressive model

$r = \rho\beta_w wr + \beta_r tc_r + \beta_s tc_s + \beta_y y + \beta_d d + e.$

$v\_trip = \rho wv\_trip + \beta_1 t\_cost + \beta_2 t\_cost\_sub + \beta_3 inc\_year + \beta_4 v\_day +$

$\beta_5 sex + \beta_6 edu + \beta_7 age + \beta_9 local\_part + \beta_{10} satisfied$

Dependent Variable: Number of trips

Table 5.25 Model 4 Summary

Model 4	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta	Lower Bound	Upper Bound
(Constant)	.065	.051		1.268	.205
wv_trip	10.902	.015	1.000	706.740	.000
t_cost	2.07E-005	.000	.014	8.595	.000
t_cost_sub	-6.59E-006	.000	-.002	-1.617	.106
inc_year	2.00E-007	.000	.005	2.918	.004
v_day	.014	.010	.002	1.369	.171
sex	-.033	.017	-.003	-1.922	.055
edu	.016	.012	.002	1.268	.205
reage	-.001	.002	-.001	-.497	.619
local_part	-.020	.014	-.002	-1.413	.158
satisfied	-.013	.009	-.002	-1.507	.132

R Square	0.999
Adjusted R Square	0.999
Durbin-Watson	1.346
F df (10,593)	51921.543 (sig. 0.000) at 5% level.

Table 5.26 Comparison of Estimated Results

Variables	Model 1 Semi-log w/o weight	Model 2 Linear w/o weight	Model 3 Semi-log w/SAR	Model 4 Linear w/SAR
(Dependent variable)	LN num of trips	Num of trips	LN num of trips	Num of trips
(Constant)	.430*** *(2.274)*	6.152*** *(4.210)*	-.167* *(-1.333)*	.065 *(.1268)*
Weighted visiting trips	-	-	.754*** *(28.263)*	1.00*** *(706.740)*
Total trip cost	-.086** *(-1.814)*	-.040 *(-.835)*	-.045* *(-1.462)*	.014*** *(8.595)*
Total trip cost to substitute site	.004 *(.094)*	.016 *(.373)*	-.010 *(-.354)*	*-.002** *(-1.617)*
Income per year	.040 *(.839)*	.024 *(.493)*	.026 *(.829)*	.005*** *(2.918)*
Number of days to visit	.163*** *(3.805)*	.058* *(1.332)*	.122*** *(4.328)*	.002* *(1.369)*
Gender	.020 *(.488)*	.055* *(1.323)*	-.023 *(-.864)*	-.003** *(-1.922)*
Level of education	.000 *(-.005)*	-.067* *(-1.380)*	.051* *(1.641)*	.002 *(1.268)*
Real age	.007 *(.138)*	-.006 *(-.125)*	.011 *(.336)*	-.001 (-.497)
Local participation	.110*** *(2.716)*	.017 *(.417)*	.096*** *(3.616)*	-.002* *-1.413*
Overall satisfied	-.137*** *(-3.359)*	-.169*** *(-4.136)*	-.011 *(-.398)*	-.002* *-1.507*
R-square	**.049**	**.038**	**.595**	**.999**
R-square Adjusted	**.035**	**.023**	**.588**	**.999**
D.W.	**1.403**	**1.626**	**1.781**	**1.346**
F value (sig at 5% level)	**3.405** ***(.051)*** *df. (9,594)*	**2.605** ***(.006)*** *df. (9,594)*	**87.061** ***(.000)*** *df. (10,593)*	**51921.543** ***(.000)*** *df. (10,593)*

Note: ***, **, * indicate coefficients are significantly different from zero at 1%, 5% and 10% levels, respectively.

With respect to the coefficient estimates, the price or travel cost coefficient estimate for each of the model (1), (2), and (3), was consistent with demand theory, in that the quantity of visitors (number of trips) was inversely related to price or travel cost. The coefficient estimate associated with the travel cost variable in models (1), (3), and (4) are significantly different from zero at a 1%, 10%, and 1% levels, respectively.

The prices of alternative sites are included in the model in order to capture the potential for site substitution. The coefficient of the total cost of substitute site variable in the model (4) was significantly different from zero at 1% level.

In models (2) and (4), the coefficients of the visitors' income variable are significantly different from zero at 1% and 5% levels and the sign was positive. The coefficient estimate associated with number of days to visit variable for each of the four model specification was consistent with theory with expected positive signs. The coefficient estimate was significantly different from zero at 1%, 10%, 1%, and 10% levels for each of the model specification, respectively.

For the gender variable, only the coefficients of the models (2), (4) are significantly different from zero at 1%, 10% level. Considering visitor's level of education in the model (3) and (4), the coefficient estimate was significantly different from zero at 10% level.

The coefficient estimate of real age variable shows no statistical significance for each of the four model specification when we used level of significance at 10% or less than 10% level. Since the park did not make a restriction on activities, activities have been selected by park official on the basis of safety for all ages. Visitors could enjoy there activities, if they wanted, so age has no relation to the number of visits..

The coefficient estimate of visitor's opinion on local people participation in the park tourism and forest protection is positive and significantly different from zero at 1%, 1%, and 10% level in the model (1), (3), and (4), respectively. Meaning a sense of local participation is positively related to the number of visits. Local community is important for the park sustain tourism development and forest protection. It cooperatively provided many resources needed, for example human resources, i.e. staffs and casual employees.

Visitor's overall satisfaction on the park facilities and services could be indirectly explained the quality of the visiting site. The coefficient estimate of visitor's opinion on quality of facilities used and services was significantly different from zero at 1%, 1%, and 10% level in the Model (1), (2), and (4), respectively.

The computed D.W. d statistics for Model 1 to Model 4 in Table 5.26 are 1.403, 1.626, 1.781, and 1.346, respectively. The null hypothesis test indicated that Model (1), (2), and (4) are significantly evidence of positive autocorrelation because of d-computed are lower than 1.675 which is the lower bound d_L of D.W. significance points at 0.05 level of significance for n=200, k=9 (Gujarati, 1995). This means that the null hypothesis test was not passed and the models have evidence of positive autocorrelation. The models get involved with correlation in error terms leading to inconsistency for model estimation. However, in model 3, the null hypothesis test for significant evidence of positive autocorrelation can not make decision. Because the d-computed is 1.781, by rule, there is no decision on the null hypothesis.

However, we have seen that other statistic values of Model (3); R-square, F-value, are improved. Both R-square and F-value showed that the Model (3) is more robust than other models. With the 0.59 of R-square, at 5% level of significance or 95% of confidence interval, about 59% the coefficient estimate of explanatory variables can used to explain the dependent variable. When F-value equals 87, at 5% level of significance, the test of overall significance of the estimated regression indicated that we can reject the joint hypothesis test for all of coefficients. We accepted that all coefficients will not equal to zero.

With the specific type model of Travel Cost, the study tried to improve the prediction efficiency of the model purposed. Therefore, introducing model with spatial autoregressive could be useful. The results show that, with higher R-square and F-statistic values, the Model (3) give us more validity and should be more accurately prediction, when the model is used.

