

**ENVIRONMENTAL IMPACTS OF TOURISM IN
KHAO YAI NATIONAL PARK, THAILAND**

A Dissertation

by

SANGSAN PHUMSATHAN

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

August 2010

Major Subject: Recreation, Park and Tourism Sciences

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ABSTRACT

Environmental Impacts of Tourism in Khao Yai National Park, Thailand. (August 2010)

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Knowledge of visitor impacts is critical for sustainable tourism management in national parks. The focus of past tourism impact research on national parks is either on bio-physical impacts (conducted as recreation ecology research) or on social impacts (human dimensions, including environmental perception and crowding). Research integrating these two dimensions has been rarely conducted. This research aims to fill this gap through the integrative approach that attempts to understand current bio-physical impacts of visitor activities in a national park, and it examines how visitors perceive these impacts. The primary objectives of this dissertation are 1) to provide a synthesis of existing of bio-physical impacts of visitor activities in the Khao Yai National Park (KYNP) and 2) to examine visitors' perception of those impacts. Also, the factors affecting visitors' perception are analyzed. Both qualitative and quantitative methods were used in this study. Previous impact studies conducted in KYNP were reviewed. A visitor survey was conducted between December 2008 and February 2009. The questionnaires were distributed to 628 domestic and 40 international visitors. The 38 KYNP official interviews were completed.

Based on previous impact research in KYNP, the most common bio-physical impacts include soil compaction, removal of humus layer, erosion, plant damage, soil and root exposure, water quality deterioration, disturbance and feeding wildlife. Other environmental impacts include noise pollution and garbage accumulation. The results indicate that more than 30% of visitors do not recognize the negative results of their activities. With the exception of vegetation and water impacts, overall, visitors perceive the impacts as less severe than the actual impacts. Environmental impacts are rated differently by the KYNP officials, domestic, and international visitors. Also, significant differences were found among birders, hikers, and campers. The key factors influencing impact perceptions include income level, education level, residential location, park visitation experience, length of stay in KYNP, recreation activity, frequency of activity, group type, and group size. It is suggested that both the quality and the quantity of visitor impact research are needed to construct the body of knowledge of impacts in KYNP. A long-term impact monitoring is required to sustain the ecological integrity in KYNP.

DEDICATION

To my grandfather
for all inspiration

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CHAPTER I

INTRODUCTION

1.1 National Parks, Tourism, and Environmental Impacts

National parks are natural areas which contain vast natural resources of ecological importance and aesthetic beauty. The World Conservation Union (IUCN) considers a national park as a Category II protected area, whose main purpose is to protect large-scale ecological processes, along with the complement of species and ecosystem characteristics of the area, to protect the ecological integrity of one or more ecosystems for present and future generations, to exclude exploitation or occupation inimical to the purposes of designation of the area, and also to provide a foundation for environmentally and culturally compatible spiritual, scientific, educational, recreational and visitor opportunities (Dudley, 2008). According to the list of world heritage and protected area 2008, there are more than 6,500 national parks worldwide, both terrestrial and marine, covering roughly an area of 4.25 million square kilometers (Badman & Bomhard, 2008).

National parks also play an important role in the development and management of tourism and recreation opportunities. Providing recreation opportunities to the people is one of the dual mandates of a national park, the other being protection of biological and cultural resources. People want to visit national parks to appreciate, enjoy, and experience the natural environment. Recent trends indicate that tourism in some national

This dissertation follows the style of the *Journal of Sustainable Tourism*.

parks is increasing (Table 1-1). For example, according to US National Park Service (2008), during the year 2003-2007 the average annual growth rate of visitors to Yellowstone and Yosemite National Park were 1.2% and 1% respectively. Annual visitation to national parks has increased not just in the US, but is a worldwide trend. For example, according to the Great Barrier Reef Marine Park Authority (2008), there were more than two million visitors to the park in 2007, an increase of 5.3% from 2003. Similarly, there were almost 150,000 visitors in 2006 to Ecuador's Galapagos National Park, which had increased by 48.6% since 2003 (Galapagos National Park, 2008). Similarly, in Kruger National Park, the largest game reserve in South Africa, there were 1.9 million visitors in 2007, which is an increase of 16.7% from 2005 (Kruger National Park, 2008). In Thailand's Khao Yai National Park, the average annual growth rate of visitors from 2003 to 2007 was 6.9% (Department of National Parks, Wildlife and Plant Conservation: DNP, 2010). However, the growth of tourism in national parks is an issue of concern as it has the potential to alter the natural ecosystems and diminish visitor satisfaction from their recreational pursuits.

Table 1-1 Visitor statistics in selected national parks (2003-2007)

National park	Year					Average annual increase
	2003	2004	2005	2006	2007	
Yellowstone, USA	3,019,375	2,868,317	2,835,651	2,870,295	3,151,343	1.22%
Yosemite, USA	3,378,664	3,280,911	3,304,144	3,242,644	3,503,428	1.00%
Great Barrier Reef, Australia	1,927,601	1,972,316	1,978,779	1,845,798	2,030,054	1.48%
Galapagos, Ecuador	100,039	110,875	123,657	148,664	N/A	11.74%
Kruger, South Africa	N/A	1,336,981	1,628,340	1,899,700	N/A	19.30%
Khao Yai, Thailand	759,687	771,922	870,088	1,251,259	871,268	6.94%

Source: US National Park Service (2008); Great Barrier Reef Marine Park Authority (2008); Galapagos National Park (2008); Kruger National Park (2008); DNP (2010)

The development and growth of tourism in national parks presents a paradoxical situation. Economic benefit is a major positive impact of tourism to a national park. Tourism can increase jobs and incomes for local people, improve their living standards, establish and improve infrastructure around neighboring communities, and provide opportunities for local employees to improve and learn new skills (Eagles, McCool, & Haynes, 2002). Tourism can also increase financial support for conservation (Bushell & Eagles, 2007). In many developing countries such as China, Nepal and Thailand, governments have promoted tourism for economic development. In Costa Rica, the government considered tourism development in the national park as a way to cope with the economic crisis experienced in the 1980s (Fennell, 2002; Honey, 1999). It raised national park entrance fees in order to collect more money especially from international visitors. Despite the increase in fees, Costa Rica's national parks and protected areas remain popular tourist destinations (Eagles *et al.*, 2002).

The development of tourism in national parks is also viewed as a way to promote environmental conservation. Many national parks have planned tourism as a conservation strategy with the hope that it enhances a greater appreciation of nature among the public and increases the level of awareness to protect natural and cultural heritage. However, when poorly managed, the development of tourism can cause significant problems for national parks due to adverse impacts of visitor activities. Examples of negative impacts of visitor activities include ecological degradation, loss of biodiversity, habitat fragmentation and isolation, wildlife disturbance, and deterioration of visitors' experience. Although many national parks have implemented various types of visitor management strategies, visitor impacts have remained a critical issue due to the higher number of users, diverse use types, concentration of visitor activities at a few locations, and the overall ecological sensitivity of the park. Practically, it is not easy to support the two major goals of a national park simultaneously, i.e., protection of nature and provision of public recreational opportunities, given the complexity of various internal and external factors involving national park management.

Several studies have highlighted the significance of visitor impact research in national parks (Cole, 2004; Daniels & Marion, 2006; Deng, Qiang, Walker, & Zhang, 2003; Newsome, Moore, & Dowling, 2002). Research on environmental impacts of recreation and tourism in national parks has mostly focused on examining the bio-physical impacts on soil, vegetation, water, and wildlife (Hammitt & Cole, 1998; Liddle, 1997). Most impact studies have focused on the relationship between amount of visitor use, use types, factors affecting impacts, and intensity of impacts (Hammitt & Cole,

1998; Priskin, 2003; Reynolds & Braithwaite, 2001). These studies have helped park managers understand impacts more precisely and develop effective visitor management strategies. Another important research dimension is the examination and understanding of visitors' perception of impacts (Deng *et al.*, 2003; Priskin, 2003). It is important to understand how visitors perceive their impacts on the environment and why they perceive in certain ways, because those impacts can affect their experience and can influence their attitudes toward other visitors (Deng *et al.*, 2003; Priskin, 2003). The study of visitor perception is complex as it deals with many social and behavioral factors. Successful visitor management in national park requires knowledge of both bio-physical impacts and perceptual impacts.

When considering the two aspects of visitor impacts, i.e., bio-physical impacts and perceptual impacts, research efforts to date indicate to a lack of integration between the two aspects. Research has been conducted either on bio-physical impacts, or on perceptual impacts. The lack of integration is perhaps one reason why concrete and practical solutions to visitor-induced environmental problems have not been found. This research aims to fill this gap by combining bio-physical impact and perceptual impacts in a single study to seek solutions based on a more comprehensive understanding of environmental impacts. This study seeks to understand current bio-physical impacts of visitor activities in a national park and examines how visitors perceive these impacts; impact perception are studied in three aspects including impact rating, acceptability of impacts, and satisfaction with current management practices. This integrative approach objects to provide a comprehensive understanding of visitor impact issues in a national

park. The Khao Yai National Park (KYNP), the most popular national park in Thailand, has been selected as the research location. Specifically, the primary objectives of this study are to: 1) provide a synthesis of existing research in KYNP on bio-physical impacts of visitor activities, and 2) examine visitors' perception of those impacts. Impact perceptions are studied across three levels; 1) comparison between existing impacts and visitors' perception of those impacts, 2) comparison across three groups of stakeholders, i.e. KYNP officials, domestic visitors, and international visitors, and 3) comparison across three groups of activities, i.e. bird watching, hiking, and camping with three different types of value orientation (anthropocentric, ecocentric, and environmental apathy). The factors affecting visitors' perception are analyzed, and some tentative conclusions on visitor management provided.

1.2 Dissertation Objectives

The primary focus of the study is to provide an integrated perspective of visitor impacts in KYNP. The study is conducted in a systematic way. First, an overview of tourism-induced environmental problems in Thailand's national park is provided to set the context for the location-specific study. Second, a synthesis of bio-physical impact research conducted in KYNP is presented. Third, the environmental impact ratings of the park official, domestic visitors and international visitors are comparatively examined. Fourth, the actual bio-physical impacts and impact rating are compared. Fifth, visitors' impact rating between three groups of users, i.e., campers, hikers, and birders are compared to examine the effect of value orientation on perceptions. Finally, the

acceptability of impacts and satisfaction with current impact management practices are examined to provide guidelines on visitor management strategies for the park.

The following three major hypotheses are tested:

- H1: Differences exist in actual and perceived impacts.
- H2: Differences exist in impact ratings between three groups of stakeholders: domestic visitors, international visitors, and KYNP official.
- H3: Domestic visitors who engage in different types of recreational pursuits (i.e., front country camping, backcountry hiking and bird watching) perceive impacts differently.

A graph depicting the research framework and hypothesis testing is shown in Figure 1-1.

1.3 Organization of the Dissertation

This dissertation is organized in seven chapters following the objectives of the study. Chapter I provides an introduction to the study, its rationale and key research objectives and hypotheses. Chapter II provides an overview of visitor impact studies conducted in national parks of Thailand. Chapter III provides a comparative perspective on actual and perceived impacts in KYNP. First, a review of current bio-physical impacts of visitor activities in the KYNP is presented, which is followed by a synthesis of perceptual impacts. Both types of impacts are comparatively assessed to examine whether differences exist between actual and perceptual impacts. Chapter IV compares impact ratings of park officials, domestic, and international visitors. It examines if

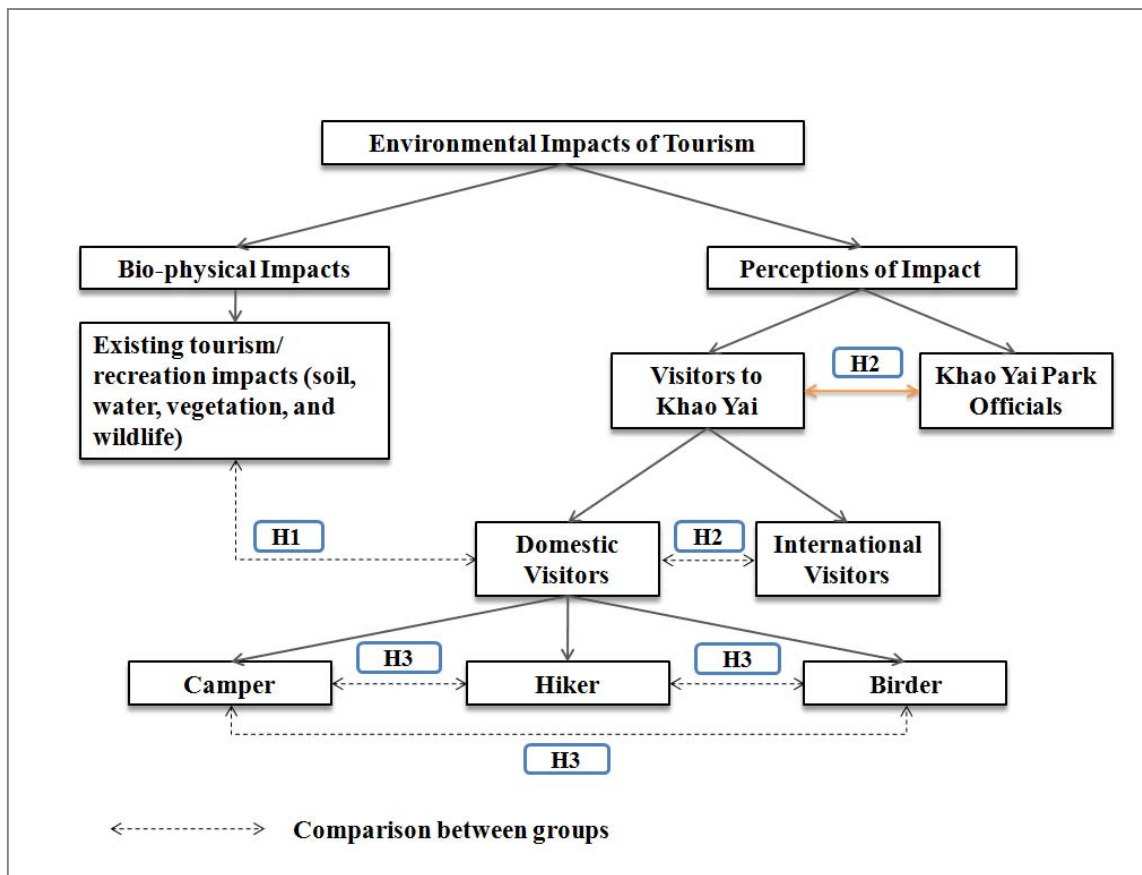


Figure 1-1 Dissertation conceptual framework and hypothesis testing

differences exist in impact ratings between the three groups. Chapter V provides a comparative analysis of environmental impact ratings by three primary groups of visitors: front country campers, hikers, and birders. This is done first by examining the environmental value orientation of the three groups of visitors, and then determining if differences exist between their ratings of impacts. Also, the effects of value orientation, previous recreation experience and other demographic variables on impact ratings are analyzed. Chapter VI focuses on impact acceptability and visitor impact management in the KYNP. The levels of acceptability of environmental impacts and satisfaction with

current management practices between KYNP officials, domestic, and international visitors are compared. Chapter VII provides an overall summary of the study, and outlines recommendations for further research.

1.4 Research Site

The KYNP has been selected to illustrate how an integrated approach to visitor impact study may provide important insights to finding integrated solutions to visitor impact management.

Located between 14°05' – 14°15' N and 101°05' – 101°50' E longitude, and approximately 200 kilometers from Bangkok, the KYNP is the first national park established in Thailand in 1962, presently administered by the Department of National Park, Wildlife and Plant Conservation Department (DNP). It is the third largest park in the country, covering an area of 2,166 square kilometers, which is equivalent to 3.01% of the total area of Thai national parks and 0.42% of the country's total land area (DNP, 2005). This national park is located within the political boundaries of four provinces in central and northeast Thailand, including Saraburi, Nakhon Nayok, Nakhon Rachasima, and Prachinburi.

The park encompasses a wide variety of habitats covering hill evergreen forest, moist evergreen forest, dry evergreen forest, mixed deciduous forest, dry dipterocarp forest and grasslands. There are several mountains higher than 1,000 meters. The park is host to more than 2,500 plant species and about 70 different species of mammals, such as elephant (*Elephas maximus*), gaur (*Bos gaurus*), barking deer (*Muntiacus muntjak*),

sambar deer (*Cervus unicolor*), white-handed gibbon (*Hylobates lar*), macaque (*Macaca nemestrina*), tiger (*Panthera tigris*), and Asian wild dog (*Cuon Alpinus*). There are more than 70 different species of reptiles and amphibians, such as king cobra (*Ophiophagus hannah*), python (*Python reticulatus*), and monitor lizard (*Varanus salvator*). There are also over 350 species of birds of which the significant ones include the great hornbill (*Buceros bicornis*), wreathed hornbill (*Rhyticeros undulatus*), brown hornbill (*Anorrhinus austeni*), oriental pied hornbill (*Anthracoceros albirostris*), siamese fireback (*Lophura diardi*), small minivet (*Pericrocotus cinnamomeus*), blue-winged leafbird (*Chloropsis cochinchinensis*), and blue pitta (*Pitta cyanea*) (DNP, 2005).

The KYNP was enlisted as an Association of Southeast Asian Nation's (ASEAN) Heritage Park in 1984. Considered by many to be among the best national parks in the world, in 2005, the KYNP was designated a World Heritage Site. It has also been enlisted as an Important Bird Area (IBA) designated by Birdlife International. The KYNP is an important watershed head area of the main rivers inside and around the national park, as it supplies more than two billion cubic meters of water per year to its surrounding areas (Foundation for Khao Yai National Park Protection, 2005; Saranet, 2004).