The results of spatial autoregressive model with an appropriate semi-log functional form have been proved by this study that the estimated conventional Travel Cost Model could be improved its predictability performance. This study utilized these models for estimating economic value of the park

5.1.2 Estimation of Economic Value of Tourism in the Park

Consumer surplus can be measured by using Eq. (10), (11) as follows: For Eq. (10), $cs_n\ (semilog) = \frac{r_n}{(-\beta_r)}$, and Eq. (11), $cs_n\ (linear) = \frac{r_n^2}{(-2\beta_r)}$, where r_n is number of trip for visitor n and β_r is coefficient of total trip cost). Therefore, for 604 visitors, total consumer surplus is equal to the sum of each individual visitor's consumer surplus. The consumer surplus for each model can be shown as follows:

Table 5.27 Consumer Surplus for Model Estimations

Model	Coefficient estimate of Total trip cost (β_r)	Total Consumer Surplus for 604 persons (baht/season)	Average Consumer Surplus (baht/person/trip)	Total Economic Value (baht /year)
Model 1	-0.086	17790.70	29.45	989,490.55
Model 2	-0.040	296,225	490.42	16,477,621.58
Model 3	-0.045	34,000	56.29	1,891,287.71
Model 4	0.014	-846,357	-1401.25	-47,080,598.75

Note: * total economic values equal total number of visitors per year multiply with average consumer surplus (by using 33,599 visitors in 2006, see Table E1 in Appendix E).

Source: by computation

Table 5.27 showed that, with the different functional forms, the consumer surplus could be different. Model (3) with spatial autoregressive regression should be a good model for the park tourism economic evaluation.

5.2 Discussion

This paper explores two particular regression models, each containing the same sets of variables in vector regressors but with the inclusion of the spatial dependence term as a weight for the second model. Total trip cost, tc_r, is the price of a trip to the park for visitor. Trip prices were calculated as the sum of the travel costs and travel time. Distance are calculate as round trip distance from the visiting center of the park to the latitude and longitude coordinates of the province official center that visitors left off for the trip. The mileage rate is 4.00 baht per kilometer, which is consistent with government estimates of the cost of operating government vehicle.

For the assumption of this study analysis, besides assumption on cost of operating the vehicle, there is also assumption in travel time which is opportunity cost, a local wage rate 150 baht per day was used. Therefore, including time cost, the computed total cost of trip could be greater than the actual travel cost.

Given that this study is focused on recreation at only one site, the single travel cost model is used to estimate the recreational demand function. Although the single site model does not completely capture the potential for site substitution, prices or total cost of alternative sites are included in the model in order to capture these effects. These estimates, however, may be expected to overestimate economic value, depending on the size of substitution effects. However, with the selected Model (3) in this study, the effect of the substitution site may be very small since the test statistic of the coefficient estimate of the total cost of substitute site was not significant.

Results from the travel cost demand function estimate begin in Table 5.22 through Table 5.25. The natural log of number of trip (lnv_trip) is used as the dependent variable in the regression Model (1) and (3). The dependent variable of Model (2) and (4) are number of trip. All of models were as defined in Eq.(1),(2),(3), and (4). The results showed the estimated Model (3) has the best goodness of fit test statistic, compared with all other estimated models. This is because using the semi-log functional form minimizes the problem of heteroskedasticity, as well as eliminating the potential problem of negative trip prediction, which can occur using a linear functional form,(as discussed in Loomis and Cooper (1990), cited in Poor and Smith, (2004)).

For spatial dependence, the Model (3) and (4) are spatial autoregressive regression (SAR) for semi-log linear in Eq. (14) and linear in Eq. (15). Although, the null hypothesis testing of D.W. for d-computed was not passed in the Model (4), d-computed is 1.346 which is less than d_L (=1.675) and the test is inconclusive in the Model (3). With its good looking model, being better than the previous models because of its higher R-square and F-value properties, the Model (3) could be used to represent the relationship between the dependent variable and the independent variables

In the Model (3), price elasticity estimates are shown to provide additional information on the relationship between the price of a trip and the number of trips taken. Price elasticity describes the percentage change in the quantity of trips that is likely to occur if price changes by 1%. For example, the price elasticity of a trip to the park is -0.045. This means that a 1% increase in price or total trip cost, would reduce trip by 0.045 %. Therefore, with this apparent inelasticity of demand, an entrance fee policy should result in a small change in number of visitor's trip.

The demand for tourism in the park was also significantly determined by number of days to visit the park and level of education. Increasing these values could increase the number of visitors' trip. Interestingly, with highly statistical significance, local people participation determined the number of visitor's trip. Visitor's opinion is that local people ought to be a part of the park operation and management both protection and tourism. Income, total cost of substitute site, and overall satisfaction are all positive relation to the number of visitor's trip, but all of them are not statistical significant.

Comparing the estimated consumer surplus (see in Table 5.27), the value of consumer surplus for each model is vary when we use the different functional forms. Improvement of the model from spatial dependence could help calculate consumer surplus more accurately. Model (3) with spatial autoregressive regression should be a good model for the park tourism economic evaluation.

From the Model (3), the calculated consumer surplus for the park is 56.29 baht per visitor per trip. Based on 33,599 visitors in 2006 (see Appendix E), the net economic value of the park tourism is about 1,891,287.71 baht per year. These estimates can provide helpful information to policy makers, park managers, and other interested individuals. The value estimates are considered to be in addition to any direct expenditure users undertake during their visits. They are the benefit excess of the expenditures for transportation and other goods and services, and they are often called "non-market" benefit. These values accrue to park users, who may be local residents, or visitors from distant location. The expenditures for transportation and other goods and services accure to the local economy, except for park fees were collected and send to central government.

Annually the park received budget around 1.2 million baht for its operation and management, referring to Phu Jong Na Yoi financial record (by interview, May 2007). About 500,000 baht of total budget was used for park maintenance. Assuming that this cost of maintenance is for the park tourism facilities and services improvement. The estimated net economic value of the park tourism from this study shows that the park tourism still have an economic gain.

To consider the rest of the models, the use of Travel Cost Model should have more investigation in many aspects. For instances, about choosing the weight function, although, the research study has tried to purpose the alternative way to apply the spatial weighted regression, there are many types of spatial weight functions or matrices that had been created and used by many researchers. Also, there has no specific type of weight function as claimed by Bao (2001) that researchers can be specified and use the weight metrics for their specific of interest.

Also, there are many variables that were not included in this research study. This is because the research focuses on model specification more than model application that most of canning research to be done. However, this should be taken into consideration for the next research study.

Although, the research had been initially studied to develop the interconnections between spatially separate locations with the linking of distance measures to the remote small recreation site, the research did not take into consideration the importance of spatially separate location, for instance, the change in quality of site attributes such as water quality and other impacts. As argued in von Haefen (1998), cited in Phaneuf and Smith (2004), changing water quality has impacts on recreation. They indicated the importance of spatially separate locations that defining the recreation commodities based on hydrological boundaries (watershed) and linking water quality measures originating in the watershed to trips to that watershed, provides a more consistent link than geographical boundaries such as counties. For this research study, the analysis of such an impact could not be done at this moment because the research needs to have more environmentally targeted data and more supporting resources. By the park, itself, there is still lack of information for the quality impacts. This should be a matter of concerned and should be considered for the future research.

To sum up, the 3 objectives of this study have been accomplished. The results of study provide support for the hypothesis of spatial dependence in the demand for the park tourism. The estimated model with application of the spatial autoregression model in the Travel Cost Model specification allows us to investigate the economic valuation of Phu Jong Na Yoi National Park. However, there are many tasks that left for the next research investigation.

CHAPTER VI

CONCLUSION

Past researchers have acknowledged the relationship between the number of trips and demographic factors, distance, in the study of the demand system for tourism. Spatial dependence in model variables can severe the standard assumption on correlation of error term in classical econometric demand model and lead to prediction problem. The 3 purposes of this study were to study the role of spatial dependence and other factors that affect ecotourism demand in the Phu Jong Na Yoi National Park at Ubon Ratchathani Province, Thailand. Second, it attempts to estimate an ecotourism demand model for the Phu Jong Na Yoi National Park by using of GIS as a tool to support the specification of spatial dependence which a hypothesis that spatial dependence has an influence on the estimated conventional recreation demand for ecotourism in the park. And third, the study measures the economic value of the used natural resources in the park for providing the benefits to visitors.

The influence of spatial effect on outdoor recreation demand studies was the hypothesis for this study. This study used Geographical Information Systems (GIS) provided an efficient method of spatially referencing geographic and economic information. A GIS approach measured travel distance from visitor origin to a recreation site and applied as a distance decay weight to spatial econometric travel cost demand model. The distance decay weight was applied into 2 functional forms of Travel Cost Model: semi-log linear and linear. Using tourism data of the park, the study tried to estimate 4 models in the 2 different functional forms. Model (1) and (2) are conventional Travel Cost Model without assigning spatial weight. Model (3) and (4) were spatial autoregressive Travel Cost Model with assigning spatial weight. Durbin-Watson statistical test for the hypothesis of autocorrelation as spatial dependence was utilized. The results of the hypothesis test for autocorrelation on the estimated models in different functional forms showed that Model (1), (2), (4) have positive autocorrelation with low R-square and F-values. But, in Model (3), by hypothesis testing rule, the study can not make decision on positive or negative autocorrelation though the model has improved its R-square, and F-value.

Using the improved Model (3), the demand for tourism in the park was significantly determined by total trip cost, number of days to visit the park, level of education, and local people participation. The coefficient estimates of these variables can apply to entrance fee policy and local people participation for the park operation and management. Changing these values could change the number of visitors' trip. However, income, total cost of substitute site, and overall satisfaction of facilities and service used not statistical significant.

The coefficient estimate of total trip cost was used to estimate consumer surplus of the park tourism. The estimated consumer surplus of the park tourism is 56.29 baht per visitor per trip. Based on 33,599 visitors in 2006 (see Appendix E), the net economic value of the park tourism is about 1,891,287.71 baht per year. These estimates can provide helpful information to policy makers, park managers, and other interested individuals. Taking to consider on an annual park budget for maintenance, this study confirmed that tourism in this national park still have a positive net economic value. Therefore, any supportive policy should be used for the park ecotourism development. This study also confirmed that, currently, there is an opportunity to gain from the park tourism when allows local people participation to get involve in its operation and management.

Future research should include the incorporation of more quality variables, spatially separate locations with the linking of distance measures. Also, the model should investigate the model specification that may have hindered the model results due to multicollinearity among expanatory variables.

Overall, this study has shown GIS-spatial linked to produce the robust Travel Cost Model. With GIS properties, the distance decay weight can be established more reliable and accurately. As evidenced in this study, an improvement of model predictability could be utilized for an application to improve an economic evaluation of environmental services.

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APPENDICES

APPENDIX A

Table A1. Capabilities of a GIS

Functional Capabilities of a GIS	**GIS basic Questions**		**Tourism Applications**
1. Data entry, storage and manipulation	Location	What is at?	Tourism resource inventories
2. Map production	Condition	Where is it?	Identify most suitable locations for development
3. Database integration and management	Trend	What has changed?	Measure tourism impacts
4. Data queries and searches	Routing	Which is the best route?	Visitor management/flows
5. Spatial analysis	Pattern	What is the pattern?	Analyze relationships associated with resource use
6. Spatial modeling decision support	Modeling	What if?	Assessing potential impacts of tourism development

Source: Bahaire and Elliot-White 1999, p. 159

Table A2. Common tourism-related issues and GIS applications

Problem	**GIS Application**
1. Benchmark/database	1. Systematic inventory of tourism resources
2. Environmental management	2. Facilitating monitoring of specific indicators
3. Conflicts	3. Mapping recreational conflicts: recreation-wildlife; user conflict
4. Tourism behavior	4. Wilderness perceptions
5. Carrying capacity	5. Identify suitable locations for tourism/recreation development
6. Prediction	6. Simulating and modeling spatial outcomes of proposed tourism development
7. Data integration	7. Integrating socio-economic and environmental datasets within a given spatial unit
8.Development control / direction	8. Decision support systems

Source: Adapted from Butler 1993, p33, cited in Bahaire and Ellite-White (1999), p 162 (unknown source)

Examples of Controversial Issues and Debate on Tourism projects in Thailand, (information from the Internet):

THAILAND's CASE reported by Tourism Investigation & Monitoring Team:

"The NGO letter to UNEP tourism programme coordinator, Oliver Hillel, regarding the International Year of Ecotourism 2002 (20/10/2000) cited the example of Thailand to illustrate what can go wrong with ecotourism development. The letter said:

"In Thailand, the upsurge of ecotourism demand has resulted in construction frenzy in rural and natural areas to provide accommodation and infrastructure for visitors. A recently published survey by the Bangkok daily 'The Nation' found that under the pretext of ecotourism promotion, massive development projects - some involving logging operations - were in full steam in national parks countrywide, funded by loans from the World Bank's Social Investment Project and the Japanese Overseas Economic Cooperation Fund (OECF)."

This case has drawn the attention of the World Bank, and Christopher Chamberlin, a Bank official based in Bangkok, forwarded his comments on the matter. In order to create a better understanding and a more solid base for further discussions on this Thailand case, the Tourism Investigation & Monitoring Team (tim-team) sent the following letter to the Bank to provide additional information and to seek clarification regarding World Bank and OECF-funded tourism projects in Thailand.

RE WORLD BANK/OECF SIP FUNDS FOR TOURISM PROJECTS IN THAILAND

Communication from World Bank official Christopher Chamberlin (dated: 25 October 2000):

"The main point to make is that this Tourism Authority of Thailand component of SIP is completely OECF/JBIC financed and supervised. We, the Bank, have no oversight whatsoever over JBIC co-financed activities under SIP. What we can do, however, is bring this to the attention of those responsible for oversight of the TAT component, namely JBIC, TAT, and the Ministry of Finance PCU. In one of the attached newspaper articles, there is one mention of logging in connection with TAT improvements of infrastructure in a national park, namely to produce construction materials for the civil works being built in the parks. According to the JBIC project documents we consulted at appraisal, these were all small scale service amenities in the parks, not "major construction".

This should be followed up by the Ministry of Finance, JBIC and TAT, and we can do our best to urge the parties to look into this. The relevant section of the article is attached below. Underlying these important allegations is a debate on the role of eco-tourism in Thailand, a most important decision for the future of Thailand's natural resources. Many would argue that foreign tourists visiting national parks are a good lever to induce responsible conservation, but I leave that to the experts."

OUR RESPONSE:

In early 1998, the press reported that the World Bank had agreed to provide about US$300 million loan for a social plan in Thailand, aimed at tackling the problems of unemployment, loss of income and higher costs of social services arising from the financial and economic crisis.