More than 20 tourism sites have been developed in the park (Figure 1-2). These sites provide opportunities for various types of recreational activities, such as animal observation, bird watching, hiking, jungle rafting, nature education, and camping. Visitor facilities include hotel accommodation, camp sites, parking areas, food services, souvenir shops, and visitor center (Foundation for Khao Yai National Park Protection,

2005). Based on the most recent statistics, the KYNP ranks number one in visitation to all national parks in Thailand.

During the past ten years (2000-2009), more than 700,000 people have visited the national park annually (DNP, 2010). Although visitor numbers have declined in the year 2007 and 2008 because of political conditions in Thailand, KYNP remains one of the most visited parks, and the visitor numbers in 2009 have increased again.

Unfortunately, because of high visitation levels, inappropriate visitor behavior, lack of adequate regulations and management practices, the KYNP has faced serious bio-physical impacts including impact on soil and vegetation (especially around campgrounds and trails), and accumulation of garbage (Saranet, 2004; Wongkorawut, 2006). Although many studies have concluded that the level of use has exceeded the park's visitor carrying capacity has exceeded, park management has not been able to control visitor numbers (Panusittikorn & Prato, 2001). One of the popular activities in KYNP includes observation of wild animals, but this activity has caused negative impacts on wildlife behavior (Kanurai, 2004; Panusittikorn & Prato, 2001). Additionally, the development of visitor facilities has destroyed wildlife habitats (Kanurai, 2004). Wildlife in the park is directly threatened by human activities and many species are threatened to become extinct from the local area. Poaching has thrived because it is profitable for local restaurants surrounding the park to use wildlife in preparing expensive dishes for visitors (Panusittikorn & Prato, 2001). These are a few examples which illustrate the challenges for park management.

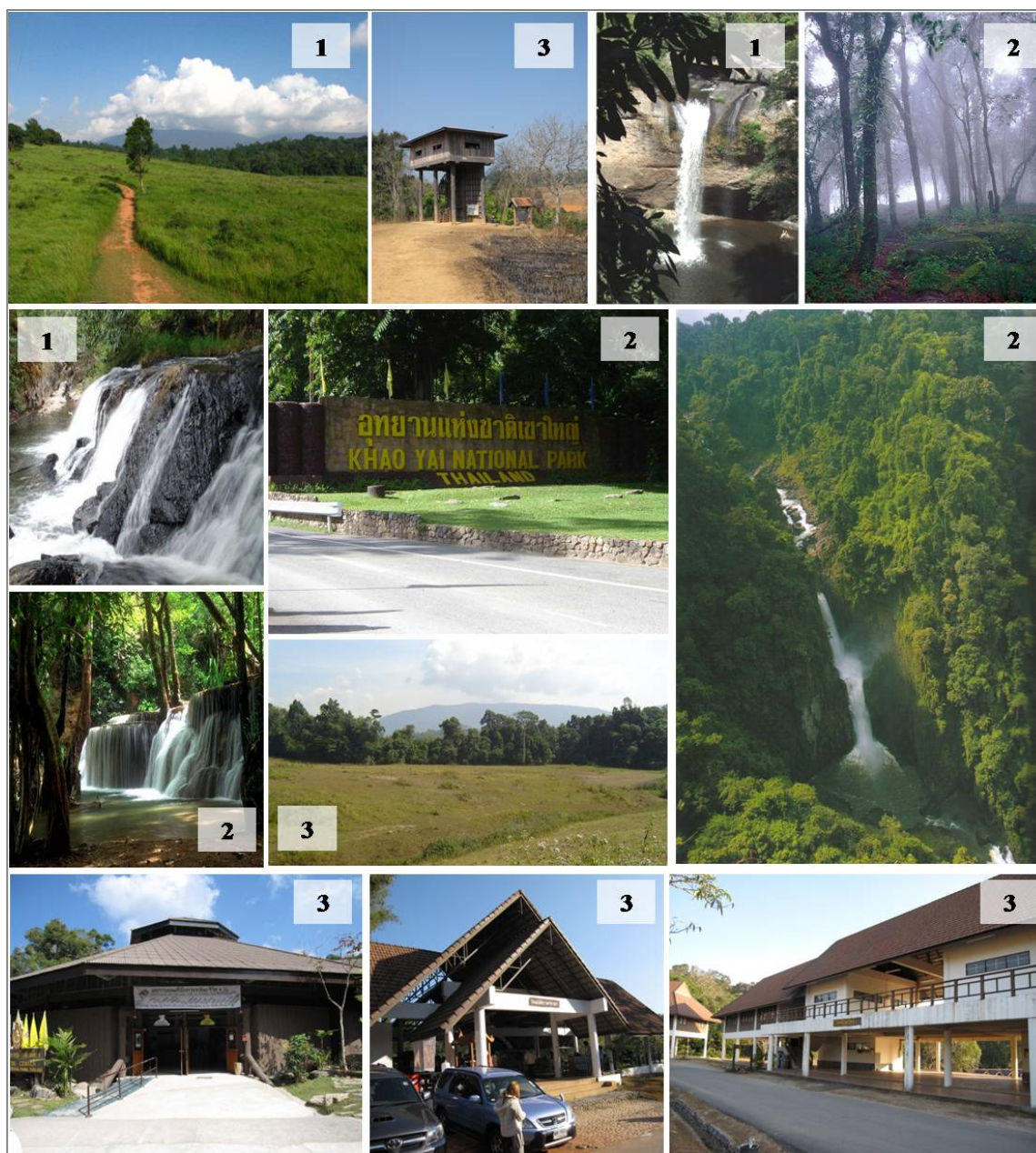


Figure 1-2 Tourist sites and facilities within KYNP

(Source: 1 DNP, 2006b; 2 Foundation of Khao Yai National Park Protection, 2005, 3 Fieldwork, 2009)

CHAPTER II

AN OVERVIEW OF ENVIRONMENTAL IMPACTS OF TOURISM IN THAI NATIONAL PARKS

2.1 Introduction

A national park is established to protect the ecological integrity of one or more ecosystems for present and future generations, exclude exploitation or occupation inimical to the purposes of designation of the area, and provide a foundation of spiritual, scientific, educational, recreational, and visitor opportunities (IUCN, 2003). The Department of National Parks, Wildlife and Plant Conservation of Thailand (DNP) defines a national park as a preserve that contains a variety of natural resources of ecological importance and unique beauty such as beautiful scenery, waterfalls, caves, mountains, hot springs, lagoons, and rare species of flora and fauna (DNP, 2006b). The seed for the present protected area system in Thailand was sown when the National Park Act of 1961 established KYNP as the country's first national park (ONEP, 2006). As elsewhere, national parks in Thailand have been established for three main purposes including: 1) maintaining ecological stability and preserving biological diversity, 2) providing recreation opportunities for the people, and 3) supporting research and education (DNP, 2006b).

Ever since the first national park was created, national parks have always been attractions for visitors. In Thailand, a national park is viewed as the most significant nature-based tourism destination for domestic and international visitors. For example,

more than 13 million national park visitors have been recorded during the last ten years (1999-2009) (DNP, 2010). As a consequence, tourism impact has become a major issue in the national parks. Visitor numbers have exceeded the carrying capacity of the parks, especially during high season and national holidays, and thus visitors pose a significant threat to the ecological integrity of the parks.

Visitor impacts on national parks have become a major concern, and as such must be addressed through proper documentation of what impacts are occurring, where, and to what extent undermines the integrity of the park. The knowledge about location-specific bio-physical impacts caused by different types of visitor activities is important to prescribe solutions that are specific but considered in the context of a broader visitor management strategy. The national park authority in Thailand has realized the significance of a science-based approach to tourism management and thus has facilitated several recent studies conducted in parks. While the emphasis on other biological research is much stronger than on visitor-related research, current trends show an increasing interest on the part of the national park authority on the latter type of research. This paper provides an overview of tourism impact studies in Thailand's national parks and a synthesis of recent ecological research conducted there to identify critical knowledge gaps for further consideration.

This paper is based on several published (research reports, journal papers, thesis, and conference abstracts) and unpublished documents. The documents were mostly collected from the DNP, KYNP, the Office of the Higher Education Commission (Thailand Library Integrated System: ThaiLIS) and the National Research Council of

Thailand (NRCT). According to these sources, a total of 178 studies in tourism-related field were conducted in Thai national parks during 1961 – 2008. They were classified into 13 different categories based on their titles and primary objectives: 1) visitor-related, 2) recreation/tourism benefits, 3) tourism resource potential, 4) policy, planning, and management, 5) nature interpretation, 6) facility/site development, 7) bio-physical impacts, 8) resource management, 9) carrying capacity, 10) local community and socio-economic, 11) marketing and business, 12) national parks' official-related, and 13) others.

2.2 Tourism in National Parks of Thailand

The Thai national parks have been established to preserve natural area for ecological conservation, research and education, and educational activities (DNP, 2006b). Thailand's national park system was originally founded based on the concern about overuse of natural resources that caused significant losses in forest areas after World War II. During World War II (1941-1945), the forest area of Thailand was about 70 percent of the total land area, which dramatically decreased to 55 percent in 1960 (The Royal Forest Department of Thailand: RFD, 2010). This situation led to the declaration of the National Park Act of 1961 which determined that the primary objective of national park establishment was to protect natural resources, ecosystems, and habitats of plants and wildlife. Logging and forest product harvesting in national park's boundaries were prohibited and declared illegal (ONEP, 2006; Panusittikorn & Prato, 2001). Since the first national park of Thailand (KYNP) established in 1961, 110

national parks (89 terrestrial national parks and 21 marine national parks) have been established covering 52,782 km², or approximately 10.3 percent of the territory of the country (Table 2-1 and Figure 2-1). Additionally, 38 new national parks (33 terrestrial and five marine national parks) are in the establishment process (DNP, 2009a).

Presently, all Thai national parks are administered by the National Park, Wildlife and Plant Conservation Department. During 1961-2002, they were under the responsibility of the Royal Forest Department of Thailand.

The National Park Research Division classified these national parks into three groups based on eight conditions, including 1) diversity and ecosystem type, 2) amount of rare and endanger species, 3) importance at international level (such as World Heritage Site, Ramsar Site, and ASEAN Heritage Park), 4) ecosystem fragility, 5) importance to communities as a watershed headquarter, 6) uniqueness of the park, 7) the extent of damaged ecosystem, and 8) the richness in biodiversity. Of the 148 Thai national parks, 22 national parks are considered areas with extremely high potential, 59 national parks have high potential, and 68 national parks have moderate potential (DNP, 2006a). During the 48 years (1961-2009) of the Thai national park system, a gradual shift in emphasis has occurred, from economic development during its earlier period, to consideration for environmental conservation in later years. Since 1987, concerns for local livelihood opportunities have also been incorporated in the overall national park management strategy (ICEM, 2003).

Table 2-1 Number of national parks in Thailand during 1961-2008

Year	Number of terrestrial national parks	Number of marine national parks	Number of national parks of Thailand
1961	1	0	1
1965	3	0	3
1970	3	1	4
1975	9	2	11
1980	17	4	21
1985	38	12	50
1990	49	13	62
1995	63	18	81
2000	81	21	102
2005	82	21	103
2008	89	21	110

Source: DNP (2009a)

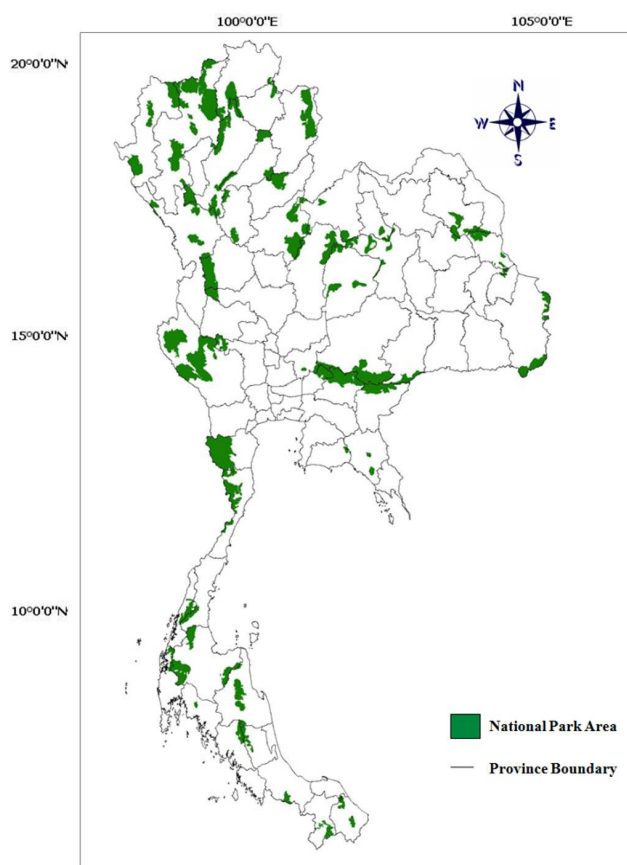


Figure 2-1 The distribution of national parks in Thailand
(Source: DNP, 2009c)

There were roughly four million visitors in 1985, which had increased to 12 million in 1995 (Fuller, 1997). On average, there are over 13.2 million people visiting Thai national parks annually, which is approximately 16 percent of the total tourists visiting the country (Table 2-2). Also, 90 percent of the visitors are domestic (DNP, 2010).

Table 2-2 Number of visitors to Thai national parks and total tourists visiting Thailand during 2000-2009

Year	Thai national park visitors ¹ (million)	Total tourists visiting Thailand ² (million)	% share
2000	15.16	64.25	23.60
2001	12.02	68.68	17.50
2002	13.01	72.62	17.92
2003	12.56	79.36	15.82
2004	13.43	86.45	15.54
2005	13.37	91.05	14.69
2006	14.20	95.31	14.90
2007	12.23	97.50	12.54
2008	10.42	94.35	11.04
2009	11.29	101.37	11.14

Source: 1 DNP (2010), 2 Office of Tourism Development (2010)

While the growth in visitor numbers continues, environmental impacts, as a result of poor planning and management, are already showing strains on the national parks. The protection of natural resources, visitor carrying capacity, quality of recreation and tourism experience, visitor impact monitoring, and quality of life of local people are concerns that park management needs to address (DNP, 2003, 2006a). As a response to these issues, the DNP's Research Division has set the goals of tourism management in Thai national parks covering the environmental, cultural, social, and economic

objectives (Table 2-3). Guidelines for the development and management of tourism have been developed. These guidelines cover eight sectors including the physical environment, management, environment and natural resources conservation, visitor use and access, local participation, nature education, information system, services, and safety (DNP, 2002). Also, park officials have been trained to conduct visitor impact assessment and monitoring.

Table 2-3 The objectives of sustainable tourism management in national parks of Thailand

Sustainable aspects	Objectives
Environmental objectives	- Ecological conservation, including conservation of biodiversity, land conservation, watershed management, and air quality maintenance
Cultural objectives	- Better knowledge and awareness of conservation among local people and visitors - Appreciation of local natural and cultural heritage - Making sustainable tourism part of local and national culture
Social objectives	- Visitor satisfaction and enjoyment - Improvement of living standards and skills of local people - Demonstration of alternatives to mass and package tourism and promotion of sustainable tourism everywhere - Enabling all sectors of society to have the chance to enjoy national parks
Economic objectives	- Improvement of the local and national economies - Provision of local business and employment opportunities - Generation of increased revenue to maintain protected areas

Source: DNP (2002)

Currently, many national parks, especially those in close proximity to the big cities, appear like mass tourism destinations. Overuse, especially during long weekends or public holidays, is one of the major concerns which can severely impact the park's ecological conditions. A carrying capacity study conducted in 2004 in five popular national parks, namely the KYNP, Doi Suthep-Pui, Erawan, Mu Ko Surin, and Khao Laem Ya-Mu Ko Samed determined optimal levels of visitor numbers for these parks (DNP, 2004). However, given the government's emphasis on economic development in national parks, it is doubtful if any actions will be taken to mitigate issues of carrying capacity.

2.3 Tourism-related Studies in National Parks of Thailand

Table 2-4 shows the number of tourism studies conducted in Thai national parks during different time periods. The majority of these studies are academic rather than practical (Nimsomboon, 2002; Sangpikul, 2008). Visitor-related issues such as visitors' characteristics and their behaviors, attitudes, expectations, and satisfaction are the most studied topics.

No tourism research was conducted during the first 20 years of national park establishment (1961-1980). This may be due to the fact that the national park authority spent more time on enforcement of the physical boundaries of the parks and preventing illegal activities within park boundaries. Research during this period was very basic, that is, primarily focused on creating inventories of plants and wildlife species. During 1981-1990, the Tourism Authority of Thailand (TAT) paid attention to developing visitor

attractions and services within park boundaries (RFD, 1986), but scientific research on tourism in national parks was not conducted. The 12 studies conducted during this period focused on values and benefit of recreation/tourism, nature interpretation, facility/site development, and visitors' perspectives on facility development.

Table 2-4 Number of tourism-related studies conducted in national parks of Thailand during 1961-2008

Topic	1981-1985	1986-1990	1991-1995	1996-2000	2001-2005	2006-2008	Total	% (of 178)
Visitor-related	1	2	1	7	30	8	49	27.53
Recreation/tourism benefit	1	1	0	3	7	7	19	10.67
Tourism resource potential	0	1	0	1	11	5	18	10.11
Policy, planning, and management	0	0	0	2	11	4	17	9.55
Nature interpretation	0	2	0	5	6	1	14	7.87
Facility/site development	2	0	0	2	7	2	13	7.30
Bio-physical impacts	0	0	0	1	7	2	10	5.62
Local community and socio-economic	1	0	1	2	5	1	10	5.62
Resource management	0	0	0	0	4	5	9	5.06
Carrying capacity	0	0	1	0	2	4	7	3.93
Marketing and business	0	1	0	2	1	1	5	2.81
National parks' official-related	0	0	0	0	2	0	2	1.12
Other issue	0	0	0	1	2	1	4	2.25
Total	5	7	3	26	95	42	178	100.00

Sources: Compiled from various publications obtained from DNP, KYNP, Thailand Library Integrated System, and National Research Council of Thailand

National park visitation during 1991-2000 reached a peak. The TAT launched several tourism promotion campaigns, culminating in the “Visit Park Thailand 2000”, jointly launched by the RFD and TAT. There was a clear emphasis on nature-based tourism development with the goal to generate more income and revenue from tourism

(ICEM, 2003). During this period, two main research themes were explored often: visitor characteristics and nature interpretation.