The Tourism Investigation & Monitoring Team (tim-team) received a copy of the 'Aide Memoire' by the Royal Thai Government (RTG) on the Social Investment Project Pre-Appraisal Mission, January 15 - February 12, 1998, which states, "The mission received essential support and guidance from J. Shivakumar, Country Director. The visit to Thailand of the World Bank's president, Mr. James D. Wolfensohn, contributed directly to advancing the project dialogue with the RTG and to broadening the understanding and support for the project in Thai civil society, particularly among NGOs."

Among other things, the report outlined a major set of governmental programs under the SIP, which directly related to tourism and was estimated to cost US$46 million. We understand that the Tourism Authority of Thailand (TAT), which participated in the SIP necgotiations was mandated to manage the proposed tourism activities in cooperation with

- Royal Forestry Department (RFD) - responsible for national parks and forest reserves,
- Fine Art Department within the Ministry of Education - responsible for cultural and historic sites,
- Ministry of Interior and its Department of Local Administration - responsible for recreational and cultural sites.

We further understand that an additional US$20 million were allocated to the Public Works Department for rural road construction to facilitate access to tourism sites, while improving village transport.

Since this 1998 agreement between the RTG and the World Bank, relatively little information trickled through to the public as to how SIP funds were actually used for tourism-related development projects. But in contradiction with Christopher Chamberlin's claim that the tourism component of SIP "is completely OECF/JBIC financed and supervised", reports by investigative journalists and other sources suggest that both the World Bank and the OECF have provided SIP funds for controversial tourism projects.

In September 1998, The Bangkok Post and The Nation reported that the TAT was set to coordinate the implementation of tourism projects worth about US$75 million as part of the Bank-initiated SIP, and this loan would be provided by the OECF. The fact that the Forest Industry Organization (FIO) - a state enterprise - was engaged to supervise OECF-funded ecotourism projects in cooperation with private companies in several protected areas was strongly criticized by academics and NGOs. They argued that the FIO's primary task was to oversee logging operations and had no experiences in forest conservation and community development. A serious conflict, which was also documented in a television programme (iTV), evolved around a FIO project at Wat Chan in Chiang Mai's Mae Chaem district. Villagers there protested for months, saying they were never consulted on this OECF-funded ecotourism project and it would have negative impacts on their culture and the environment. In light of the growing controversy, the Wat Chan project was quietly stopped.

Reports about doubtful tourism projects in national parks - including the building of roads, parking lots, accommodation and other facilities - have surfaced last and this year. On 12 April 2000, The Bangkok Post published a major story entitled "The business of parks", which questioned the RFD's development plan in relation to its "Visit National Parks Year 2000" promotion, noting that the drawn-up regulations for the scheme were "still unavailable for public scrutiny". It included an interview with RFD chief Plodprasop Suraswadi, who said, "Last year, we got a budget of 700 million baht from SIP. This year, it's likely that we get a loan of more than 10,000 million from the OECF, and we'll be able to do a lot of improvements with this money." Meanwhile, civic voices expressed skepticism about RFD's tourism-related activities. For example, former law lecturer and now senator Kaewsun Atibodhi was quoted as saying, "This plan will involve lots of investment and construction, which seems to go against the original purpose of national parks, which are supposed to be preserved for public relaxation and education."

Also in April, a group of 100 angry villagers in Surat Thani province seized a bulldozer owned by the RFD and trunks of trees felled by RFD officials in Khao Sok National Park (The Nation 12 April 2000). The protesters charged that national park staff had already felled 169 large trees with diameters of between 100cm and 200cm in relation to constructing a 1,000 sqm parking lot, a 800m-long road, 10 toilets and concrete stairs leading to a pier in the park. This news item did not say what agency financed this destruction. A few days later, however, Uamdao Noikorn of the Bangkok Post reported in an article

"Plodprasop defends tourist plan" (19 April 2000) that the "so-called renovation project is part of the [forestry] department's loan from World Bank's Social Investment Fund to develop facilities in 11 national parks to promote tourism and increase capacity in line with demand."

A front page story in the Sunday Nation of 14.5.2000 (title: "National parks threatened by tourist tide: Construction damaging ecology") confirmed the Bank's involvement. It said, "The fine line dividing the conservation and tourism uses of national parks was blurred again when the Tourism Authority of Thailand dumped Bt600 million of loans it received from the World Bank's Social Investment Project on the Royal Forestry Department to build additional tourist facilities in 19 protected areas." It further stated, "The Social Investment Project loan conditions call for all projects to be completed by the end of the year [2000]." That indicates that the construction was done in a hurry to meet the Bank's conditions, but apparently without much thought for the nature reserves' carrying capacity and biodiversity conservation.

The Nation article alerted the public that, "Major construction projects - some involving logging operations - are being undertaken at full steam in national parks countrywide under the pretence of ecotourism."

"Among the 19 parks (which were listed in an extra table, including the new facilities coming up) are highly popular ones already overwhelmed by visitors during the high season. Accommodations are being put up, concrete roads laid, parking lots paved, nature trails carved out and camping grounds installed," the article went on to say. "At Khao Sok in Surat Thani province, Khao Yai in Nakhon Ratchasima province and Kaeng Kracharn in Phetchaburi province, trees have been felled for use as construction materials. On top of a small hill in Kaeng Kracharn alone, as many as six new bungalows are springing up. New souvenir shops and large car parks are spoiling the abundant nature of Doi Suthep-Pui and Doi Inthanon in Chiang Mai. Construction also includes security units, toilet grounds and camping grounds."

In accordance with these press reports are case studies that have been forwarded to tim-team by national park staff and other sources (who do not want to be named). There have been complaints that too many - and often unnecessary and lavish - service amenities are being established in the parks. Creating luxurious bungalows for high government officials and rich tourists only or extravagant multi-purpose buildings, equipped with audio-visual rooms and noise-polluting sound systems, inside significant wildlife habitats are a step back into the past in terms of nature conservation, the critics said.

One source informed us that with funding from the OECF SIP, Khao Yai park staff had actually "put forward a comprehensive management plan that seemed to follow the concept of eco-tourism reasonably well." However, "due to pressure from above, many of these worthwhile plans have been put on the shelf. Instead, the new priorities are on servicing the VIP visitor and increasing the amount of accommodation within the central area of the Park! Associated increases in costs will deter the poorer members of Thai society from visiting Khao Yai." The informant also pointed out that local communities around Khao Yai park were unlikely to benefit from the new tourism plan, saying, "though there is considerable talk of working with communities on 'eco-tourism' activities", but unconscionably, "there is no finance to back up such projects..."

"The current approach to tourism in national parks would more accurately be described as 'Mass Nature Tourism'," concluded the source reporting from Khao Yai. "The focus is on numbers - the more the better! No attention is being paid to how these ever increasing numbers of tourists will damage Thailand's precious natural areas."

On a merry note, we are also wondering whether the World Bank believes it is a good idea if their loans are spent for the promotion of what has been called "military tourism". Here is what The Nation said in an article headlined "Fearless Fun" (20 July 2000): "...adrenaline pumping adventures are available at the Twenty-first Infantry Regiment Queen's Guard Compound, Nawanintrajinee Army Camp in Chon Buri Province, which recently received Bt136,300 from Miyasawa and World Bank loan to develop the place for tourism..." This project is part of a major scheme, initiated in 1997 by then Commander of Chief of the Army, Gen Chettha Thanajaro, aimed to develop a number of military camps as tourist attractions and offer activities such as firing weapons and jungle adventure tours. Pistol-shooting, tower jumps and zip-line flying are the tourists' favourites at the Bank-funded Nawamintrajinee military camp, according to The Nation article. Does the World Bank support such "Rambo" tourism activities by co-financing pistol ranges and the like?

Mr. Chamberlin's proposal to bring the matter to the attention of agencies in charge of the TAT component of the SIP (OECF/JBIC, TAT, Ministry of Finance) is very laudable. But it also seems highly necessary that the Bank examines its own role in the affair! In light of all the information above, it will be difficult for the Bank to deny any involvement in the tourism-related projects in question by shifting responsibility to OECF/JBIC alone. If the press reports included incorrect or misleading information about the Bank's role in the controversial projects under SIP, why did Bank officials based in Bangkok not make any effort to rectify the allegations when they were brought to public? Do Bank people not follow the local media and major environmental debates in the countries in which they operate and so are not aware of what is happening on the ground?

In any case, it is really hard to believe that the powerful Bank, which plays such a prominent role in influencing economic and developmental policies in many countries of the world and did initiate the SIP in Thailand, has "no oversight whatsoever" of the tourism component under SIP, as Mr. Chamberlin suggests.

Regarding the charges of logging operations in connection with tourism development projects in parks, Mr. Chamberlin said, "According to the JBIC project documents we consulted at appraisal, these [projects, where logging occurred to produce construction materials] were small scale service amenities in the parks, not 'major construction'." Mr. Chamberlin may not be properly informed about Thailand's environmental legislation. Whether there has been minor or major construction in the parks is not the point here. In fact, any felling of trees or landscape alteration in parks constitutes a violation of the national park law and can be prosecuted. It is even illegal to remove a pebble, and poor villagers get arrested if they collect mushrooms in the forest and mussels and corals in marine parks. So if the Bank endorses RFD's logging in parks for the building of tourist facilities - even small-scale ones-, that would mean it endorses state-sanctioned breaking of national park law.

In any case, to focus on "small-scale" logging in this way means to sidestep the issue, which is the big financial institutions' aiding and abetting with the technically illegal and environmentally destructive large-scale construction of tourism infrastructure in national parks.

Therefore, we request that the concerned World Bank officials carefully study the issues in question and let us know how they plan to proceed. Unfortunately, the tourism-related projects under SIP are almost completed and much of the damage done cannot be reversed. But at least, the responsible authorities and the public should learn lessons from this case for the future, also with respect to the US$150 million program recently launched in Thailand by the World Bank in cooperation with the Global Environment Facility and Conservation International. We will surely watch this large scheme that proclaims to preserve "biological hotspots" in Thailand, while creating "alternative" income opportunities for local residents, which may involve ecotourism development".

APPENDIX B

This part is from Lesage's Spatial Econometrics. It provides an introduction to traditional spatial econometric regression models which represent relatively straightforward extensions of regression models. However, Maximum likelihood estimation method could be used for current study. A short description is the following way:

1. Spatial dependence

Spatial dependence in a collection of sample data implies that observations at location i depend on other observations at location $j \neq i$. Formally we might state:

$$y_i = f(y_j),\ i = 1,\dots,n \quad j \neq i \tag{1}$$

Note that we allow the dependence to be among several observations, as the index i can take on any value from $i = 1,\dots,n$.

Spatial dependence can rise from theoretical as well as statistical considerations

1.1 A theoretical motivation for spatial dependence.

From a theoretical viewpoint, consumers in a neighborhood may emulate each other leading to spatial dependence. Pollution can create systematic patterns over space, and clusters of consumers who travel to a more distant store to avoid a high crime zone would also generate these patterns.

1.2 A statistical motivation for spatial dependence.

Spatial dependence can rise from unobservable latent variables that are spatially correlated. Consumer expenditures collected at spatial locations such as housing prices. It seems plausible that difficult-to-quantify or unobservable characteristics such as the quality of life may also exhibit spatial dependence.

Estimation consequences of spatial dependence might be the following:

For model of the type: $y_i = f(y_j) + X_i\beta + \varepsilon_i$,,

Least-squares estimates for β are biased and inconsistent, similar to the simultaneity problem,

For model of the type: $y_i = X_i\beta + u_i$, $u_i = f(u_j) + \varepsilon_i$,,

Least-squares estimates for β are inefficient, but consistent, similar to the serial correlation problem.

2. Specifying dependence using weight matrices

There are several ways to quantify the structure of spatial dependence between observations, but a common specification relies on an n x n spatial weight matrix D with elements $D_{ij} > 0$ for observations j=1…n sufficiently close (as measured by some metric) to observation i.

As a theoretical motivation for this type of specification, suppose we observe a vector of utility for 3 individuals. For the sake of concreteness, assume this utility is derived from expenditures on their tourist site in the national park at the different distance on their home zones, similar to expenditures on their homes. Let these be located on a regular lattice in space such that individual 1 is a neighbor to 2, and 2 is a neighbor to both 1 and 3, while individual 3 is a neighbor to 2. The spatial weight matrix based on this spatial configuration takes the form:

The first row in D represents observation #1, so we place a value of 1 in the

$$D = \begin{pmatrix} 0 & 1 & 0 \\ 1 & 0 & 1 \\ 0 & 1 & 0 \end{pmatrix} \qquad (2)$$

second column to reflect that #2 is a neighbor to #1. Similarly, both #1 and #3 are neighbors to observation #2 resulting in 1's in the first and third columns of the second row. In (2) we set $D_{ii} = 0$ for reasons that will become apparent shortly. Another convention is to normalize the spatial weight matrix D to have row-sums of unity, which we denote as W, known as a "row-stochastic matrix". We might express the utility, y as a function of observable characteristics $X\beta$ and unobservable characteristics ε producing a spatial regression relationship:

$$(I_n - \rho W)y = X\beta + \varepsilon$$

$$y = \rho W y + X\beta + \varepsilon$$

$$y = (I_n - \rho W)^{-1} X\beta + (I_n - \rho W)^{-1}\varepsilon \qquad (3)$$

Where the implied data generating process for the traditional spatial autoregressive (SAR) model is shown in the last expression in (3). The second

expression for the SAR model make it clear why $W_{ii} = 0$, as this precludes an observation y_i from directly predicting itself. It also motivates the use of row-stochastic W, which makes each observation y_i a function of the "spatial lag" Wy, an explanatory variable representing an average of spatially neighboring values, e.g.,
$y_2 = \rho\,(1/2y_2+1/2y_3)$.

Assigning a spatial correlation parameter value of $\rho = 0.5$, $(I_3 - \rho W)^{-1}$ is as in (4). This model reflects a data generating process where $S^{-1}X\beta$ indicates that individual (or observation) #1 derives utility that reflects a linear combination of the observed characteristics of their own house as well as characteristics of both other homes in the neighborhood. The weight placed on own-house as well as characteristics is slightly less than twice that of the neighbor's house (observation/individual #2) and around 7 times that of the non-neighbor (observation/individual #3). An identical linear combination exists for individual #3 who also has a single neighbor.

For individual #2 with two neighbors we see a slightly different weighting pattern to the linear combination of own and neighboring house characteristics in generation of utility. Here, both neighbors' characteristics are weighted equally, accounting for around one-fourth the weight associated with the own-house characteristics.
Spatial models take this approach to describing variation in spatial data observations.

$$S^{-1} = (I_n - \rho W)^{-1} = \begin{pmatrix} 1.1667 & 0.6667 & 0.1667 \\ 0.3333 & 1.3333 & 0.3333 \\ 0.1667 & 0.6667 & 1.1667 \end{pmatrix} \qquad (4)$$

Note that unobservable characteristics of houses in the neighborhood (which we have represented by ε) would be accorded the same weights as the observable characteristics by the data generating process.