The post 2001 period saw tourism as a topic of research interest not only to academics but also to government, non-government organizations (NGOs), and the private sector. The study topics were more diverse, and included tourism resource potential, policy, planning and management, tourism benefit, facility/site development, bio-physical impacts, resource management, carrying capacity, and local community and their socio-economic well-being. It is likely that the sustained focus during this period was a result of increasing levels of awareness of environmental degradation in national parks and a general interest in sustainable tourism. As a result of these studies, several national parks incorporated sustainable tourism strategies in their management plans. In general, tourism studies in Thailand are now conducted by scholars in forestry, environmental sciences, natural resources, watershed management, social sciences, and economics. Many universities in Thailand developed and introduced tourism as a field of study in the undergraduate and graduate levels (Commission of Higher Education, 2010).

2.4 Bio-physical Impacts of Visitor Activities in National Parks of Thailand

Visitor impacts, in the context of parks and protected areas, mostly refer to bio-physical impacts indicating undesirable changes in the natural environment as a result of visitor activities (Hammitt & Cole, 1998; Liddle, 1997). The impacts are not only related to recreation activities, but also include the consequences of visitor-related infrastructure

construction and provision of recreation services. Visitor impact studies are important to national park management, as these studies provide answers to some critical questions about how to balance visitors' needs with the need for natural resources protection. Key questions in a bio-physical impact study focus on the relationship between use patterns and level of impacts. Some of the key questions in such studies include: (i) what types of bio-physical impacts exist in a particular area; (ii) what is the magnitude of impacts and how can we measure it; (iii) how visitor impacts affect ecological conditions of an area, (iv) what are the major sources of impacts; (v) what are the factors affecting the impacts; (vi) what is the relationship between amount of use and intensity of impacts; (vii) what degree of visitor impact is acceptable and how can we determine it; (viii) how managers respond to research results; (ix) what is an appropriate management strategy for particular area that can balance visitor use and resource protection; and (x) how can research and impact assessment methods be improved (Buckley, 2004b; Farrell & Marion, 2001; Leung & Marion, 2000; Newsome *et al.*, 2002; Sun & Walsh, 1998).

Studied on bio-physical impacts of visitor activities have focused on soil, vegetation, wildlife, and water (Hammit & Cole, 1998; Priskin, 2003; Reynolds & Braithwaite, 2001). It is important to note that of the 178 studies noted in Table 2-4, only ten studies have focused on bio-physical impacts of tourism and recreation.

2.4.1 Soil Impacts

Impacts on soil can occur in many different ways, such as soil compaction, loss of organic matter and humus, loss of mineral soil, reduced soil moisture, reduction in soil macroporosity, reduction in air and water permeability, erosion, and increasing runoff. In a study conducted in the recreational area of Nacimiento del Río Mund, Spain, Andres-Abellan *et al.* (2005) found that the most visited sites showed approximately 50% increase in soil compaction, and 60-70% increase in the amount of bare ground. Farrell & Marion (2001) assessed trails and recreation site conditions in eight protected areas in Costa Rica and Belize. The study found that visitor impacts to soil included trail proliferation, soil erosion, trail widening, muddiness on trail, bare ground, and soil exposure. Recreation activities can also cause changes in chemical composition of soil. Arocena, Nepal, & Rutherford (2006) studied the chemical composition of soils in backcountry areas of Mt Robson Provincial Park in Canada. Their findings indicated higher amounts of aluminum, iron, potassium, sodium and cobalt as a result of soil leaching in areas where visitors were permitted to wash their dishes. Also plastic and metallic containers brought to backcountry sites were the sources of chemical elements such as copper when those containers were burned in fire pits.

In Thai national parks, visible soil impacts that are commonly observed in visitor sites include soil erosion, reduction or removal of litter and human layer, reduction in organic matter, area of bare ground, and social trails (Chatsiriworrakul, 2003; DNP, 2004; Nuampukdee, 2002). Soil impacts were mostly associated with camping and

hiking activities. Key indicators of impacts used in these studies were infiltration rate, bulk density, total weight, and saturated soil hydraulic (K_s).

Nuampukdee (2002) examined hiking impacts on bulk density, total weight of soil, and water infiltration rate at two trails with different topographical characteristics and levels of use in KYNP. This study indicated that values for these indicators differed significantly between disturbed and undisturbed sites. Level of use and slope significantly affected the magnitude of impacts. Chatsiriworrakul (2003) determined the impact of tent camping on soil compaction by using soil infiltration rate as indicator at campsites in Nam Nao National Park located in the northern part of Thailand. Soil infiltration rates of three sites with different levels of uses were compared. The study found significant differences in infiltration rate between the three sites, highly used sites reported high infiltration rates. In a more recent study, Nimsantichareun (2007) analyzed visitor impact on soil along five hiking trails in KYNP. On each trail, values of the saturated soil hydraulic (K_s) was compared across three plots with three different levels of use, i.e., low, moderate, and high. Results indicated that the K_s between the three plots on each trail were significantly different. In contrast, K_s values of two interpretive trails in Khao Laem Ya - Mu Ko Samet Marine National Park, showed no difference even though the use levels on the trails were different (DNP, 2004). The results indicated that level of use may not be a good predictor of impact levels, and supports the findings that even low level of use may cause impacts similar to high use levels.

2.4.2 Vegetation Impacts

Vegetation is one of the important components in recreation setting, especially day-use site, which provides shade, screening and recreation appreciation to visitors. Visitor activities easily cause impacts to vegetation communities even on lightly used site (Cole, 2004; Hammitt & Cole, 1998; Pickering & Hill, 2007). Studies related to visitor impacts on vegetation are mostly associated with camping, horse riding, hiking, off-road driving, and mountain biking (Nepal & Way, 2007; Newsome, Cole, & Marion, 2004; Pickering & Hill, 2007; Turton, 2005). Visitor impacts on vegetation in recreation areas often observed are loss of ground cover, changes in species composition and age structure, root penetration, loss of tree seedling, introduction of exotic species, removal of shrub and tree stem, removal of trees along trails and in campsites, and vegetation clearance (Daniels & Marion, 2006; Deng *et al.*, 2003; Hammitt & Cole, 1998; Leung & Marion, 2000; Potito & Beatty, 2005; Priskin, 2003). Visitor impacts may also result in decrease in species richness, diversity and stratification of plant species, and impacts on native vegetation, as noted in the study conducted in Nacimiento del Río Mund (Andres-Abellan *et al.*, 2005).

Loss of ground cover, root penetration, introducing of exotic species such as palm tree around visitor center, removal of shrub and tree stem, vegetation clearance, tying trees with ropes to hang clothes, clearing saplings in camping areas and on trails, and felling trees to use as tent poles or for firewood are some of the common types of vegetation impacts in Thai national parks (Chatsiriworrakul, 2003; DNP, 2004; Nuampukdee, 2002). Nuampukdee (2002) compared tramping intensity on plant

communities on two hiking trails in KYNP. The results showed that the type and the average density of plants in undisturbed locations were significantly higher compared to disturbed locations. However, the results could not clearly determine if the differences could be attributed to varying degrees of slope, plant communities and level of use, as suggested in the literature. Similarly, Chatsiriworrakul (2003) compared biomass at three locations with different number of campers per night – a high use campsite, a low use campsite, and a control site in Nam Nao National Park – and found that while the biomass in the undisturbed area was higher than the other two sites there was no significant difference between the two campsites.

A DNP (2004) study also measured visitor impacts on plant communities along five hiking trails in KYNP. Species richness, expressed as the Important Value Index (IVI), of tree and sapling of keystone species such as *Cinnamomum subavenium*, *Eurya nitida*, and *Syzygium pachyphyllum* were analyzed. Results showed that the IVI of dominant species at the edges of the trails (disturbed areas) were significantly lower than those away from the trails (undisturbed areas). Another study (DNP, 2004) measured visitor impacts to plant communities along an interpretive trail in Doi Suthep National Park. The IVI of tree and sapling of keystone species namely *Mahonia siamensis*, *Beilschmiedia gammieana*, *Engelhardtia aceriflora*, *Lithocarpus thomsonii*, *Castanopsis diversifolia*, and *Cinnamomum iners* at the edge of trail and natural areas were measured. Results indicated that there were significant differences in IVI between impacted (edge of trail) and undisturbed (natural) area. Another study (DNP 2004), measured the extent of tree root exposure along an interpretive trail at Mo Ko Surin Marine National Park.

The study classified impacts at three levels: 0-25% of exposed tree root (low impact), 25-50% (moderate impact), and more than 50% (severe impact). Results indicated that 94 % of the trail could be characterized as lowly impacted, four percent as moderate, and two percent as severely impacted. The study also found that slope of the trail was a major factor influencing impact levels.

2.4.3 Wildlife Impacts

Visitor activities can cause various negative impacts to wildlife, both directly and indirectly. Direct impacts are impacts that occur upon contact between wildlife and visitors, such as harassment and harvest. Indirect impacts occur as impacts on wildlife habitat and other environmental conditions (Hammitt & Cole, 1998; Rowa, Blouin-Demersa, & Weatherhead, 2007). Impacts to wildlife can also directly affect physiological reaction (such as loss of health condition and increased susceptibility to disease) (Buckley, 2004a; Dyck & Baydack, 2004; Newsome, Dowling, & Moore, 2005). Most commonly researched impacts on wildlife include wildlife disturbance and harassment, habitat modification, species displacement, reduction in reproduction levels, and changes in species composition and structure (Reynolds & Braithwaite, 2001). In a study of visitor impacts on caribou population in Canada's Charlevoix Biosphere Reserve, Duchesne, Côté & Barrette (2000) compared caribou's behavior during and after recreation visits with behavior during days without visits. The study concluded that in the presence of visitors most caribou spent increased amount of time being vigilant or just standing, mostly at the expense of time spent resting and foraging. After the visitors

were gone, the caribou tended to spend more time resting compared to the days without visitors. In another study conducted in Nepal's Chitwan National Park, the behavior of Asian one-horned rhinoceros (*Rhinoceros unicornis*) was compared before, during, and after tourist visits. The result indicated that tourist visits disrupted the rhinos' behavior, especially by interrupting feeding (Lott & McCoy, 1995).

In Thai national parks, visitors attract wildlife to feed them; Thai park managers and scholars have reported the feeding by visitors to be extremely detrimental to wildlife (Sangjun, Tanakanjana, Pattanavobool, & Bhumpakphan, 2006). To demonstrate the impacts of wildlife feeding, Kanurai (2004) examined how macaques (*Macaca nemestrina*) interacted with the visitors. The study suggested that macaques were found along the road 83.3% of all observations. They were mostly found during 2:00 to 6:00 pm, and with a frequency of 6.01 macaques per hour. On average, the macaques received 2.2 pieces of food items per visitor. Similarly, Sangjun *et al.* (2006) examined the effects of night spotlights on sambar deer (*Cervus unicolor*) behavior. The study found that the frequency of spotlights from visitors' cars did not affect deer responses. However, there were significant differences in the amount of time that the deer stopped eating when they were spotlighted. Deer stopped eating longer closer to the road than further away from the road. Also, the study indicated level of use, forest types, and seasons significantly influenced the intensity of habitat utilization by the deer.

Bird watching in national parks is a very popular activity in Thailand. There are 62 Important Bird Areas (IBAs), of which 23 are in national parks. Birdlife International (2009) reported that tourism related road and resort construction in and around Khao

Sam Roi Yot National Park have caused a major threat to water birds and their nesting habitat. Unskilled birders are mentioned as a significant threat to horn bill in the KYNP (Intarak, 2005; Poonswad & Tsuji, 1994). Similarly, declining numbers of five species of sea turtles, including *Chelonia mydas*, *Eretmochelys imbricate*, *Lepidochelys olivacea*, *Caretta caretta*, and *Dermochelys coriacea* in the marine parks of Mu Ko Surin, Mu Ko Similan, Mu Ko Ra-Ko Phra Thong, and Tarutao Marine National Park have been attributed to tourism development. The major threat reported is the loss of turtle nesting beaches to beach related construction of visitor facilities. The study noted that the light from restaurants and hotels located along the beaches had affected the ability of the turtles to return to the sea after hatching (DNP, 2006a; Wangkulangkul, 2009).

2.4.4 Water Impacts

In natural area, water resources provide many recreation opportunities for visitors. Various activities take place on or near water resources as Jaakson (1970) (cited by Moisich & Arthington, 2004) classified three main groups of water-based visitor activities. First, on-water activities refer to activities that take place on water surface, such as boating and water skiing. Second, contact activities include the activities which human body contact with water, such as swimming, snorkeling, and diving. Third, littoral activities are the activities that take place on the area around water resources, such as camping, hiking, and picnicking. These activities can cause significant impacts to water which are more directly related to visitors' health. Major impacts focus

primarily on water quality, such as chemical contamination, fuel leakage, bacterial contamination, turbidity, nutrient influx, and reduced levels of dissolved oxygen (Hammitt & Cole, 1998; Moisich & Arthington, 2004; Priskin, 2003). Other water-related impacts include effects on aquatic plants and animals, such as degradation of coral reef, damage to riparian vegetation, reduction in fish hatching, clogging of respiratory structures by silt and reduction in feeding success (Moisich & Arthington, 2004; Roupheal & Inglis, 1997). The sources of water impacts can be from human waste, or from recreation activities like boating and jet skiing. Water quality also gets affected by seepage of fertilizers and herbicides, which are widely used on golf courses and hotel gardens around water resources (Holden, 2008). Englebert, McDermott, & Kleinheinz (2008) studied the impacts of visitor activities on water quality. They investigated the contamination of *Escherichia coli* (*E. coli*) in mats of green algae, *Cladophora*, in three recreational beaches in Door County, Wisconsin. The result showed that the concentrations of *E. coli* in three beaches were higher than in surrounding water. Similarly, in a study conducted in 15 lakes on Fraser Island in Australia, compared to the data collected in 1990, the most recent study showed high levels of nutrient and chlorophyll *a* concentrations due primarily to nutrient additions from tourist activities and their facilities (Hadwen, Arthington, & Mosisch, 2003).

According to the DNP and TAT, there are 1,504 nature-based tourism attractions in Thailand's national parks. These consist of 623 waterfalls, 122 lakes, 119 beaches, and 52 hot springs (Tanakanjana, Aroonpraparat, Pongpattananurak, Nuampakdee, & Chumsangsee, 2006). Given how the Thai visitors congregate at water sites, the

contamination of water resources is unavoidable. Unfortunately, there are only a few studies on water impacts in Thai national parks.

Phumsathan & Tanakanjana (2003) assessed visitor impacts on water quality at Erawan National Park. They analyzed water color, turbidity, temperature, total solid, suspended solid, dissolved oxygen (DO), biochemical oxygen demand (BOD), pH, total coliform bacteria, and fecal coliform bacteria. Significant differences were found in water color, temperature, total solid, suspended solid, DO, pH, and total coliform bacteria between the dry and rainy seasons. As for the comparison between sites with different use levels, it was found that total solid, pH, and total coliform bacteria of high use area were significantly higher compared to low use area. This study illustrated that season and levels of use were significant factors influencing the type and magnitude of water impacts. Nimsantichareun (2007) compared water temperature, pH, DO, BOD, transparency, and total coliform bacteria at six sites in the KYNP. Results indicated that while the water quality at these sites was poor it was still within acceptable limits when compared to standard quality of surface water as per the National Environmental Board (1992). In another study in KYNP (DNP 2004), plankton diversity index was used as the indicator of water quality appropriate for aquatic species growth. Results showed that areas with high visitor concentration had moderately impacted plankton diversity. Likewise, water quality at Mu Ko Surin Marine National Park was reportedly impacted by visitor activities (DNP 2004).

Based on the results reported above, it can be concluded that tourism has impacted the ecological conditions in Thai national parks. A summary of the main

impacts is shown in Table 2-5. Given the small number of studies, there is a significant gap in knowledge about the impact of tourism on the ecological conditions of Thai national parks. Several studies have been conducted to investigate factors influencing the level of impacts. Studies suggested that the magnitude of impact varies with the levels of use, vegetation type, season, and topographic conditions. Research has not been up to speed with the level of tourism development. A main critique of the above-reported studies is that they are fairly descriptive and do not provide detail information on methodology. Hence, the reliability of the research is questionable. Also, most are short-term studies conducted by independent researchers; efforts to institutionalize research in national parks are very limited. Findings of the studies reported above are very similar to the studies conducted elsewhere. For example, the most common visitor impacts occurring in Thai national parks are similar to the impacts reported in the United States (Cole, 2004; Englebert *et al.*, 2008) or in Australia (Smith & Newsome, 2002; Sun & Walsh, 1998). Second, study of bio-physical impacts of visitor use in Thai national parks relies on techniques developed in the United States. One significant obstacle is a lack of funding for visitor impact studies in Thailand.