Other points to note are that:

1. Increasing the magnitude of the spatial dependence parameter ρ would lead to an increase in the magnitude of the weights as well as a decrease in the decay as we move to neighbors and more distance non-neighbors (see the inverse expression (6)).

2. The addition of another observation/individual not in the neighborhood, represented by another row and column in the neighborhood, represented by another row and column in the weight matrix with zones in all positions will have no effect on the linear combinations.
3. All connectivity relationships come into play through the matrix inversion process. By this we mean that house #3 which is a neighbor to #2 influences the utility of #1 because there is a connection between #3 and #2 which is a neighbor of #1.
4. We need not treat all neighboring (contiguity) relationships in an equal fashion. We could weight neighbors by distance, length of adjoining property boundaries, or any number of other schemes that have been advocated in the other literatures on spatial regression relationships. In these cases, we might temper the comment above to reflect the fact that some connectivity relations may have very small weights, effectively eliminating them from having an influence during the data generating process.

Regarding points 1) and 4), the matrix inverse for the case of $\rho = 0.3$ is:

$$S^{I} = \begin{pmatrix} 1.0495 & 0.3297 & 0.0495 \\ 0.1648 & 1.0989 & 0.1648 \\ 0.0495 & 0.3297 & 1.0495 \end{pmatrix} \quad (5)$$

while that for $\rho = 0.8$ is:

$$S^{I} = \begin{pmatrix} 1.8889 & 2.2222 & 0.8889 \\ 1.1111 & 2.7778 & 1.1111 \\ 0.8889 & 2.2222 & 1.8889 \end{pmatrix} \quad (6)$$

APPENDIX C

Consumer surplus:

1. Semi-log Models: for exponential function $y = e^x$, taking natural log into the function as follows:

$$\ln y = \ln e^x \quad (1)$$

$$= x \ln e \quad (2)$$

By the study models: $r = e^{(f(tc_r, tc_s, y, d))}$ (3)

Take natural log in eq.(3); $\ln r = f(tc_r, tc_s, y, d)$ (4)

or $\ln r = \beta_r tc_r + \beta_s tc_s + \beta_y y + \beta_d d$ (5)

Letting $y = e^{\alpha t}$, the indefinite integral of function is

$$\int e^{\alpha t}\, dt = \frac{e^{\alpha t}}{\alpha} + c \quad (6)$$

for definite integral; $\int_A^B e^{\alpha t}\, dt = \left.\frac{e^{\alpha t}}{\alpha}\right|_A^B$ (7)

$$= \frac{e^{\alpha B}}{\alpha} - \frac{e^{\alpha A}}{\alpha} \quad (8)$$

Considering on consumer surplus equation, $cs_n = \int_{tc_{rn}}^{tc^*_{rn}} f(tc_r, tc_s, y, d)\, d\, tc_r$, letting tc_r is a target variable for a change in consumer surplus at tc_{rn} to tc^*_{rn}. To substitute $\beta_r tc_r$ term from eq.(5) into αt term in eq.(6), (7), and (8), and take integral with respect to tc_r. The consumer surplus values for semi-log models can be solved as follows:

$$\int e^{\beta_r tc_r}\, dtc_r = \frac{e^{\beta_r tc_r}}{\beta_r} + c \quad (9)$$

$$\int_{tc_{rn}}^{tc^*_{rn}} e^{\beta_r tc_r}\, dtc_r = \left.\frac{e^{\beta_r tc_r}}{\beta_r}\right|_{tc_{rn}}^{tc^*_{rn}} \quad (10)$$

$$= \left.\frac{e^{\beta_r tc_r}}{\beta_r}\right|_{tc^*_{rn}} - \left.\frac{e^{\beta_r tc_r}}{\beta_r}\right|_{tc_{rn}} \quad (11)$$

where tc_{rn} is the trip cost to individual n and tc^*_{rn} is the trip cost at which the number of trips taken in the estimated demand function go to zero. For eq.(3) and Eq.(10), the consumer surplus for individual n is

$$= 0 - \left.\frac{e^{\beta_r tc_r}}{\beta_r}\right|_{tc_{rn}} \tag{12}$$

$$= \frac{r_n}{-\beta_r} \tag{13}$$

2. Linear model: $r = f(tc_r, tc_s, y, d)$ (14)

or $r = \beta_r tc_r + \beta_s tc_s + \beta_y y + \beta_d d$ (15)

Similar to semi-log model, we follow the above steps and results are as follows:

$$cs_n = \int_{tc_{rn}}^{tc^*_{rn}} r\,dtc_r = \int_{tc_{rn}}^{tc^*_{rn}} \beta_r tc_r\,dtc_r \tag{16}$$

$$= \left.\frac{\beta_r tc_r^2}{2}\right|_{tc_m}^{tc^*_m} \tag{17}$$

$$= \left.\frac{\beta_r tc_r^2}{2}\right|_{tc^*_m} - \left.\frac{\beta_r tc_m^2}{2}\right|_{tc_m} \tag{18}$$

$$= 0 - \left.\frac{\beta_r tc_{rn}^2}{2}\right|_{tc_{rn}} \tag{20}$$

$\because r = \beta_r tc_r$

$r^2 = (\beta_r tc_r)^2 = \beta_r^2 tc_r^2 \Rightarrow \beta_r tc_r^2 = \dfrac{r^2}{\beta_r}$, substitute into eq.(20);

$$= \frac{r_n^2}{(-2\beta_r)} \tag{21}$$

APPENDIX D

MODEL 1

REGRESSION: Model 1 Semi-log Travel Cost Model without Weighted Distance Decay Variable.

```
/DESCRIPTIVES MEAN STDDEV CORR SIG N
 /MISSING MEANSUB
 /STATISTICS COEFF OUTS CI BCOV R ANOVA CHANGE ZPP
 /CRITERIA=PIN(.05) POUT(.10)
 /NOORIGIN
 /DEPENDENT lnv_trip
 /METHOD=ENTER t_cost t_cost_sub inc_year v_day sex edu reage local_part
 attitude
 /RESIDUALS DURBIN .
```

Regression

[DataSet7] C:\Documents and Settings\Administrator\My Documents\data_tcm1.sav

Descriptive Statistics

	Mean	Std. Deviation	N
LN number of trip	.4317	.74650	604
Total trip cost	3434.5990	3902.02411	604
Total trip cost to substituting site	119.9669	2048.28893	604
Income per year	46271.7914	139613.09928	604
Number of day to visit	1.62	.837	604
Gender	.37	.484	604
Level of education	2.41	.766	604
real age	21.8046	5.97340	604
Local_participate	.79	.571	604
Overall satisfying	3.11	.954	604

Coefficients(a)