Table 2-5 Bio-physical impacts of visitor activities in national parks of Thailand

Impact Categories	Bio-physical Impacts
Soil Impacts	<ul style="list-style-type: none"> - Soil erosion ^{1, 2} - Reduction or removal of litter and humus layer ² - Reduction in organic matter ² - Area of bare ground ² - Social trails ² - Soil compaction ^{1, 3, 4} - Higher infiltration rate ^{1, 3, 4} - Higher bulk density ³
Vegetation Impacts	<ul style="list-style-type: none"> - Vegetation trampling ³ - Alteration of plant communities ^{1, 3} - Changes in plant composition ^{2, 3} - Exposed tree root ² - Reduced biomass ¹
Wildlife Impacts	<ul style="list-style-type: none"> - Disturbance ^{5, 7, 9, 10, 11} - Changes in behavior ^{5, 6, 10, 11} - Increasing of wildlife in visitor zone ^{6, 11} - Effect on reproduction level ¹¹ - Habitat modification ^{8, 11}
Water Impacts	<ul style="list-style-type: none"> - Changes in water quality ^{2, 4, 12} - Bacterial contamination ^{2, 4, 12} - Effect on freshwater ecosystem ^{2, 4} - Oil film on water surface ²

Sources: 1 Chatsiriworrakul (2003), 2 DNP (2004), 3 Nuampukdee (2002), 4 Nimsantichareun (2004), 5 Sangjun *et al.* (2006), 6 Kanurai (2004), 7 Poonswad & Tsuji (1994), 8 Birdlife International (2009), 9 Intarak (2005), 10 DNP (2006a), 11 Wangkulangkul (2009), and 12 Phumsathan & Tanakanjana (2003)

2.5 Conclusion

Despite all the progress made in visitor impact research, there are several issues that merit further consideration. First, most studies have focused on one or two types of impacts. There is a lack of studies that examine a combination of impacts; therefore, a comprehensive study of visitors' impacts at a particular site is greatly needed. Second, some types of impacts cannot clearly define the sources of impacts; for example distinguishing human-induced changes from natural changes is critical. Third, most studies tend to be conducted over a short period. Some studies on bio-physical impacts require long-term monitoring, especially, for ecological sustainability. Fourth, most visitors' impact study focus on the relationship between visitor activities and environmental impacts; impacts as a result of construction of facilities are few. Facility development is one of the critical issues discussed in parks and protected area management. Many types of infrastructures have been constructed without any environmental impact assessment. Resource depletion and waste are other critical issues which have not been researched well. Finally, research to date indicates that most visitor impact studies focus on current conditions occurring in the area. It means that we are studying the impacts that are occurring or have already occurred prior to the current research. So, the result of the research focuses on solving currently existing problems rather than preventing foreseeable impacts. Current research has thus been more reactionary than pre-emptive and predictive.

This study aimed to provide an overview of tourism-impact studies conducted in national parks of Thailand. The number of studies conducted in Thai national parks is

increasing, and this is a good sign. However, the research studies are mostly stand alone research, and no attempts have been made to link research to management and policy development. The primary contribution of these studies is to provide a theoretical knowledge base more than supporting and solving tourism management problems that are occurring in national parks. The majority of the research has applied descriptive survey and comparison of used and unused sites. These two methods are able to apply in many tourism sites with different conditions and also can be applied within a short period and limited funding. Nevertheless, experimental approach is needed to generate reliable scientific knowledge. Currently there are 21 marine national parks covering an area of 5,810 km² along the Gulf of Thailand and Andaman Sea coast (RFD, 2002; Sethapun, 2000). These marine parks are popular tourism destination especially for diving. Marine parks such as Tarutao, Mu Ko Surin, Mu Ko Similan and Ao Phang Nga have been proposed as World Heritage sites (Sethapun, 2000). Concerted efforts must be made to conduct baseline research on ecological conditions especially in the marine national parks. The DNP should consider establishing a center dedicated to conducting research in national parks, similar to Australia's Sustainable Tourism Cooperative Research Centre (STCRC), the Rocky Mountain Research Station in USA, and the Tourism Research Institute in New Zealand. Such a center should develop a cooperative relationship with Thai universities to engage in a research agenda focused on visitor impact management.

CHAPTER III

ACTUAL AND PERCEIVED ENVIRONMENTAL IMPACTS

IN KHAO YAI NATIONAL PARK, THAILAND

3.1 Introduction

Trends in national parks related tourism development around the world indicate a significant increase in visitor numbers. National parks have been a magnet for visitors in many developing countries, such as Costa Rica, China, Nepal, and Thailand, among others. Many people want to visit national parks to appreciate, enjoy, and experience the natural environment. This creates a paradoxical situation for a national park: it is expected to maintain its natural integrity, and at the same time, provide exceptional recreational opportunities to the visitors. Tourism provides benefits to a national park and surrounding local communities in various ways, such as promoting conservation, generating income and revenue, increasing job opportunities, enhancing infrastructure development, supporting economic activities, reducing consumptive uses of forest resources by the locals, and minimizing resource conflicts between the park and local communities. Inevitably, tourism and visitor uses cause undesirable changes to the biophysical conditions of a park, such as soil erosion, alteration of plant communities, habitat fragmentation, alteration of wildlife behavior, and changes in water quality (Buckley, 2004b; DNP, 2004; Hammitt & Cole, 1998; Leung & Marion, 2000). These impacts not only affect ecological sustainability of a national park but also deteriorate visitors' experience (Bushell & Eagles, 2007; Manning, 2007).

Studies on visitor impacts, both bio-physical and perceptual impacts, are conducted to support the development of guidelines for effective knowledge-based visitor impact management (Cole, 2004; Daniels & Marion, 2006; Deng *et al.*, 2003; Newsome *et al.*, 2002). The knowledge of visitors' perception of environmental impacts is an important element in the management and provision of quality recreation opportunities in a national park (Cressford, 2000). A comprehensive visitor impact management strategy should be based on natural science research on ecological impacts and social science research on visitor perceptions of those impacts. However, current research on visitor (or tourism) impacts indicates to a gap. Studies have been conducted either on bio-physical impacts only, or on perception of impacts only, and are thus treated separately. There is a lack of integration of these two aspects of impact research, which has made it difficult to find concrete solutions to these complex issues. This research aims to fill this gap, as it seeks to understand current bio-physical impacts of visitor activities in a national park, and examines how visitors perceive these impacts. This integrative approach objects to provide a comprehensive understanding of visitor impact issues in a national park. The Khao Yai National Park (KYNP), the most popular national park in Thailand, has been selected as the research location. The primary objectives of this study are to: 1) provide a synthesis of current research on bio-physical impacts of visitor activities in KYNP, 2) examine visitors' rating of environmental impacts, and 3) determine the differences between actual and impact ratings. This knowledge is critical if visitor impact management is treated as a topic that requires a blending of natural and social science research.

3.2 Literature Review

3.2.1 Bio-physical Impacts of Tourism

Visitor impacts, in the context of parks and protected areas, mostly refer to undesirable changes in the natural environment as a result of recreation activities (Hammit & Cole, 1998). The sources of impacts are not only limited to recreation activities but also include the consequences of visitor-related infrastructure construction and provision of recreation services. Visitor impact studies are important to national park management, as these studies provide answers to some critical questions about how to balance visitors' needs with the need for natural resources protection. Key questions in a bio-physical impact study focus on the relationship between use patterns and level of impacts, the selection of suitable indicators, and acceptable standards for impact assessment and monitoring. While there are numerous types of environmental impacts of visitor activities in a national park, research has focused mostly on four primary resources: soil, vegetation, wildlife, and water (Hammit & Cole, 1998; Leung & Marion, 2000; Liddle, 1997).

Studies on soil impacts are mostly related to camping and hiking activities and vehicle use. Visitor impacts to soil refer to changes in soil characteristics and properties, such as soil texture, structure, bulk density, porosity and productivity. Visible soil impacts that are commonly observed in many national parks include soil compaction, soil erosion, reduction or removal of litter and humus layer, reduction in organic matter, area of bare ground, and development of social trails (Andres-Abellan *et al.*, 2005; Cole, 2004; Deng *et al.*, 2003; Farrell & Marion, 2001). Studies related to visitor impacts on

vegetation are mostly associated with camping, horse riding, hiking, off-road driving, and mountain biking (Nepal & Way, 2007; Newsome *et al.*, 2004; Pickering & Hill, 2007; Turton, 2005). Other studies have examined the effect of infrastructure development (Holden, 2008; Pickering & Hill, 2007). Recreation related vegetation impacts include loss of ground cover, changes in species composition and age structure, tree root exposure, loss of tree seedlings, introducing of exotic species, removal of shrub and tree stem, and removal of trees along trails and around campsites (Daniels & Marion, 2006; Deng *et al.*, 2003; Hammitt & Cole, 1998; Leung & Marion, 2000; Potito & Beatty, 2005; Priskin, 2003). Visitor impacts may also result in decrease in species richness, diversity and stratification of plant species, and impacts on native vegetation, as noted in the study conducted in Nacimiento del Río Mund (Andres-Abellan *et al.*, 2005).

Visitor induced wildlife impacts are broadly categorized as direct impacts and indirect impacts. Direct impacts are impacts that occur upon contact between wildlife and visitors, such as harassment and harvest. Indirect impacts occur as impacts on wildlife habitat and other environmental conditions (Hammitt & Cole, 1998; Rowa *et al.*, 2007). Impacts to wildlife can also directly affect physiological reaction (such as loss of health condition and increased susceptibility to disease) (Buckley, 2004a; Dyck & Baydack, 2004; Newsome *et al.*, 2005). Most commonly researched impacts on wildlife include wildlife disturbance and harassment, habitat modification, species displacement, reduction in reproduction levels, and changes in species composition and structure (Reynolds & Braithwaite, 2001).

Water impacts are more directly related to visitors' health. Major impacts focus primarily on water quality, such as chemical contamination, fuel leakage, bacterial contamination, turbidity, nutrient influx, and reduced levels of dissolved oxygen (Hammitt & Cole, 1998; Moisich & Arthington, 2004; Priskin, 2003). Other water-related impacts include effects on aquatic plants and animals, such as degradation of coral reef, damage to riparian vegetation, reduction in fish hatching, clogging of respiratory structures by silt and reducing feeding success (Moisich & Arthington, 2004; Rouphael & Inglis, 1997). The sources of water impacts can be from human waste, or from recreation activities like boating and jet skiing. Water quality also gets affected by seepage of fertilizers and herbicides which are widely used on golf courses and hotel gardens around water resources (Holden, 2008).

Recreation resource impacts are influenced by many factors, which can be classified into three primary groups: site, visitor, and management. Site factors focus on the attributes of the destination itself, and include such elements as site resistance, site resilience, vegetation resistance, topographic, and ecosystem characteristics (Eagles *et al.*, 2002; Hammitt & Cole, 1998). Visitor factors include visitor number, length of stay, mode of travels, use patterns and trends, skills of visitors, attitudes, beliefs, values of place, and perception (Bonnes, Lee, & Bonaiuto, 2003; Cressford, 2000; Fransson & Garling, 1999; Hillery, Nancarrow, Griffin, & Syme, 2001). Visitor impacts also depend on management regime. Management practices can control impacts at particular sites by improving site resistance and resilience, and by controlling visitor demand. Additionally,

management practices can influence social value of visitor through education programs and regulations (Buckley, 2004b; Eagles *et al.*, 2002; Hammitt & Cole, 1998).

3.2.2 Perception of Environmental Impacts

Perception is a part of human cognitive process (Bonnes *et al.*, 2003). This is one of the oldest fields in psychology. The contemporary concept of perception in social psychology has been defined as “the processes by which people perceive one another, and is an impression, a sense, or both, of personalities and social traits of others based on their behavior” (Roeckelin, 2006: 128). It refers to an individual’s awareness of the behaviors of others that are revealing of their attitude or motive and emphasizes factors such as knowledge and belief (Roeckelein, 2006; Stern, 1992). Although, perception implies awareness, it is not necessarily conscious awareness (Fazio & Roskos-Ewoldsen, 2004). Furthermore, perception is unique to each person and leads to preference judgment of individual. Therefore, from a recreational perspective, what people prefer his/her experience to be, the environment that they choose to recreate in, and the impacts they associate with, are all based on their perceptions (Kaplan & Kaplan, 1989).

Perception studies have been conducted in many disciplines, such as environmental psychology, human behavior, architecture, and education (Bechtel & Churchman, 2002). Many studies have been conducted to explore the factors affecting perception. Primary factors which have been indentified to influence perceptions include gender, education, social class, economic status (Zebroski, 2007), attitude and belief (Fazio & Roskos-Ewoldsen, 2004), knowledge, and emotional tension (Bonnes *et al.*,

2003). Perception research is very common in outdoor recreation and tourism studies (Chin, Moore, Wallington, & Dowling, 2000; Manning, 1999; Priskin, 2003). At least three different types of perception research have been conducted from a recreational perspective: perception of conflict, perception of crowding, and perception of environmental impacts. Perception of conflict is recognized as a primary source of psychological impact affecting visitor's experience (Eagles *et al.*, 2002). Perception of crowding, as a psychological phenomenon, refers to the restrictive aspect of limited space that is perceived by visitors (Bonnes *et al.*, 2003). Perception of environmental impacts refers to how visitors perceive about changes in environmental conditions (Symmonds, Hammitt, & Quisenberry, 2000).

Understanding visitors' perception of the environmental impacts is critical for providing a quality experience. Research results can be used to develop strategies that can improve visitor's behavior to be more environmentally friendly. Past research on this topic has focused on three key aspects: 1) visitors ability to recognize or determine the impact, 2) the perceived importance of impact conditions relative to other aspects of the setting, and 3) the evaluation of a given condition as desirable or undesirable (Graefe, Vaske, & Kuss, 1984). Impact perceptions have also been studied in association with issues about acceptability of impacts and satisfaction relating to undesirable changes in environmental conditions (Deng *et al.*, 2003; Floyd, Jang, & Noe, 1997).

Manning (1999) argues that research on environmental impact perception is somewhat limited compared to other visitor perception studies. Moreover, although impact perception has been frequently studied in recreation and tourism contexts, there is

a paucity of research on relating it to current actual bio-physical impacts. Visitor perceptions are dependent on a multitude of factors, for example, the type(s) of recreation activity visitors engage in, recreational goals of various user groups, visitors' background, environmental knowledge, and awareness of resource management objectives (Hammit & Cole, 1998). Environmental impact perceptions at a particular site are often different from reality (Deng *et al.*, 2003; Priskin, 2003). Individuals may see the same level of impact differently (Graefe *et al.*, 1984; Hillery *et al.*, 2001). This could be based on the effect of age, education, origin of visitor, (Leujak & Ormond, 2007; Priskin, 2003), skill level (Leujak & Ormond, 2007; Symmonds *et al.*, 2000), and value orientation (Raadik & Cottrell, 2007). Also, some studies have found that differences exist in perception of impacts of a recreation activity between resource managers and visitors (Farrell, Hall, & White, 2001; Priskin, 2003) and visitors in different activities (Hillery *et al.*, 2001). Moreover, visitors often underestimate their own impacts because they perceive that the other groups sharing the same resource cause more impact than they do (Priskin, 2003; Symmonds *et al.*, 2000).

Based on previous studies, the factors which influence environmental impact perceptions can be summarized into five groups. These include recreation activities, demographic characteristics, environmental value orientation, group of people, and recreation experience (Figure 3-1). Variables affecting perception, such as attitudes, norms, values and culture are complicated. Due to the large number of variables, results are not always consistent, for example, what visitors think and how they respond to

certain question are not always consistent. This calls for a cautious approach to application of measurement scales and interpretation of the results.

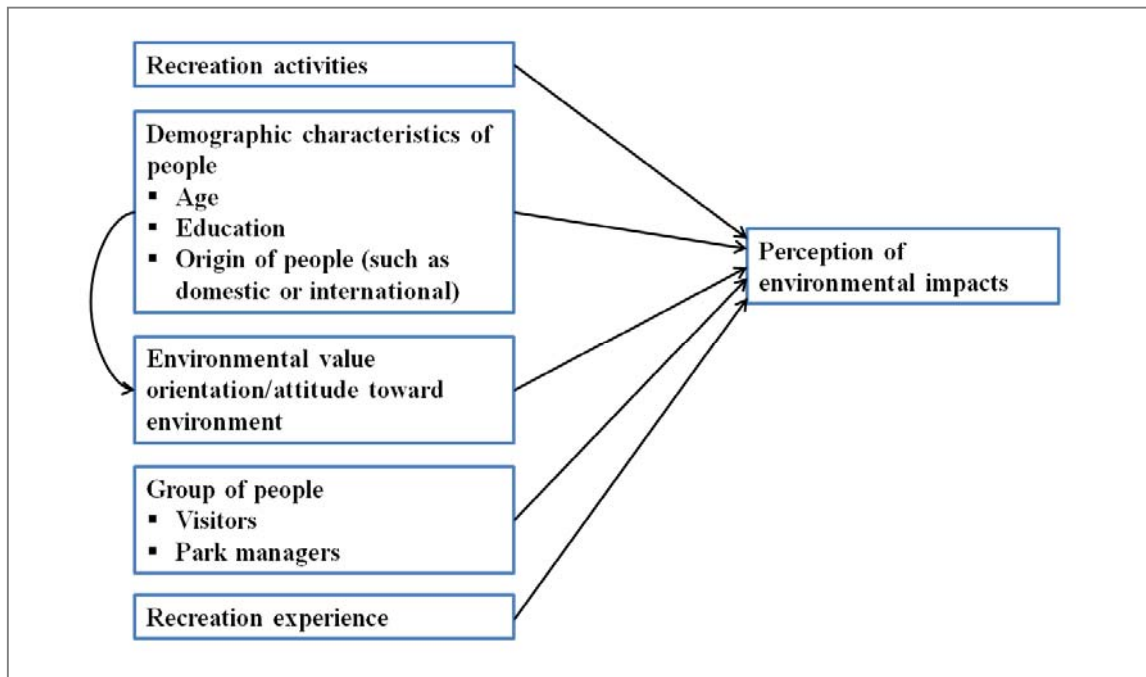


Figure 3-1 Factors affecting environmental impact perception

3.3 Methodology

3.3.1 Study Area

Located between 14°05' – 14°15' N latitude and 101°05' – 101°50' E longitude, and approximately 200 kilometers from Bangkok, KYNP is the first national park established in Thailand in 1962. The KYNP is the third largest park in the country, covering an area of 2,166 square kilometers (DNP, 2006b). The park encompasses a wide variety of habitats and forest types. There are more than 2,500 plant species, 70

different kinds of mammals and over 350 species of birds. Because of its unique characteristics and outstanding values, KYNP was enlisted as an ASEAN Heritage Park in 1984, designated a World Heritage Site in 2005, and enlisted as an Important Bird Area (IBA) designated by Birdlife International (DNP, 2006a). There are more than 20 tourism sites in KYNP with a rich diversity of plant species, plentiful wildlife, beautiful scenery, and an interesting cultural history. These provide various types of recreational opportunities for visitors, such as wildlife observation, hiking, jungle rafting, nature education and camping (DNP, 2006b). Many visitor facilities such as camp sites, parking areas, food stations, souvenir shops, visitor center, and other types of infrastructure have been built to provide visitors a comfortable and enjoyable national park experience. During the past ten years (2000-2009) KYNP was visited annually by more than 700,000 people (DNP, 2010), generating a lot of income for the national park. In recent years, environmental impacts of tourism development and visitor activities have been reported as significant concerns for KYNP management. Visitor-induced environmental impacts include impacts on soil and vegetation (especially around campgrounds and trails), water and noise pollution, accumulation of garbage, changes in wildlife behavior and habitat destruction.