Model 4	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B		Collinearity Statistics	
	B	Std. Error	Beta	Lower Bound	Upper Bound	Zero-order	Partial	B	Std. Error
(Constant)	.065	.051		1.268	.205	-.036	.165		
Total trip cost	2.07E-005	.000	.014	8.595	.000	.000	.000	.715	1.398
Total trip cost to substituting site	-6.59E-006	.000	-.002	-1.617	.106	.000	.000	.908	1.102
Income per year	2.00E-007	.000	.005	2.918	.004	.000	.000	.690	1.450
Number of day to visit	.014	.010	.002	1.369	.171	-.006	.034	.865	1.156
Gender	-.033	.017	-.003	-1.922	.055	-.066	.001	.937	1.067
Level of education	.016	.012	.002	1.268	.205	-.009	.040	.695	1.440
real age	-.001	.002	-.001	-.497	.619	-.004	.002	.644	1.552
Local_participate	-.020	.014	-.002	-1.413	.158	-.048	.008	.970	1.031
Overall satisfying	-.013	.009	-.002	-1.507	.132	-.030	.004	.941	1.062
Weighted visiting trip	10.902	.015	1.000	706.740	.000	10.872	10.932	.961	1.041

a Dependent Variable: Number of trip

Residuals Statistics(a)

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	.54	99.59	2.53	5.730	604
Residual	-.523	1.048	.000	.194	604
Std. Predicted Value	-.348	16.937	.000	1.000	604
Std. Residual	-2.681	5.364	.000	.992	604

a Dependent Variable: Number of trip

87

Model Summary(b)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
4	.999(a)	.999	.999	.195	.999	51921.543	10	593	.000	1.346

a Predictors: (Constant), Weighted visiting trip, Local_participate, Income per year, Total trip cost to substituting site, Number of day to visit, Overall satisfying, Gender, Level of education, Total trip cost, real age
b Dependent Variable: Number of trip

ANOVA(b)

Model		Sum of Squares	df	Mean Square	F	Sig.
4	Regression	19799.724	10	1979.972	51921.543	.000(a)
	Residual	22.613	593	.038		
	Total	19822.338	603			

a Predictors: (Constant), Weighted visiting trip, Local_participate, Income per year, Total trip cost to substituting site, Number of day to visit, Overall satisfying, Gender, Level of education, Total trip cost, real age
b Dependent Variable: Number of trip

88

MODEL 4

REGRESSION: : Model 4 Linear Travel Cost Model with Weighted Distance Decay Variable

```
/DESCRIPTIVES MEAN STDDEV CORR SIG N
/MISSING MEANSUB
/STATISTICS COEFF OUTS CI BCOV R ANOVA CHANGE ZPP
/CRITERIA=PIN(.05) POUT(.10)
/NOORIGIN
/DEPENDENT v_trip
/METHOD=ENTER t_cost t_cost_sub inc_year v_day sex edu reage local_part
 attitude wv1_trip
/RESIDUALS DURBIN .
```

Regression

[DataSet7] C:\Documents and Settings\Administrator\My Documents\data_tcm1.sav

Descriptive Statistics

	Mean	Std. Deviation	N
Number of trip	2.53	5.733	604
Total trip cost	3434.5990	3902.02411	604
Total trip cost to substituting site	119.9669	2048.28893	604
Income per year	46271.7914	139613.09928	604
Number of day to visit	1.62	.837	604
Gender	.37	.484	604
Level of education	2.41	.766	604
real age	21.8046	5.97340	604
Local_participate	.79	.571	604
Overall satisfying	3.11	.954	604
Weighted visiting trip	.2214	.52592	604

89

Coefficients(a)

Model 3	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B		Collinearity Statistics	
	B	Std. Error	Beta	Lower Bound	Upper Bound	Zero-order	Partial	B	Std. Error
(Constant)	-.167	.125		-1.333	.183	-.413	.079		
Total trip cost	-8.65E-006	.000	-.045	-1.462	.144	.000	.000	.715	1.398
Total trip cost to substituting site	-3.53E-006	.000	-.010	-.354	.724	.000	.000	.908	1.102
Income per year	1.40E-007	.000	.026	.829	.407	.000	.000	.690	1.450
Number of day to visit	.109	.025	.122	4.328	.000	.059	.158	.865	1.156
Gender	-.036	.042	-.023	-.864	.388	-.118	.046	.937	1.067
Level of education	.050	.031	.051	1.641	.101	-.010	.110	.695	1.440
real age	.001	.004	.011	.336	.737	-.007	.009	.644	1.552
Local_participate	.125	.035	.096	3.616	.000	.057	.194	.970	1.031
Overall satisfying	-.008	.021	-.011	-.398	.691	-.050	.033	.941	1.062
Weighted visiting trip	1.070	.038	.754	28.263	.000	.995	1.144	.961	1.041

a Dependent Variable: LN number of trip

Residuals Statistics(a)

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	-.0259	9.7974	.4317	.57575	604
Residual	-5.19223	1.32808	.00000	.47517	604
Std. Predicted Value	-.795	16.267	.000	1.000	604
Std. Residual	-10.836	2.772	.000	.992	604

a Dependent Variable: LN number of trip

Model Summary(b)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
3	.771(a)	.595	.588	.47916	.595	87.061	10	593	.000	1.781

a Predictors: (Constant), Weighted visiting trip, Local_participate, Income per year, Total trip cost to substituting site, Number of day to visit, Overall satisfying, Gender, Level of education, Total trip cost, real age
b Dependent Variable: LN number of trip

ANOVA(b)

Model		Sum of Squares	df	Mean Square	F	Sig.
3	Regression	199.885	10	19.988	87.061	.000(a)
	Residual	136.148	593	.230		
	Total	336.033	603			

a Predictors: (Constant), Weighted visiting trip, Local_participate, Income per year, Total trip cost to substituting site, Number of day to visit, Overall satisfying, Gender, Level of education, Total trip cost, real age
b Dependent Variable: LN number of trip

MODEL 3

REGRESSION: Model 3 Semi-log Travel Cost Model with Weighted Distance Decay Variable
/DESCRIPTIVES MEAN STDDEV CORR SIG N
/MISSING MEANSUB
/STATISTICS COEFF OUTS CI BCOV R ANOVA CHANGE ZPP
/CRITERIA=PIN(.05) POUT(.10)
/NOORIGIN
/DEPENDENT lnv_trip
/METHOD=ENTER t_cost t_cost_sub inc_year v_day sex edu reage local_part
attitude wv1_trip
/RESIDUALS DURBIN .

Regression

[DataSet7] C:\Documents and Settings\Administrator\My Documents\data_tcm1.sav

Descriptive Statistics

	Mean	Std. Deviation	N
LN number of trip	.4317	.74650	604
Total trip cost	3434.5990	3902.02411	604
Total trip cost to substituting site	119.9669	2048.28893	604
Income per year	46271.7914	139613.09928	604
Number of day to visit	1.62	.837	604
Gender	.37	.484	604
Level of education	2.41	.766	604
real age	21.8046	5.97340	604
Local_participate	.79	.571	604
Overall satisfying	3.11	.954	604
Weighted visiting trip	.2214	.52592	604

92

Coefficients(a)