Two campsite locations (Lam Takong and Pha Kluai Mai), three trail heads (Km. 33 – Nong Phak Chi, Visitor Center – Kong Keaw Waterfall, and Haew Suwat – Pha Kluai Mai Trail), and one trail end (Haew Narok Waterfall Trail) were selected for data collection (Figure 3-2). These locations were selected based on initial observations that

these were the preferred areas for the three specific visitor activities. Appendix A provides detail information about each site.



Figure 3-2 Data collection locations in KYNP

3.3.2 Bio-physical Impacts

To study existing bio-physical impacts caused by visitor activities in KYNP, current tourism/recreation impact related research studies were reviewed. According to the available research documents from DNP, KYNP, Thailand Library Integrated System (ThaiLIS) and the National Research Council of Thailand (NRCT), 153 research

studies were conducted in KYNP between the year 1963 and 2008 (see Appendix B for a list of the studies). These studies were classified into seven categories based on their topical concentration and primary objectives, including 1) wildlife, 2) plant, 3) environment, 4) policy, 5) socio-economic, 6) recreation/tourism, and 7) other issue (Table 3-1). Of these 40 studies were related to recreation and tourism; these studies were primarily focused on understanding visitor attitudes and opinion, satisfaction levels, motivation, and behavior. Only eight studies focused on visitor impacts (see Appendix C for an abstract of each study); therefore, the synthesis of bio-physical impacts of visitor activities is based on the eight studies. The assessment of the level of impact is based on this author's evaluation of the results presented in those studies.

Table 3-1 Number of research conducted in KYNP between 1963 and 2008

Time Period	Wildlife	Plant	Environment	Policy	Socio-economic	Tourism	Other	Total
1963-1970	6	1	1	0	0	0	0	8
1971-1980	7	1	3	2	1	0	1	15
1981-1990	3	1	6	1	4	6	0	21
1991-2000	15	3	1	2	3	12	4	40
2001-2008	27	13	1	2	0	22	2	67
Total	58	19	12	7	8	40	7	151

Sources: Compiled from various publications obtained from DNP, KYNP, Thailand Library Integrated System, and National Research Council of Thailand

3.3.3 Visitors' Ratings of Impacts

The second part of this study focuses on understanding visitors' ratings of the environmental impacts in KYNP, based on questionnaire interviews. Originally developed in English, and based on previously published literature, the questionnaire was translated in Thai and pilot tested before the actual survey. The questionnaire was divided into four sections: section one gathered general information about visitors' recreation activities and past experience; section two measured visitors value orientation based on the ecocentrism-anthropocentrism scale developed by Thompson and Barton (1994); section three focused on measuring perception of visitor-induced environmental impacts in KYNP; section four collected socio-demographic information. The full set of questionnaire is included as Appendix D.

Visitors' rating of environmental impacts in KYNP was measured using 18 impact items statements covering impacts on soil, vegetation, water, wildlife, and others, and one item measuring overall level of impact in KYNP. Respondents were required to rate the levels of impacts that they perceive, soliciting responses at a five-point scale: slight (1), somewhat (2), moderate (3), severe (4), and very severe (5). Visitors were asked to rank the top three activities that cause the most impacts. Surveys were conducted by trained interviewers to ensure a complete response and a high response rate. To avoid interviewers' bias, self-administered interviews which draw on core principles of the cognitive interview technique, were conducted (Bernard, 2000; Gabbert, Hope, & Fisher, 2010). Interview length varied between 15-20 minutes. Visitors were approached randomly and interviewed on site as they were completing

their activity for the day. A total of 628 surveys of domestic visitors were completed. The on-site interviews were conducted during January to February, 2009, during weekdays and weekends.

Data analysis is mostly descriptive. The study compares the results of bio-physical impact research with visitors' impact ratings to show if there is a difference in impact perception and reality, that is, do the results of bio-physical impact research support visitors' perceptions of environmental impacts?

3.4 Results

3.4.1 Existing Bio-physical Impacts of Tourism in KYNP

Soil impacts. The impacts that were commonly observed in KYNP include soil erosion, removal of humus layer, reduction in organic matter, and area of bare ground. There were also several user-created social trails (Figure 3-3). A review of past study on soil impacts conducted in KYNP suggests that impacts are mostly associated with camping and hiking. The key indicators of impacts used in these studies were infiltration rate, bulk density, total weight, and saturated soil hydraulic (K_s). Utarasakul (2001) examined hiking impacts along the Headquarter - Nong Phak Chi Trail and reported several locations showing soil erosion and muddiness. Nuampukdee (2002) examined hiking impacts on bulk density, total weight of soil, and water infiltration rate at two trails with different levels of use. This study indicated that values for these indicators differed significantly between disturbed and undisturbed sites. Nimsantichareun (2007) examined impacts along five hiking trails. On each trail, the saturated soil hydraulic (K_s)

was measured and compared across three plots with three levels of use: low, moderate, and high. Results indicated that the values for K_s between the three plots on each trail were significantly different. Based on these studies, it can be concluded that the level of soil impact in KYNP is “severe”.



Figure 3-3 Evidence of soil impacts in KYNP
(Source: Fieldwork, 2009)

Vegetation impacts. Field observations confirmed that vegetation impact in KYNP was wide spread, particularly around camping areas and hiking trails. Loss of ground cover, root exposure, introduction of exotic species such as palm tree around visitor center, removal of shrub and tree stem, and vegetation clearance were the common types of impacts. Other observations include tying trees with ropes to hang clothes, clearing saplings in camping areas and on trails, and felling trees to use as tent poles or for firewood (Figure 3-4). Past research shows that the type and average density

of plants in undisturbed locations adjacent to hiking trails was significantly higher compared to disturbed locations (Nuampukdee, 2002). However, the results could not clearly determine if the differences could be attributed to varying degrees of slope, plant communities and level of use. The DNP (2004) measured visitor impacts on plant communities along five hiking trails. Species richness, expressed as the Important Value Index (IVI), of tree and sapling of keystone species such as *Cinnamomum subavenium*, *Eurya nitida*, and *Syzygium pachyphyllum* were analyzed. Results show that the IVI of dominant species at the edges of the trails (disturbed areas) were significantly lower than those away from the trails (undisturbed areas). Based on these two studies, it can be concluded that vegetation impact in KYNP is “moderate”.



Figure 3-4 Examples of vegetation impacts in KYNP
(Source: Fieldwork, 2009)

Wildlife impacts. Wildlife is one of the major attractions of tourism in KYNP.

There are many activities associated with wildlife and these activities can cause negative

impacts to wildlife and their habitat in various ways. Visible impacts to wildlife observed in KYNP are shown in Figure 3-5. Wildlife feeding and behavior changes were the two major concerns, which had been mentioned frequently by KYNP officials and scholars as severe. Kanurai (2004) studied impacts of wildlife feeding on the population and behavior of macaques (*Macaca nemestrina*). The behavior of macaques and their presence along the road were observed. The study suggested that macaques were found along the road 83.3% of all observations. They were mostly found during 2:00 to 6:00 pm, and with a frequency of 6.01 macaques per hour. On average, the macaques received 2.2 pieces of food items per visitor. Sangjun *et al.* (2006) examined the effects of night spotlights on sambar deer (*Cervus unicolor*) behavior. The study found that the frequency of spotlights from visitors' cars did not affect deer responses. However, there were significant differences in the amount of time that the deer stopped eating when they were spotlighted. Deer stopped eating longer closer to the road than those further away from the road. In studies of bird watching, less experienced birders were mentioned as a significant threat to hornbills in KYNP (Intarak, 2005; Poonswad & Tsuji, 1994). Additionally, declining tiger (*Panthera tigris*) population and elephant (*Elephas maximus*) harassment have been frequently mentioned by KYNP officials. Based on these findings, this study considers wildlife impacts in KYNP as "severe".



Figure 3-5 Examples of wildlife impacts in KYNP

(Sources: 1 Fieldwork, 2009; 2 Kanurai, 2004; 3 Research Division, KYNP, 2009)

Water impacts. There are many water-related attractions within the boundaries of KYNP. These attractions naturally draw a large number of visitors and are also the primary locations for recreational developments. Field observations indicated that visitors were engaged in practices that were potentially harmful for the aquatic environment. These practices include, but not limited to, disposing waste (i.e., kitchen) water, and using detergent, shampoo, or soap directly in or close to water resources. Some examples are illustrated in Figure 3-6. The national park's research division (DNP, 2004) studied freshwater ecosystem and water quality of seven tourist sites where the temperature, pH, dissolved oxygen (DO), biochemical oxygen demand (BOD), and total coliform bacteria were measured. Also, the plankton diversity index was used to

measure the quality of water appropriate for the growth of aquatic life forms. Results indicated that surface water quality was good at all seven sites; visitor activities impacted water quality only at a low level. Results of the plankton diversity index showed that there was a moderate level of impact caused by the visitors. Similarly, Nimsantichareun (2007) analyzed water quality at six sites potentially affected by visitor activities. The study measured water temperature, pH, DO, BOD, transparency, and total coliform bacteria; results indicated that visitor activities affected water quality at a low level. Based on these studies, it can be concluded that water impact in KYNP is at the “somewhat” level.



Figure 3-6 Examples of visitor-induced water pollution in KYNP
(Sources: Fieldwork, 2009)

Noise pollution. Noise pollution has a very large effect on wildlife and may lead to psychological effects on the visitors. Two sources of noise pollution in KYNP are the motor vehicles and visitors (Figure 3-7). The DNP (2004) study measured the “equivalent continuous sound level” in a 24 hours time frame (L_{eq} 24 hr or a single value of sound level for any desired duration) at 11 sites. The United States Environmental Protection Agency has suggested that average decibels (dB) of wilderness area should be around 35 dB, and that L_{eq} 24 hr should not exceed 55 dB to avoid nuisance and impact on outdoor activities (Orlando, Perdelli, Cristina, & Piromalli, 1994). The KYNP study indicated noise level varied between 49.5 and 72.1 dB; seven sites recorded noise levels exceeding 55 dB. The American Speech-Language-Hearing Association (2009) has classified noise levels into five categories: faint (<30 dB); moderate (31-50 dB); very loud (51-80 dB); extremely loud (81-110 dB); and painful (>110 dB). In this study, two sites had noise levels at a moderate level and nine sites at very loud level. It can be concluded that noise pollution in KYNP is “severe”.



Figure 3-7 Primary sources of noise pollution in KYNP
(Source: Fieldwork, 2009)

Garbage accumulation. Although KYNP has attempted to improve garbage management system, the amount of garbage in KYNP has not declined, especially at major visitor sites, such as Lam Takong Campsite, Pha Kluai Mai Campsite, and Food Center (Figure 3-8). The quantity of solid waste collected in KYNP was 268.10 tons in 2003 which increased to 483.04 tons in 2007 (KYNP, 2008). Three studies were conducted on garbage management. In the first study, the amount of garbage was used as an indicator of impact; it showed that plastic was the most commonly found garbage along the hiking trails, and that there was a significant correlation between the number of visitors and the amount of garbage (Utarasakul, 2001). The second study examined garbage accumulation at Pha Kluay Mai Campsite and Heaw Suwat Waterfall, and found a positive relationship between visitor numbers and amount of garbage. Inadequate transportation and disposal of solid waste, insufficient bin, absence of waste recycling, and littering behaviors of visitors were determined as the primary reasons for ineffective waste management (Jaihaw & Panklang, 2001). The third study showed that KYNP visitors discarded three major types of garbage including left-over food, glass, and plastic bags (Phaiboonsombat, 2003). The highest quantity of garbage was collected from camping areas (1,415 kg./day and 1.19 kg./person/day). Also, there was a significant difference between the quantity of garbage between day-use and over-night use areas. It can be concluded that garbage accumulation in KYNP is a “very severe” problem.



Figure 3-8 Garbage accumulation in visitor sites in KYNP
(Source: Fieldwork, 2009)

The main results of bio-physical impact research in KYNP are summarized in Table 3-2.

Table 3-2 Summary of bio-physical impacts in KYNP

Impacts	Sites	Sources
Impacts on soil		
- Muddiness soil erosion	- Headquarters - Nong Phak Chi Trail	Utarasakul (2001)
- Changes in physical properties of soil (bulk density, total weight of soil, and water infiltration rate)	- Pha Kluai Mai-Haew Suwat Trail	Nuampukdee (2002)
- Soil compaction, or removal of litter and human layer	- Dong Tiew-Mo Sing To Trail	Nimsantichareun (2007)
- Reduction in organic matter	- Dong Tiew-Nong Pak Chee Trail	Field observation (2009)
- Area of bare ground	- Km 33 - Nong Pak Chee Trail	
- User-created social trails	- Pha Diew Dai Trail	
	- Lam Takong Campsite	
	- Pha Kluai Mai Campsite	
	- Kong Kaew Trail	
	- Haew Narok Trail	
Impacts on vegetation		
- Decreasing species richness	- Headquarter - Nong Phak Chi Trail	Nuampukdee (2002)
- Affects to plant communities (species richness)	- Pha Kluai Mai-Haew Suwat Trail	DNP (2004)
- Loss of ground cover	- Km 33 – Nong Phak Chee Trail	Field observation (2009)
- Root penetration	- Dong Tiew - Nong Phak Chee Trail	
- Introducing of exotic species	- Dong Tiew – Mo Sing To Trail	
- Removal of shrub and tree stem	- Khong Kaew Trail	
- Vegetation clearance	- Lam Takong Campsite	
- Tying trees with ropes to hang clothes	- Pha Kluai Mai Campsite	
- Clearing saplings	- Kong Kaew Trail	
- Felling trees to use as tent poles or for firewood	- Haew Narok Trail	
Impacts on Wildlife		
- Impacts of wildlife feeding on the population and behavior of macaques of sambar deer	- Along the roads in KYNP	Kanurai (2004)
- Wildlife disturbance	- Wildlife spotlighting route (13 kilometers from Km.33 to Training Center)	Sangjun, et al. (2006)
- Changes in habitat utilization of sambar deer	- Km 33 - Nong Pak Chee Trail	Field observation (2009)
- Some wildlife died because of car accident.	- Haew Suwat- Khao Laem Trail	
- Beggar monkeys	- Lam Takong Campsite	
- Wildlife on the road/ very close to the road	- Pha Kluai Mai Campsite	
- Habituated deer	- Pha Kluai Mai – Heaw Suwat Trail	
- Population ratio of monkey in wilderness area that was less than in tourist sites	- Kong Kaew Trail	
- Habitat modification	- Haew Narok Trail	
- The overall decrease in predator and increase in prey	- KYNP golf course	
	- Youth Camp	

Table 3-2 Continued

Impacts	Sites	Sources
Impacts on Water		
- Impact on growth of aquatic life	- Mo Sing To Reservoir	DNP (2004)
- Deterioration of water quality	- Hin Phoeng Creek	Nimsantichareun
- Increase the temperature of water resources	- Pha Kluai Mai Waterfall	(2007)
- Affect the growth of aquatic plants and bacteria	- Kong Kaew Waterfall	Field observation
- A film of un-burn oil on the water surface	- Haew Suwat Waterfall	(2009)
- Chemical contamination	- Haew Narok Waterfall	
- Sedimentation	- Takraw Waterfall	
	- Sarika Waterfall	
	- Lam Takong Campsite	
	- Pha Kluai Mai – Heaw Suwat Trail	
	- Kong Kaew Trail	
	- Haew Narok Trail	
	- Visitor Center	
Noise Pollution		
- Noise pollution from vehicles and visitors	- Sarika Waterfall	DNP (2004)
	- Haew Suwat Waterfall	Field observation
	- Kong Kaew Waterfall	(2009)
	- Haew Sai Waterfall	
	- Haew Pratoon Waterfall	
	- Haew Narok Waterfall	
	- Hin Phoeng Creek	
	- Pha Diew Dai view point	
	- Takraw Waterfall	
	- Visitor Centers	
	- Lam Takong Campsite	
	- Pha Kluai Mai Campsite	
Garbage		
- Garbage accumulation	- Headquarters - Nong Phak Chi Trail	Utarasakul (2001)
- Increasing in the amount of solid waste	- Pha Kluay Mai Campsite	Jaihaw & Panklang
	- Heaw Suwat Waterfall	(2001)
	- Visitor Center	Phaiboonsombat
	- Haew Narok Waterfall	(2003)
	- Lam Takong Campsite	Field observation
	- Pha Kluai Mai Campsite	(2009)
	- Youth Camp	
	- Kong Kaew Lodge	
	- Tanarat Lodge	

3.4.2 Domestic Visitors' Perception of Environmental Impacts

This section reports the results of 628 questionnaire interviews conducted with three types of domestic visitors: campers, hikers, and bird watchers (or birders). The respondents included 48.4% campers, 37.7% hikers, and 13.9% birders. Roughly 51% of the surveyed visitors is male, and the majority (47.8%) is 21-30 years old. Roughly 61.5% has completed undergraduate level education, and 86.7% is non-local residents. The three major occupation groupings are student (30.9%), private company employee (27.6%), and government employee (13.5%). The majority (34.3%) has annual income lower than Baht 120,000 (US\$1 = Thai Baht 33 approximate). Roughly 61.6% has visited KYNP before and 70.0% has had prior experience in their major recreation activity (i.e., bird watching, hiking, and camping) before their current visit to KYNP. The majority (93.0%) has selected KYNP as their primary destination for this trip. Most of the respondents (98.7%) visit KYNP as a group, especially with friends (49.2%). The average (38.2%) group size is between 2 – 5 people. Primary activities include camping (75.8%), photography (66.4%), hiking (61.5%), sightseeing (59.4%), and relaxing (48.9%). Roughly, 57.8% of participants stays in KYNP for one night. The main motivation for visiting KYNP is relaxation (46.7%), return to nature (34.2%), and enhancing family and friend affinity (27.2%).

Roughly two-third of participants agrees that visitor activities do cause environmental impacts. Of the 18 impact items, five items are reported non-existent by more than 20% of the visitors. These are soil erosion (23.9%), exposed tree roots (26.9%), presence of exotic plant (36.5%), turbidity (20.5%), and habituated deer

(20.9%). Camping (30.8%), cooking (30.3%), and picnicking (14.0%) are rated as the top three activities causing the most impacts (Table 3-3). Of the 34 items listed by visitors as major threats to KYNP's environment, the majority (18.6%) states garbage accumulation as the most significant threat, followed by visitor use and activities (12.0%) and lack of visitor awareness and responsibility (8.6%) (Table 3-4).

The majority (41.0%) rates the overall level of impact in KYNP as "moderate" with a mean of 3.31 ($n = 603$, $SD = 1.02$). The average rating of impact is between 2.48 (presence of non-native plant) to 3.98 (accumulation of garbage) on a five point scale. Of the 18 impact items listed on the questionnaire, 10 items are rated by the majority as "moderate". These are soil erosion (37.0%), bare ground (35.1%), exposed tree roots (29.2%), damaged trees/saplings/seedlings (32.4%), presence of non-native plant (28.8%), turbidity in local stream/river (33.5%), seeing wildlife on the road or very close to the road (30.8%), deer habituation (27.8%), noise from vehicles (30.3%) and noise from visitors (31.9%). Eight items are rated by the majority as "very severe". These include suspended solid matter on water surface (35.0%), solid waste in water (37.7%), monkeys waiting for food from the visitors (29.1%), conversion of natural area into developed area (34.6%), air pollution from vehicles (30.8%), bad smell from toilets, bin, garbage, etc. (30.1%), accumulation of garbage (48.7%), and disturbance to natural area by visitor activities, such as vehicles parked in unauthorized natural areas (28.4%).

Table 3-3 Visitors rating of the top three activities causing environmental impacts in KYNP

Activity	Number of visitor (%)		
	1 st (n = 406)	2 nd (n = 399)	3 rd (n = 383)
Water-based activities	7.9	4.8	8.1
Picnicking	14.0	21.6	24.8
Camping	30.8	26.6	15.1
Cooking	30.3	28.6	20.6
Bicycling	0.0	0.5	1.0
Wildlife observing	9.6	7.5	11.7
Hiking	5.7	6.8	8.6
Sight seeing	0.5	1.0	1.8
Rafting	0.5	2.3	3.1
Bird watching	0.0	0.0	0.5
Photography	0.0	0.5	1.0
Nature education	0.7	0.0	3.4
Total	100.0	100.0	100.0

Table 3-4 Major threats to the environment as per the domestic visitors

Major threats to environment	Number of respondents (%)
Tourism issues	
- Garbage	18.6
- Visitor use and activities	16.2
- Lack of awareness/responsibility	8.6
- Too many visitors	7.9
- Noise pollution from visitors	6.1
- Too many vehicles	5.1
- Inappropriate/vandalism behavior	4.8
- Vehicle exhaust pollution	4.8
- Uninformed visitor/lack of education	4.5
- Wildlife disturbance	3.0
- Facility development/ construction	2.5
- Noise pollution from vehicles	2.2
- Natural area disturbance	1.5
- Lack of cooperation from visitors	1.2
- Consume more natural resources	0.8
- Visitors need more convenience	0.4
- Over site's carrying capacity	0.2
- Big events, such as concert	0.1
Administration issues	
- Lack of management	3.1
- Lack of law enforcement	1.2
- More tourism development	1.0
- Did not provide information to visitors	0.8
- Unplanned development	0.8
- No park ranger	0.4
- Unsuitable policy	0.2
Broader environmental/global issues	
- Nature itself	1.0
- Technology development	0.5
- Forest fire	0.4
- Natural disasters	0.4
- Global warming/ climate change	0.2
- Environmental degradation	0.2
Illegal activities	
- Illegal forest harvesting	1.3
- Illegal hunting	0.2
- Illegal land owner	0.2
Total	100.00

3.4.3 Differences between Real and Perceived Impacts

Table 3-5 shows visitors' ratings of the impacts. They rate soil erosion and bare ground as "moderate" (mean = 3.257, n = 528, SD = 1.050). In contrast, results of the recreation ecology study show that soil impact is "severe". Similarly, vegetation impacts (exposed tree roots, damaged trees/saplings/ seedlings, and presence of non-native plants) are rated by the visitors as "moderate" (mean = 2.833, n = 576, SD = 1.000). This is also the conclusion of recreation ecology research on vegetation. Visitors perceive impact on water quality (turbidity in local stream/river, suspended solid matter on water surface, and solid waste in water) as "severe" (mean = 3.507, n = 595, SD = 1.804). In contrast, recreation ecology studies show that water quality is "somewhat" impacted. The impact on wildlife (monkeys waiting for food from the visitors, seeing wildlife on the road or very close to the road, and habituated deer) is rated by the visitors as "moderate" (mean = 3.245, n = 562, SD = 1.086), whereas recreation ecology research show wildlife as "severe". Visitors rate noise level as "moderate" (mean = 3.390, n = 596, SD = 1.100). In contrast, recreation ecology research shows this as "severe". Most visitors perceive accumulation of garbage as "severe" (mean = 3.984, n = 608, SD = 1.248) whereas recreation ecology research shows it as "very severe". The results indicate that, overall, with the exception of vegetation and water impacts visitors perceive environmental impacts as "*less severe*" than actual impacts. The comparison of results from recreation ecology research and visitor perception research is shown in Table 3-6.

Table 3-5 The average of visitors' rating of environmental impacts in KYNP

	Impacts	n	Mean	S.D.	Overall level of impact (based on five-point scale)		
					Mean	S.D.	Level
Soil	- Erosion	478	2.994	1.177	3.057	1.050	Moderate
	- Bare ground	507	3.168	1.185			
Vegetation	- Exposed tree root	459	2.802	1.223	2.833	1.000	Moderate
	- Damaged tree	547	3.112	1.236			
	- Present of exotic plant species	399	2.484	1.207			
Water	- Suspended solid	531	3.654	1.290	3.507	1.804	Severe
	- Solid waste in water	565	3.683	1.334			
	- Turbidity	499	3.152	1.199			
Wildlife	- Monkeys waiting for food from the visitors	530	3.509	1.302	3.245	1.086	Moderate
	- Wildlife on the road or close to the road	506	3.109	1.284			
	- Dear are not afraid to visitors	497	3.155	1.319			
Noise pollution	- Vehicular noise	578	3.426	1.212	3.390	1.110	Moderate
	- Noise from visitors	583	3.400	1.196			
Garbage accumulation		608	3.984	1.248	3.984	1.248	Severe

Table 3-6 Differences between actual and perceived impacts in KYNP

Impact	Actual Impact*			Perception of impact*
	Sources	Level of impact	Overall level of impact	
Impacts on soil	Utarasakul (2001) Nuampukdee (2002) Nimsantichareun (2007) Field observation (2009)	Somewhat Moderate Very severe Severe	Severe	Moderate
Impacts on vegetation	Nuampukdee (2002) DNP (2004) Field observation (2009)	Moderate Moderate Moderate	Moderate	Moderate
Impacts on water	DNP (2004) Nimsantichareun (2007) Field observation (2009)	Moderate Slight Somewhat	Somewhat	Severe
Impacts on wildlife	Kanurai (2004) Sangjun, et al. (2006) Field observation (2009)	Moderate Moderate Very severe	Severe	Moderate
Noise pollution	DNP (2004) Field observation (2009)	Severe Severe	Severe	Moderate
Garbage accumulation	Utarasakul (2001) Jaihaw & Panklang (2001) Phaiboonsombat (2003) Field observation (2009)	Moderate Severe Very severe Very severe	Very severe	Severe

* Based on five-point scale

3.5 Discussion

Despite the limitation of this research, due to the small number of recreation ecology studies reported in this paper, the results reported in this study provide some interesting observations. It should be noted that the recreation ecology research conducted in KYNP is primarily descriptive than analytical. While the studies indicate that the level of impacts varies with the amount of use (DNP, 2004; Jaihaw & Panklang, 2001; Nimsantichareun, 2007; Nuampukdee, 2002; Phaiboonsombat, 2003; Utarasakul, 2001), visitor behavior (Kanurai, 2004; Phaiboonsombat, 2003; Utarasakul, 2001), season (Sangjun *et al.*, 2006), site characteristics (Nuampukdee, 2002), and site (day or overnight-used area) (Phaiboonsombat, 2003), there is not enough evidence to test the reliability of the results reported in these studies. Nevertheless, these results are consistent with many studies carried out elsewhere, for example, in the US (Cole, 2004; Leung & Marion, 2000), Australia (Buckley, 2004a; Hillery *et al.*, 2001; Sun & Walsh, 1998), Canada (Nepal & Way 2007), China (Deng *et al.*, 2003), and Nepal (Nepal, 2003).

The other limitation of bio-physical impact study in KYNP is the research design. Impact studies conducted in KYNP applied descriptive surveys and comparison of used and unused sites. Although, the descriptive and comparison methods have been applied at diverse locations and in different countries, the research reported in KYNP do not provide detail information on the methodology. Hence, the reliability of the research results is questionable. Also, most are short-term studies conducted by independent researchers; efforts to institutionalize research in KYNP are very limited.

Despite the research limitations noted above, results presented in this paper are interesting. The study shows that, overall, visitors perceive impacts to be less severe than they really are. The results support the hypothesis that there are differences in actual and perceived impacts. Also, one third of the respondents do not perceive recreation and tourism as a threat to the park. Moreover, more than 20% of visitors do not recognize five items of impacts as consequences of visitor activities. These are soil erosion, exposed tree roots, presence of exotic plant, turbidity, and habituated deer. The results are consistent with previous studies on environmental impact perception which have frequently concluded that visitors did not perceive their own impacts on environmental conditions; what they noticed was the impacts from visitors in other activities (Hillery *et al.*, 2001; Manning, 1999). The study findings are also conflicting. The majority of visitors noted visitor activities, lack of awareness/responsibility of visitors, and too many visitors as major threats to environment in KYNP. However, they still want to visit the park. This has tremendous implications for managing visitor impact in KYNP and clearly shows that KYNP needs to make a significant effort in visitor education. Visitors need to understand how they use natural resources and what potential impacts may result from their activities.

The findings of this study, that visitors tend to perceive the impact to be less serious than actual impact, is consistent with the findings from other studies, including a study in Central Australia (Hillery *et al.*, 2001), in China's Zhangjiajie National Forest Park (Deng *et al.*, 2003), and in the Central Coast Region of Western Austria (Priskin, 2003). However, this conclusion requires a note of caution. The types and levels of

impacts reported by the recreation ecology researchers in KYNP are primarily based on their conclusions. The results are based on different measurement scales, different standards, and different approaches. The visitors' perception of environmental impacts is dependent on what the visitor actually sees on the ground, or perceives as a result of his/her most recent experience in the park. Their perceptions can be influenced by many factors including perception of their peers. Their ratings are based mostly on what is observable and does not include other invisible impacts, such as chemical and bacterial contamination in water.

The results indicate that visitors perceive the level of impact on water resources to be more severe than actual impact as reported by the recreation ecology study. This is different from the conclusions of other previous studies. Two assumptions are determined. First, visitors might be more sensitive with the impacts that directly relate to themselves or affect their health. Secondly, the levels of water impact are judged by comparing with the standard quality of surface water (National Environmental Board, 1992) for general purposes. If the researchers compare water quality measured in KYNP with different standards such as water quality for recreational area or wilderness area instead of the standard of surface water, the level of perceived water impact might be higher than what is reported in the research documents. Thus, indicators and standards of water quality specific for recreation activities in wilderness area are needed.

3.6 Conclusion

This study aims to provide an overview of current conditions of visitor-induced impacts in KYNP, based on previously conducted research on ecological impacts, and fieldwork on visitors' perception of those impacts. The most common bio-physical impacts include soil compaction, removal of litter and humus layer, reduction in organic matter, erosion, plant damage, vegetation cover loss, soil and root exposure, water quality deterioration, disturbance and feeding wildlife. Other environmental impacts include noise pollution and accumulation of garbage. These types of impacts are similar to impacts reported elsewhere in different countries.

Visitor perceptions of environmental impacts are examined and compared to actual impacts as reported in KYNP research documents. The results indicate that more than 30% of visitors do not recognized the negative results from their activities. With the exception of vegetation and water impacts, overall, visitors perceive the impacts as less severe than actual impacts. This finding supports previous perception studies which have concluded that visitors tend to perceive impacts from their activities to be less harmful than what exists in reality. The study indicates that KYNP visitors may be less aware of the negative consequences of their activities on the natural environments in the park. As such, the focus of visitor management strategy needs to be on education.

Based on the results of this study, it is suggested that KYNP make a significant effort to institutionalize recreation ecology research, with the objective of conducting periodic assessment and monitoring of bio-physical impacts and visitor perception of impacts. Impact studies need to be conducted at different time periods and in different

locations so as to help develop an impact management plan that is current and is based on locational factors. The results clearly indicate that KYNP needs to strengthen its environmental education programs. Visitors need to be made aware of the negative consequences of their activities, and also reinforce positive behavior amongst those who are aware of these issues. When visitors' understanding about environmental impacts is improved, they might be more aware of the outcomes of their activity and behavior. This could help reduce high-impact behavior of visitors and encourage visitors to perform environmentally friendly actions.

CHAPTER IV
ENVIRONMENTAL IMPACT RATING:
COMPARISON BETWEEN PARK OFFICIALS, DOMESTIC, AND
INTERNATIONAL VISITORS IN KHAO YAI NATIONAL PARK, THAILAND

4.1 Introduction

National parks play an important role in the development and management of tourism and recreation opportunities. Providing recreation opportunities to the people is one of the dual mandates of a national park, the other being protection of biological and cultural resources. The development and growth of tourism in national parks presents a paradoxical situation. Economic benefit is a major positive impact of tourism to a national park and surrounding communities. Tourism can increase jobs and income for local people, improve living standards, establish and improve infrastructure around neighboring communities, and provide opportunities for local employees to improve and learn new skills (Eagles *et al.*, 2002). Also, tourism can increase financial support for conservation (Bushell & Eagles, 2007). When poorly managed, the development of tourism can cause significant problems for national parks due to adverse impacts of visitor activities, for example, ecological degradation, loss of biodiversity, habitat fragmentation and isolation, wildlife disturbance, and deterioration of visitors' experience. Although many national parks have implemented various types of visitor management strategies, visitor impacts have remained a critical issue due to the higher

number of users, diverse use types, concentration of visitor activities at a few locations, and the overall ecological sensitivity of the park.

Balancing the growth in tourism demand and at the same time protecting the natural environment is an important issue that national park managers must address. Knowledge of users' perception of environmental impacts has been considered an important element in the management and provision of quality recreation opportunities (Cressford, 2000; Priskin, 2003). In the context of tourism in national parks, there are two important groups of stakeholders involved in, and affected by, tourism. The first group is park officials, representing the government authority they are responsible for the day to day operations and management of the park. The other group is the visitors who consume the natural resources and generate impacts as a result of their interactions with nature. Therefore, it is critical to understand the perception of park officials when determining appropriate levels of management interventions. Likewise, it is also important to understand the visitors' perspective of essential elements that make their visit to a national park enjoyable and their relationship with the park enduring. Thus, knowledge about how each group of users perceives impacts in a national park is a critical aspect of effective management. This study compares the perception of environmental impacts of recreation and tourism between park officials and visitors in Thailand's Khao Yai National Park (KYNP). The primary objectives of this study are to 1) examine the perception of three groups of stakeholders – KYNP officials, domestic, and international visitors; and 2) analyze if perceptions differ between the three groups

of stakeholders. Consequently, suggestions for impact management and future research are discussed based on the research findings.

4.2 Literature Review

4.2.1 Perception of Environmental Impact

Perception studies have been conducted in many disciplines, such as environmental psychology, human behavior, architecture, and education (Bechtel & Churchman, 2002). Many studies have been conducted to explore the factors affecting perception. Primary factors which have been identified to influence perceptions include gender, education, social class, economic status (Zebroski, 2007), attitude and belief (Fazio & Roskos-Ewoldsen, 2004), knowledge, and emotional tension (Bonnes *et al.*, 2003). Perception research is very common in outdoor recreation and tourism studies (Chin *et al.*, 2000; Manning, 1999; Priskin, 2003). At least three different types of perception research have been conducted from a recreational perspective: perception of conflict, perception of crowding, and perception of environmental impacts. Perception of conflict is recognized as a primary source of psychological impact affecting visitor's experience (Eagles *et al.*, 2002). Perception of crowding, as a psychological phenomenon, refers to the restrictive aspect of limited space that is perceived by visitors (Bonnes *et al.*, 2003). Perception of environmental impacts refers to how visitors perceive about changes in environmental conditions (Symmonds *et al.*, 2000).