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B		Collinearity Statistics	
2	B	Std. Error	Beta	Lower Bound	Upper Bound	Zero-order	Partial	B	Std. Error
(Constant)	6.152	1.461		4.210	.000	3.282	9.022		
Total trip cost	-5.83E-005	.000	-.040	-.835	.404	.000	.000	.717	1.395
Total trip cost to substituting site	4.41E-005	.000	.016	.373	.709	.000	.000	.908	1.101
Income per year	9.81E-007	.000	.024	.493	.622	.000	.000	.690	1.450
Number of day to visit	.394	.296	.058	1.332	.184	-.187	.976	.867	1.153
Gender	.650	.491	.055	1.323	.186	-.315	1.615	.940	1.064
Level of education	-.498	.361	-.067	-1.380	.168	-1.207	.211	.697	1.435
real age	-.006	.048	-.006	-.125	.901	-.101	.088	.644	1.552
Local_participate	.171	.410	.017	.417	.677	-.634	.976	.970	1.031
Overall satisfying	-1.017	.246	-.169	-4.136	.000	-1.499	-.534	.968	1.033

a Dependent Variable: Number of trip

Residuals Statistics(a)

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	-.25	6.45	2.53	1.117	604
Residual	-5.450	93.935	.000	5.624	604
Std. Predicted Value	-2.492	3.507	.000	1.000	604
Std. Residual	-.962	16.579	.000	.993	604

a Dependent Variable: Number of trip

93

Model Summary(b)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
2	.195(a)	.038	.023	5.666	.038	2.605	9	594	.006	1.626

a Predictors: (Constant), Overall satisfying, Total trip cost to substituting site, real age, Number of day to visit, Local_participate, Gender, Level of education, Total trip cost, Income per year
b Dependent Variable: Number of trip

ANOVA(b)

Model		Sum of Squares	df	Mean Square	F	Sig.
2	Regression	752.538	9	83.615	2.605	.006(a)
	Residual	19069.800	594	32.104		
	Total	19822.338	603			

a Predictors: (Constant), Overall satisfying, Total trip cost to substituting site, real age, Number of day to visit, Local_participate, Gender, Level of education, Total trip cost, Income per year
b Dependent Variable: Number of trip

94

MODEL 2

REGRESSION: Model 2 Linear Travel Cost Model without Weighted Distance Decay Variable

/DESCRIPTIVES MEAN STDDEV CORR SIG N
/MISSING MEANSUB
/STATISTICS COEFF OUTS CI BCOV R ANOVA CHANGE ZPP
/CRITERIA=PIN(.05) POUT(.10)
/NOORIGIN
/DEPENDENT v_trip
/METHOD=ENTER t_cost t_cost_sub inc_year v_day sex edu reage local_part attitude
/RESIDUALS DURBIN .

Regression

[DataSet7] C:\Documents and Settings\Administrator\My Documents\data_tcm1.sav

Descriptive Statistics

	Mean	Std. Deviation	N
Number of trip	2.53	5.733	604
Total trip cost	3434.5990	3902.02411	604
Total trip cost to substituting site	119.9669	2048.28893	604
Income per year	46271.7914	139613.09928	604
Number of day to visit	1.62	.837	604
Gender	.37	.484	604
Level of education	2.41	.766	604
real age	21.8046	5.97340	604
Local_participate	.79	.571	604
Overall satisfying	3.11	.954	604

Coefficients(a)

Model 1	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B		Collinearity Statistics	
	B	Std. Error	Beta	Lower Bound	Upper Bound	Zero-order	Partial	B	Std. Error
(Constant)	.430	.189		2.274	.023	.059	.802		
Total trip cost	-1.64E-005	.000	-.086	-1.814	.070	.000	.000	.717	1.395
Total trip cost to substituting site	1.44E-006	.000	.004	.094	.925	.000	.000	.908	1.101
Income per year	2.16E-007	.000	.040	.839	.402	.000	.000	.690	1.450
Number of day to visit	.146	.038	.163	3.805	.000	.071	.221	.867	1.153
Gender	.031	.064	.020	.488	.626	-.094	.156	.940	1.064
Level of education	.000	.047	.000	-.005	.996	-.092	.092	.697	1.435
real age	.001	.006	.007	.138	.891	-.011	.013	.644	1.552
Local_participate	.144	.053	.110	2.716	.007	.040	.248	.970	1.031
Overall satisfying	-.107	.032	-.137	-3.359	.001	-.169	-.044	.968	1.033

a Dependent Variable: LN number of trip

Residuals Statistics(a)

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	-.0040	1.9603	.4317	.16534	604
Residual	-.82549	3.98486	.00000	.72796	604
Std. Predicted Value	-2.635	9.245	.000	1.000	604
Std. Residual	-1.125	5.433	.000	.993	604

a Dependent Variable: LN number of trip

96

Model Summary(b)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.221(a)	.049	.035	.73346	.049	3.405	9	594	.000	1.403

a Predictors: (Constant), Overall satisfying, Total trip cost to substituting site, real age, Number of day to visit, Local_participate, Gender, Level of education, Total trip cost, Income per year
b Dependent Variable: LN number of trip

ANOVA(b)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	16.484	9	1.832	3.405	.000(a)
	Residual	319.549	594	.538		
	Total	336.033	603			

a Predictors: (Constant), Overall satisfying, Total trip cost to substituting site, real age, Number of day to visit, Local_participate, Gender, Level of education, Total trip cost, Income per year
b Dependent Variable: LN number of trip

97

APPENDIX E

Table E1 Total Number of Visitors and Park Revenues from 2000 to 2006

Year	Number of visitors (persons)	Park revenues (baths/ year[a])	Average revenue per visitor (baht/person/year)
2000[b]	24,504	40,825	1.67
2001	10,531	209,565	19.90
2002	19,918	415,460	20.86
2003	23,528	597,490	25.39
2004	20,698	597,490	25.39
2005	21,579	530,030	25.61
2006	25,000*	579,860	26.87

Note: [a] indicated by fiscal year.
[b] means the park reported only three months since the park had started to collect a fee.
* is approximated by the park officer.
na is no report.

Table E2 Entrance Fee and Service Charge of National Park for Person

#	Thai		Foreigner	
	Child	Adult	Child	Adult
1	10 baht	20 baht	200 baht	400 baht

Note :

1) Child who lower 3 years don't take service charge.

2) Child is person between 3-14 years.

3) Thai student in an uniform or come to field trip picks the service charge in child rate.

4) Service charge rate for a person use for residence tourist

in national park has time to vacate 7 not exceed day.

Source: URL: http://www.dnp.go.th/parkreserve/np_rate.asp?lg, May, 2007

Table E3 Entrance Fee for Bicycle, Motorcycle and Automobile

No	List	Baht/Unit
1	bicycle	10
2	motorcycle	20
3	Personal Car	30
4	Load car that isn't exceed 1 ton (4 wheels)	30
5	Take car that isn't exceed 12 seats	30
6	Take car that isn't exceed 24 seats	100
7	Take car more 24 seats	200
8	Load car that isn't exceed 4 ton (6 wheels)	100
9	Load car that isn't exceed 10 wheels	200

Note :

1) Driver and Passenger pay national park service charge except driver in No 6-9

2) Don't permit for Load car more 10 wheels

Source: URL: http://www.dnp.go.th/parkreserve/np_rate.asp?lg, May, 2007

BIOGRAPHY

Mr. Boonchauy Boonmee was born on May 18, 1964 in Suphanburi Thailand. He graduated with a Bachelor degree of Science in Agricultural Education in 1992 from the Faculty of Education, Kasetsart University, and a Master degree of Science in Agricultural Economics in 1995 from the Faculty of Economics of the same University. He won a Government Scholarship to study Economics in the United States of America. He graduated with the second Master degree of Science in Agricultural Economics in 1998 from Department of Food and Resource Economics, University of Delaware, USA. Currently, he works at Suranaree University of Technology, Thailand.