Understanding visitors' perception of the environmental impacts is critical for providing a quality experience. Research results can be used to develop strategies that

can improve visitor's behavior to be more environmentally friendly. Past research on this topic has focused on three key aspects: 1) visitors' ability to recognize or determine the impact, 2) the perceived importance of impact conditions relative to other aspects of the setting, and 3) the evaluation of a given condition as desirable or undesirable (Graefe *et al.*, 1984). Impact perceptions have also been studied in association with issues about acceptability of impacts and satisfaction with undesirable changes in environmental conditions (Deng *et al.*, 2003; Floyd *et al.*, 1997).

Manning (1999) argues that research on environmental impact perception is somewhat limited compared to other visitor perception studies. Moreover, although impact perception has been frequently studied in recreation and tourism context, there is a paucity of research on relating it to current actual bio-physical impacts. Visitor perceptions are dependent on a multitude of factors, for example, the type(s) of recreation activity visitors engage in, recreational goals of various user groups, visitors' background, environmental knowledge, and awareness of resource management objectives (Hammit & Cole, 1998). Environmental impact perceptions at a particular site are often different from reality (Deng *et al.*, 2003; Priskin, 2003). Individuals may see the same level of impact differently (Graefe *et al.*, 1984; Hillery *et al.*, 2001). This could be based on the effect of age, education, origin of visitor, (Leujak & Ormond, 2007; Priskin, 2003), skill level (Leujak & Ormond, 2007; Symmonds *et al.*, 2000), and value orientation (Raadik & Cottrell, 2007). Also, studies have found that differences exist in perception of impacts of a recreation activity between resource managers and visitors (Farrell *et al.*, 2001; Priskin, 2003) and visitors in different activities (Hillery *et*

al., 2001). Moreover, visitors often underestimate their own impacts because they perceive that the other groups sharing the same resource cause more impact than they do (Priskin, 2003; Symmonds *et al.*, 2000).

4.2.2 Visitor versus Manager Perception

The differences in perceptions between park officials and visitors have been examined in several studies. The differences are dependent on several variables. For example, the meanings and purposes of a national park are different among individuals and vary overtime (Manning, 1999; Stankey & Lucas, 1984). For park officials, a national park is their place of work and they are responsible for protecting its natural resources. For visitors, it is a place to enjoy and relax. These different purposes could be the fundamental reason of the differences of appropriate use and impact perception among the two groups of people.

The concept of judgment has been used to explain the difference of perception as well (Pickering & Hill, 2007). The judgment is associated with cognitive aspect that refers to the evaluation of evidence or situation in the formation of making a decision. The formal process of evaluation has to consider a set of conditions and criteria (Kaplan & Kaplan, 1989). A park official's judgment may be based on management plan and policy while a visitor may construct his/her judgment based on satisfaction with the park visit (Kaplan & Kaplan, 1989). Also, a park official is more oriented to natural environment; thus they tend to be greatly concerned with bio-physical impacts, especially from visitors use (Manning, 1999; Stankey & Lucas, 1984). The park official

might attempt to control these impacts by enforcing the rules and regulations on visitors while visitors do not perceive any impact and resist the enforcement.

The differences of perceptions between park officials and visitors can also be explained through the application of sense of place theory. This theory refers to the meaning of place held by an individual or group based on their experience, relationship, and emotion that they have with the place (Tuan, 1977). In this sense, places refer to physical settings with three components including physical setting, human activities, and psychological process in there (Stedman, 2003). Sense of place comprises of both the cognitive and affective aspects of the human-environment relationship (Farnum, Hall, & Kruger, 2005). The sense of place can differ among groups of people, cultural, and race/ethnicity (Farnum *et al.*, 2005). Thus, individuals with different sense of place could perceive the changes in the quality or conditions of a site differently (Farnum *et al.*, 2005; Kaplan & Kaplan, 1989).

4.3 Methodology

4.3.1 Study Area

Located between 14°05' – 14°15' N latitude and 101°05' – 101°50' E longitude, and approximately 200 kilometers from Bangkok, KYNP is the first national park established in Thailand in 1962. The KYNP is the third largest park in the country, covering an area of 2,166 square kilometers (DNP, 2006b). The park encompasses a wide variety of habitats and forest types. There are more than 2,500 plant species, 70 different kinds of mammals and over 350 species of birds. Because of its unique

characteristics and outstanding values, KYNP was enlisted as an ASEAN Heritage Park in 1984, designated a World Heritage Site in 2005, and enlisted as an Important Bird Area (IBA) designated by Birdlife International (DNP, 2006a). There are more than 20 tourism sites in KYNP with a rich diversity of plant species, plentiful wildlife, beautiful scenery, and an interesting cultural history. These provide various types of recreational opportunities for visitors, such as wildlife observation, hiking, jungle rafting, nature education and camping (DNP, 2006b). Many visitor facilities such as camp sites, parking areas, food stations, souvenir shops, visitor center, and other types of infrastructure have been built to provide visitors a comfortable and enjoyable national park experience. During the past ten years (2000-2009) KYNP was visited annually by more than 700,000 people (DNP, 2010), generating a lot of income to national park. In recent years, environmental impacts of tourism development and visitor activities have been reported as significant concerns for KYNP management. Visitor-induced environmental impacts include impacts on soil and vegetation (especially around campgrounds and trails), water and noise pollution, accumulation of garbage, changes in wildlife behavior and habitat destruction.

Two campsite locations (Lam Takong and Pha Kluai Mai), three trail heads (Km. 33 – Nong Phak Chi, Visitor Center – Kong Keaw Waterfall, and Haew Suwat – Pha Kluai Mai Trail), and one trail end (Haew Narok Waterfall Trail) were selected for data collection. These locations were selected based on initial observations that these were the preferred areas for the three specific visitor activities.

4.3.2 Visitors' Rating of Impacts

Visitors' ratings of current environmental impacts in KYNP were measured through a questionnaire survey. Originally developed in English, and based on previously published literature, the questionnaire was translated in Thai for domestic visitors and pilot tested before the actual survey. Visitors' ratings of impacts was measured using 18 impact items statements covering impacts on soil, vegetation, water, wildlife, and others, and one item of overall level of impact in KYNP. Respondents were required to rate the levels of impacts that they perceive, soliciting responses at a five-point scale: slight (1), somewhat (2), moderate (3), severe (4), and very severe (5). Visitors were also asked to rank the top three activities that cause the most impacts. They were asked to provide a list of the major threats to the environmental conditions in the park.

Surveys were conducted by trained interviewers to ensure a complete response and a high response rate. To avoid interviewers' bias, self-administered interviews which draw on core principles of the cognitive interview technique, were conducted (Bernard, 2000; Gabbert *et al.*, 2010). Interview length varied between 15-20 minutes. Visitors were approached randomly and interviewed on site as they were completing their activity for the day. A total of 668 surveys were completed (628 domestic and 40 international visitors). For international visitors, maximum of two visitors were interviewed per one tour group; each tour group constituted an average of 15 tourists. Only English-speaking international visitors were selected. The on-site interviews were conducted during January to February, 2009, during weekdays and weekends.

4.3.3 Park Officials' Rating of Impacts

Based on a purposive sampling approach, park officials responsible for tourism management in KYNP and willing to participate in the survey were selected for interviews. A total of 38 interviews were completed. This included nine interviews at Lam Takong Campsite, seven at Haew Narok Waterfall site, six at Pha Kluai Mai Campsite, five at the visitor center, five at Haew Suwat Waterfall site, three at the national park administrative office, two at the Research and Resources Development office, and at the Accommodation office. The interviews were conducted face-to-face, and guided by a semi-structured questionnaire. All interviews were conducted in Thai, interview length varied between 20-57 minutes, with an average of 30 minutes. The 22 interviews were recorded on an audio-tape. The interviews were guided by questions related to: 1) informants' background and working experience, 2) general information about KYNP and opinions on tourism development, and 3) opinions about environmental impacts of tourism and tourism management. This was then followed by a measurement scale consisting of 18 impact item statements and one item of overall level of impact, similar to the one applied in measuring the visitors' perception. The full set of interview checklist is included in Appendix D.

Data analysis consists of descriptive statistics and measures of differences. Statistical comparisons are made to test the hypothesis if differences in impact ratings exist between visitors and park officials. The comparisons are made based on the means of the total samples of each group of users. Because the dependent variable (impact rating) is in ordinal scale, an ordinal regression is performed to investigate the

relationship between impact ratings and predictor variables such as gender, age, education, and recreation experiences. The ordinal regression model is better suited as it can avoid heteroscedastic and non-normal errors (Long & Freese, 2006). SPSS (Version 16) was used for data coding, processing and analysis (SPSS, 2007).

4.4 Results

4.4.1 Tourism Development in KYNP

This section summarizes tourism development issues in KYNP from park officials' perspectives. The officials informed that tourism development has been a priority ever since the park was established in 1962. During its early year, tourism development in the park was overseen by the Tourism Promotion Unit (renamed Tourism Authority of Thailand in 1979); KYNP administration had a very nominal role in the development of tourism within park boundaries, as park officials were more focused on natural resource protection. The early years experienced significant alteration in the park's boundaries, primarily due to conversion of park land to farmland and built-up areas. Illegal activities including forest product harvesting, logging, poaching, and disputes with land owners were the major threats to the park. With major infrastructure improvements during the 1980s, including the construction of a highway to the park and establishment of several accommodation facilities, a hotel and a golf course, KYNP became a major tourism destination for residents from Bangkok. Park related businesses multiplied and prospered at the expense of the natural environment. In 1992, as a result of heightened awareness of environmental issues in the park, the Khao Yai Hotel and

Golf Course, a premier facility in the country, was closed. However, despite the closing of the hotel and golf course in the park, various campaigns have been launched to promote tourism in national parks. For example, in 2000, the Royal Forestry Department and the Tourism Authority of Thailand launched the “Visit Park Thailand” to encourage people to visit national parks. During the International Year of Ecotourism in 2002, KYNP was promoted as a premier ecotourism destination. In 2005, its designation as a World Heritage Site fuelled further growth in visitor numbers. In 2008, KYNP generated Baht 65.75 million (approximately 1.9 million US dollars) in tourism revenue (DNP, 2009b).

Focusing on tourism impacts, park officials were asked to briefly describe the positive and negative impacts of tourism development in KYNP. The main positive benefits identified were job opportunities for local people, and tourism business owners. Roughly, half of the administration budget comes from tourism revenue (entrance fees, food purchases, and camping fees). Also, KYNP officials receive some direct benefits, for example, wildlife observation fees and profits from the food center operated by KYNP are shared with park officials. As for negative impacts, environmental degradation, declining predator population, garbage accumulation, overcrowding, overuse of natural resources, and wildlife disturbance are considered as the main challenges. The high number of visitors to the park, inappropriate visitor behavior, lack of visitor awareness, and increasing number of vehicles to the park were listed as the major causes of environmental impacts.

Visitor management strategies identified by the park officials include the control on visitor numbers, reservation requirement for overnight stays, noise prohibition after 10:00 pm, and prohibition of musical instruments in certain areas, alcohol consumption, and wildlife feeding. The park officials complained of visitors who violate national park rules and regulations, and a general lack of visitor awareness of environmental issues. Also mentioned were lack of strict enforcement of rules, as indicated by a park official who stated that during his 20 years in KYNP as enforcement personnel he never issued a citation and just warned the violators. National level policy preference for economic development was also cited as a problem.

4.4.2 Park Officials' Rating of Environmental Impacts

Results of the interviews with officials show that 73.7% is male, the majority (39.5%) is between 21-30 years old and 34.2% has completed high school. Roughly 56.2% is a local resident (living in Saraburi, Nakhon Nayok, Nakhon Rachasima, and Prachinburi). Their work experiences in KYNP vary between six months to 31 years, with an average of nine years. The majority (39.5%) has worked in the park less than five years.

All KYNP officials agree that visitor activities do indeed cause environmental impacts. They identify 12 sources of threats to KYNP; 27.3% states that high visitor numbers is the primary problem and another 16.4% indicates specific types of visitor activities as threats, while 14.6% refers to vandalism and inappropriate behaviors (Table 4-1). The majority (55.3%) judges the overall level of impacts in KYNP as “moderate”

with a mean of 3.34 ($n = 38$, $SD = 0.58$). The average impact rating scores is between 2.34 (presence of non-native plant) to 3.95 (monkeys waiting for food from the visitors) on a five point scale. Of the 18 impact items listed on the questionnaire, two items are rated by the majority as “somewhat”; these are soil erosion (33.3%) and solid waste in water (30.6%). Similarly, 11 items are rated by the majority as “moderate”; these are bare ground (28.6%), exposed tree roots (37.8%), damaged trees/saplings/ seedlings (31.6%), presence of non-native plant (44.7%), suspended solid matter on water surface (34.2%), turbidity in local stream/river (45.7%), seeing wildlife on the road or very close to the road (32.4%), conversion of natural area into developed area (39.5%), air pollution from vehicles (37.8%), bad smell from toilets, bin, garbage, etc. (39.5%), and noise from visitors (42.1%). Three items are rated by the majority as “severe”; these include deer habituation (25.0%), accumulation of garbage (42.1%), and disturbance to natural area by visitor activities, such as vehicles parked in unauthorized natural areas (34.2%). Vehicle noise is perceived to be a “moderate” to “severe” problem by the majority. Also, 46.0% considers monkeys begging for food from visitors as a “very severe” problem.

Table 4-1 Major threats to environment as perceived by KYNP officials, domestic, and international visitors

Major threats to environment	KYNP officials (%) (n = 55)	Domestic Visitors (%) (n =1008)	International Visitors (%) (n=79)
Tourism issues			
- Garbage	12.7	18.6	8.9
- Visitor use and activities	16.4	16.2	6.3
- Lack of awareness/responsibility	5.5	8.6	7.6
- Too many visitors	27.3	7.9	34.2
- Noise pollution from visitors	1.8	6.1	
- Too many vehicles		5.1	
- Inappropriate/vandalism behavior	14.6	4.8	5.1
- Vehicle exhaust pollution	3.6	4.8	3.8
- Uninformed visitor/lack of education	3.6	4.5	3.8
- Wildlife disturbance		3.0	
- Facility development/ construction		2.5	2.5
- Noise pollution from vehicles		2.2	2.5
- Natural area disturbance		1.5	
- Lack of cooperation from visitors	7.3	1.2	1.3
- Consume more natural resources		0.8	1.3
- Visitors need more convenience		0.4	1.3
- Over site's carrying capacity		0.2	1.3
- Big events, such as concert		0.1	
Administration issues			
- Lack of management		3.1	8.9
- Lack of law enforcement		1.2	
- More tourism development		1.0	
- Did not provide information to visitors		0.8	3.8
- Unplanned development		0.8	1.3
- No park ranger		0.4	
- Unsuitable policy		0.2	1.3
Broader environmental/global issues			
- Nature itself		1.0	
- Technology development		0.5	
- Forest fire		0.4	
- Natural disasters		0.4	
- Global warming/ climate change		0.2	
- Environmental degradation		0.2	
Illegal activities			
- Illegal forest harvesting		1.3	
- Illegal hunting		0.2	
- Illegal land owner		0.2	

4.4.3 Domestic Visitors' Rating of Environmental Impacts

This section reports the results of 628 questionnaire interviews conducted with three types of visitors: campers, hikers, and birders. The respondents included 48.4% campers, 37.7% hikers, and 13.9% birders. Roughly 51% of the surveyed visitors is male, the majority (47.8%) is 21-30 years old, 61.5% has completed undergraduate level education, and 86.7% is non-local. The three major occupation groupings are student (30.9%), private company employee (27.6%), and government employee (13.5%). The majority (34.3%) has annual income lower than Baht 120,000 (US\$1 = Thai Baht 33). Roughly 61.6% has visited KYNP before and 70.0% has prior experience in their major recreation activity (i.e., bird watching, hiking, and camping) before their current visit to KYNP. The majority (93.0%) has selected KYNP as their primary destination for this trip. Most of the respondents (98.7%) visit KYNP as a group, especially with friends (49.2%). The majority of group size (38.2%) is between two to five people (small group) with the mean of 9.3 people per group. Primary activities include camping (75.8%), photography (66.4%), hiking (61.5%), sightseeing (59.4%), and relaxing (48.9%). Roughly, 57.8% of participants stays in KYNP for one night. The main motivations for visiting KYNP are relaxation (46.7%), return to nature (34.2%), and enhancing family and friend affinity (27.2%).

Roughly two-third of participants agrees that visitor activities do cause environmental impacts. Of the 18 impact items, five items are reported non-existent by more than 20% of the visitors. These are soil erosion (23.9%), exposed tree roots (26.9%), presence of exotic plant (36.5%), turbidity (20.5%), and habituated deer

(20.9%). Of the 34 items listed by domestic visitors as major threats to KYNP's environment, the majority (18.6%) state garbage accumulation as the most significant threat, followed by visitor use and activities (12.0%) and lack of visitor awareness and responsibility (8.6%) (Table 4-1).

The majority (41.0%) rate the overall level of impact in KYNP as "moderate" with a mean of 3.31 ($n = 603$, $SD = 1.02$). The average rating of impact is between 2.48 (presence of non-native plant) to 3.98 (accumulation of garbage) on a five point scale. Of the 18 impact items listed on the questionnaire, 10 items are rated by the majority as "moderate". These are soil erosion (37.0%), bare ground (35.1%), exposed tree roots (29.2%), damaged trees/saplings/seedlings (32.4%), presence of non-native plant (28.8%), turbidity in local stream/river (33.5%), seeing wildlife on the road or very close to the road (30.8%), deer habituation (27.8%), and noise from vehicles (30.3%) and from visitors (31.9%). Eight items are rated by the majority as "very severe". These include suspended solid matter on water surface (35.0%), solid waste in water (37.7%), monkeys waiting for food from visitors (29.1%), conversion of natural area into developed area (34.6%), air pollution from vehicles (30.8%), bad smell from toilets, bin, garbage, etc. (30.1%), accumulation of garbage (48.7%), and disturbance to natural area by visitor activities, such as vehicles parked in unauthorized natural areas (28.4%).

4.4.4 International Visitors' Rating of Environmental Impacts

Interviews were conducted with 40 international visitors. Roughly 77.5% of the surveyed visitors is male, the majority (50.0%) is 21-40 years old, and 61.5% had completed graduate level education. Visitors are primarily from the USA (20.0%), U.K. (15.0%), Germany (10.0%), and Switzerland (10.0%). The majority (51.6%) has annual income more than US\$ 60,000. Roughly 67.5% has visited Thailand and 25.0% visited KYNP before this trip. The majority (67.5%) did not select KYNP as their primary destination for this trip. For their current visit, the majority (45.0%) is accompanied by their friends and group sizes are between two to five people in group (65.0%) with the mean of 2.4 people per group. The most favorite recreation activities are hiking (27.5%), sightseeing (22.5%), camping (12.5%), bird watching (12.5%), exploring nature (12.5%), wildlife watching (7.5%), and enjoy nature/relaxing (5.0%). The majority (82.5%) has had prior experience in their activity of choice during their current visit to KYNP. Roughly 57.5% has visited for day trip only (they stay in the hotels or resorts outside the boundary of KYNP). The main motivations for visiting KYNP are experiencing new things (25.0%), relaxing (25.0%), and returning to nature (22.5%).

Roughly 87.5% of the international visitors indicates that visitor activities do cause environmental impacts, while 12.5% think differently. Of the 18 items listed by international visitors as the most significant threats to KYNP's environment, the majority (34.2%) mentioned too many visitors as the most significant threat, follow by garbage accumulation (5.9%) and lack of awareness/ responsibility of visitors (7.6%) (Table 4-1).

The majority (55.3%) rate the overall level of impacts in KYNP as “moderate”, with a mean of 2.72 ($n = 40$, $SD = 1.176$). The average rating of impact is between 1.47 (presence of non-native plant) and 3.21 (monkeys waiting for food from the visitors) on a five point scale. Of the 18 items of impacts, 16 items are rated by the majority as “slight”. These are soil erosion (43.6%), bare ground (46.2%), exposed tree roots (43.6%), damaged trees/ saplings/seedlings (48.7%), presence of non-native plant (76.3%), suspended solid matter on water surface (56.4%), solid waste in water (51.3%), turbidity in local stream/river (48.7%), seeing wildlife on the road or very close to the road (33.3%), deer habituation (48.7%), air pollution from vehicles (35.9%), bad smell (from toilets, bin, garbage, etc.) (61.5%), accumulation of garbage (46.2%), disturbance to natural area by visitor activities, such as vehicles parked in unauthorized natural areas (46.2%), noise from vehicles (43.6%), and visitor noise level (59.0%). The majority (31.6%) rates conversion of natural area into developed area as “moderate”, and 30.8% rates the monkeys waiting for food from the visitors as a very “severe” problem.

4.4.5 Differences between Three Groups of Participants

Results of the three surveys conducted with park officials, domestic visitors, and international visitors are compared here to test the hypothesis that differences exist in perceptions between the three groups. Based on the average impact rating of each item (mean values), overall, the results indicate that domestic visitors tend to perceive impacts from visitor activities to be more severe than international visitors and KYNP officials. Similarly, international visitors tend to perceive impacts to be less severe than the other two groups (Figure 4.1).

Overall, domestic visitors perceive 16 types of impacts at a higher level than the other two groups. These are soil erosion, bare ground, exposed tree roots, presence of non-native plant, suspended solid matter on water surface, solid waste in water, turbidity in local stream/river, wildlife on the road or very close to the road, habituated deer, conversion of natural area into developed area, air pollution from vehicles, bad smell from toilets, bin, garbage, etc., accumulation of garbage, disturbed natural area by visitor activities such as vehicles parked in unauthorized areas, and noise pollution from vehicles, noise pollution from visitors. There are only two items of impacts that KYNP officials perceived at a higher level than the other two groups. These are damaged tree/sapling/seedling, and monkeys waiting for food from visitors.

The ANOVA results indicate significant differences in impact ratings between the three groups (Table 4-2). Therefore, the results support the hypothesis that there are differences in impact perceptions between KYNP officials, domestic visitors, and

international visitors. Except wildlife on the road or very close to the road, significant differences in perception are found across all items.

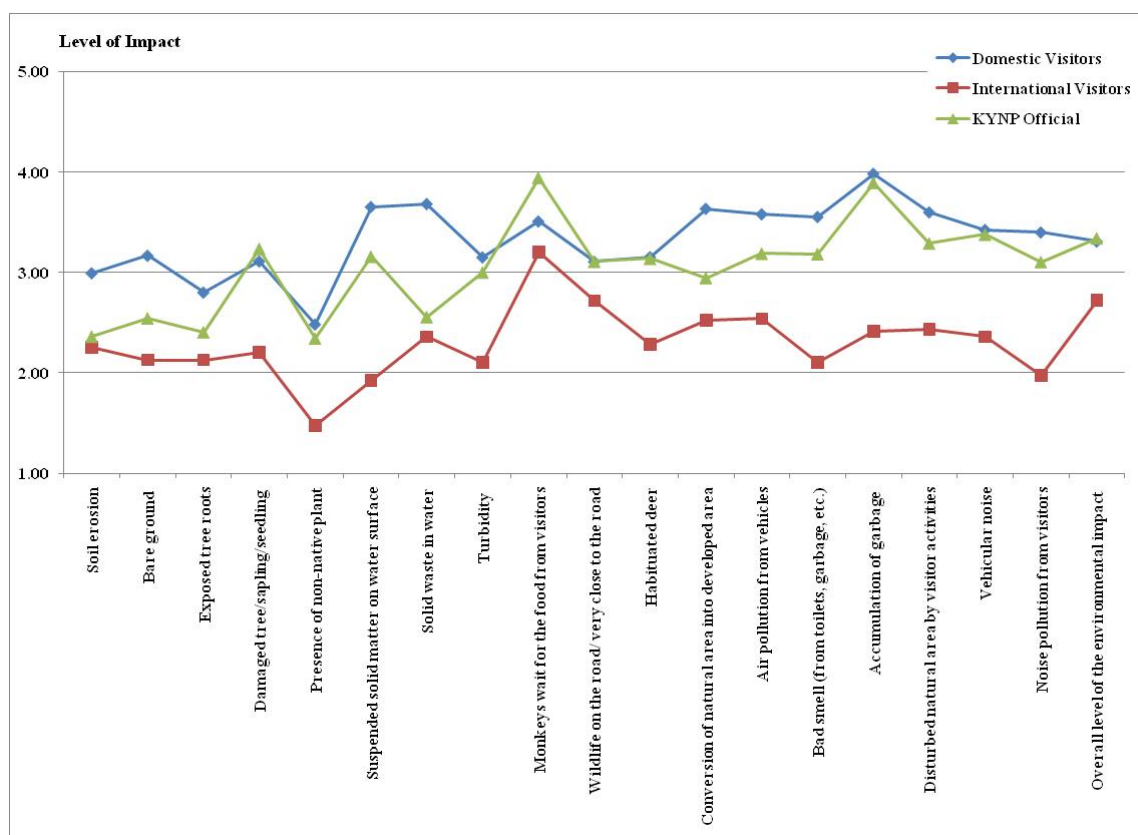


Figure 4-1 Comparison of impact ratings of KYNP officials, domestic and international visitors

Table 4-2 Comparison of environmental impact rating between KYNP officials, domestic, and international visitors

	Average Impact Score (based on five-point scale)			F	p
	Domestic Visitors	International Visitors	KYNP Officials		
Soil impacts					
– Soil erosion	2.994	2.256	2.361	11.050	0.000**
– Bare ground	3.168	2.128	2.543	17.100	0.000**
Vegetation impacts					
– Exposed tree roots	2.802	2.128	2.405	6.999	0.001*
– Damaged tree/sapling/seedling	3.112	2.205	3.237	10.119	0.000**
– Presence of non-native plant	2.484	1.474	2.342	12.776	0.000**
Water impacts					
– Suspended solid matter on water surface	3.654	1.923	3.158	34.647	0.000**
– Solid waste in water	3.683	2.359	2.556	27.692	0.000**
– Turbidity	3.152	2.103	3.000	13.853	0.000**
Wildlife impacts					
– Monkeys wait for the food from visitors	3.509	3.205	3.946	3.068	0.047*
– Wildlife on the road/ very close to the road	3.109	2.718	3.108	1.640	0.195
– Habituated deer	3.155	2.282	3.139	7.712	0.000**
Other impacts					
– Conversion of natural area into developed area	3.635	2.526	2.947	17.816	0.000**
– Air pollution from vehicles	3.581	2.539	3.189	13.918	0.000**
– Bad smell (from toilets, garbage, etc.)	3.554	2.103	3.184	23.913	0.000**
– Accumulation of garbage	3.984	2.410	3.895	28.621	0.000**
– Disturbance to natural area by visitor activities, such as vehicles parked in unauthorized areas	3.600	2.436	3.290	17.434	0.000**
– Vehicular noise	3.426	2.359	3.378	13.853	0.000**
– Noise from visitors	3.400	1.974	3.105	26.409	0.000**
Overall level of the environmental impact	3.310	2.725	3.342	6.323	0.002**

** Significant at @ 0.00 level.

* Significant at @ 0.05 level.

The effect of group of users, gender, age, and education level on impact ratings of park officials, domestic, and international visitors is analyzed. Ordinal regression analyses show that groups of users, education, and age are the factors which significantly relate to impact ratings (Table 4-3). The impact ratings are higher among domestic visitors, those with higher education levels, and people over 60 years of age.

Focusing on the differences of impact rating between domestic and international visitors, the effect of predictor variables, including group of visitors, gender, age, education, KYNP visitation experience, trip motivation, length of stay in KYNP, length of recreation experience, group type, and group size is analyzed. Results of ordinal regression analyses indicate that group of visitors, education, park visitation experience, length of stay in KYNP, length of recreation experience, and group size significantly influence impact ratings (Table 4-4). The results show that domestic visitors rate the impact more severely than international visitors. Likewise, visitors who have visited KYNP before this trip rate impact more severely than first-time visitors. Similarly, a person with higher level of education tends to rate the impacts more severely than a person with lower level of education. Also, impact ratings are higher among visitors who are part of a big group, stay longer in the park, and engage in major activity more than 10 times per year.

Table 4-3 Ordinal regression analyses of environmental impact ratings by KYNP officials, domestic, and international visitors

Variables	Categories	Estimation	Wald	Sig.
Group of users	Domestic visitors	0.128	0.151	0.698
	International visitors	-2.582	28.775	0.000***
	KYNP officials	-	-	-
Gender	Male	-0.025	0.030	0.862
	Female	-	-	-
Education	Lower than high school	-1.098	7.672	0.006**
	High school	-1.143	12.318	0.000***
	Vocational education	-0.600	3.912	0.048**
	Undergraduate	-0.490	3.582	0.058*
	Graduate	-	-	-
Age	Younger than 20 years old	-1.217	3.566	0.059*
	21-30 years old	-1.096	3.051	0.081*
	31-40 years old	-1.258	3.936	0.047**
	41-50 years old	-1.315	4.069	0.044**
	51-60 years old	-0.917	1.591	0.207
	Older than 60 years old	-	-	-

*** Significant at @ 0.000 level.

** Significant at @ 0.05 level.

* Significant at @ 0.1 level.

Table 4-4 Ordinal regression analyses of environmental impact ratings by domestic and international visitors

Variables	Categories	Estimation	Wald	Sig.
Group of users	Domestic visitors	2.947	61.296	0.000***
	International visitors	-	-	-
Gender	Male	0.082	0.300	0.584
	Female	-	-	-
Education	Lower than high school	-0.556	1.765	0.184
	High school	-0.647	3.930	0.047**
	Vocational education	0.003	0.000	0.993
	Undergraduate	0.089	0.129	0.720
	Graduate	-	-	-
Age	Younger than 20 years old	-0.070	0.012	0.913
	21-30 years old	-0.009	0.000	0.989
	31-40 years old	-0.243	0.152	0.696
	41-50 years old	-0.120	0.035	0.852
	51-60 years old	0.171	0.054	0.816
	Older than 60 years old	-	-	-
KYNP visitation experience	Have visited KYNP before this trip	-0.323	4.282	0.039**
	Never visited KYNP before this trip	-	-	-
Trip motivation	Anthropocentric approach	0.021	0.010	0.922
	Ecocentric approach	-	-	-
Length of stay in KYNP	One day trip (o night)	-0.559	5.528	0.019**
	1 nights	0.019	0.013	0.911
	More than 1 night	-	-	-
Frequency of activity	Less than 5 times per year	-0.527	2.567	0.109
	6-10 times per year	-0.564	2.818	0.093*
	More than 10 times per year	-	-	-
Group type	Group of friend	0.446	1.060	0.303
	Group of family	0.451	0.985	0.321
	Group of family and friend	0.470	0.972	0.324
	Tour group	0.154	0.023	0.880
	Visiting alone	0.588	0.652	0.419
	Other group type	-	-	-
Group size	1-2 people	-0.372	2.051	0.152
	3-5 people	-0.631	8.466	0.004**
	6-10 people	-0.256	1.647	0.199
	More than 10 people	-	-	-

*** Significant at @ 0.000 level.

** Significant at @ 0.05 level.

* Significant at @ 0.1 level.

4.5 Discussion and Conclusion

This study shows how environmental impact ratings vary between park officials, domestic and international visitors. While some results reported here are consistent with previous studies, others are somewhat contradicting. For example, two studies about campsite impacts at the Eagle Cap Wilderness in Oregon and Australian Alps Protected Areas reported that park managers rated impacts at a higher level than visitors (Martin, McCool, & Lucas, 1989; Pickering & Hill, 2007). In this study, it is the domestic visitors who rated the impacts at a higher level.

Studies have shown that the cognitive steps of mental transformation of information from the media to the reality that the receptors can be expected to encounter influences perceptions (Bonnes *et al.*, 2003; Pearce & Stringer, 1991; Rohall, Milkie, & Lucas, 2007). Information about KYNP including newspaper articles and magazines about Thailand's national parks may have influenced the domestic visitors' perception of impacts. The local media often portrays highly positive images of national parks and biodiversity of Thailand. The KYNP management has successfully marketed the natural resources of the Park as pristine, abundant, and diverse via different media channels. For example, *Osotho*, a local tourism magazine with one of the highest circulations in Thailand, always promotes tourism in KYNP in a positive way. Prior to their visit, the domestic visitors are likely to be less aware of the negative impacts of tourism and recreation in the park. Expectations of a high quality natural environment in KYNP may have been heightened with the designation of it as a World Heritage Site in 2005. When they visit the KYNP and observe some negative impacts, they are likely to be

disappointed, which in turn may influence how they rate the environmental conditions in the Park. Studies have shown that visitors with higher expectation might perceive environmental impacts more severe than perceived by others (Bonnes *et al.*, 2003).

The results indicate that highly educated people tend to rate the impacts at a higher level. It can be argued that well-educated people have high expectations from their travel; expect information-rich experiences, good service and management, and good quality of environmental conditions (Bushell & Eagles, 2007). The visitors to KYNP tend to be more educated; for example, the results from this study show that 61.5% had completed undergraduate and 8.3% had completed graduate level education. This is a likely factor why domestic visitor perceived impact more severe than KYNP officials. Also, there is a strong relationship between environmental concern and perception of impacts. Several literature suggest that people who have higher education level are more likely to be more environmentally concerned than people with low education level (Casey & Scott, 2006; Vaske, Donnelly, Williams, & Jonker, 2001). Several recent studies conducted in KYNP implied that park visitors show a high level of environmental concern. Naksiri (2000) observed the behavior of 20 birdwatchers, and found that the birdwatchers showed environmentally friendly behaviors, such as maintaining silence as they are walking, and limiting the group size to two or three individuals. Similarly, Anantachaimontree (2004) reported that many visitors to KYNP identified themselves as ecotourists, with a desire to participate in low-impact activities.

An important reason that could explain why the KYNP officials rated impacts lower than domestic visitors is insufficient knowledge about natural resource

conservation, as reported in Eawpanich (2001). The study found that the majority of KYNP officials (61.5%) had only a basic knowledge of natural ecological processes, and were poor in their knowledge about park related legal provisions, and use of non-edible forest products. The results of the study clearly show that environmental education should target not only the visitors but the park officials too. Aspects of curriculum content, length, delivery, and pre and post assessments are critical areas for further research.

Several factors could explain why international visitors rated impacts lower than domestic visitors and park officials. The first factor is time constraint. The majority (57.5%) of international visitors is day trippers, and is part of a tour group. Most visitors try to see as many attractions as possible during their short length of stay in Khao Yai. Their tour of KYNP is very structured and hardly any free time is available for self-guided excursions. Studies have shown that limited time spent in the park does not allow for visitors to make a more accurate observation of the conditions of the park they visit (Pickering & Hill, 2007). Thus, for future research, various methods for data collection that could potentially minimize the effect of survey time constraints should be looked into. These might include shortening the length of the questionnaire, distributing mail survey, interviewing visitors in hotels after their tour of KYNP, and recruiting tour guide as a facilitator for surveying the tourists.

Past experience is another factor which may influence environmental rating of international visitors. Lack of experience may cause people to misinterpret what they have seen (Bazerman & Moore, 1986). This could be supported by the fact that for the

majority of international visitors (75%) this was their first visit to the KYNP, and for many it is their first experience in a tropical rain forest environment. Also, frequency of engaging in major activity which refers to level of use is another factor influencing impact rating of visitors. This finding is similar to a study conducted in the Ras Mohammed National Park and at Sharm El Sheikh, South Sinai, Egypt, which concluded that snorkeling skills of visitors significantly affected perceptions of reef quality; a visitor with greater skills corresponded with higher ratings of impacts (Leujak & Ormond, 2007).

Group size is another factor that influences differences in impact ratings of domestic and international visitors. Previous studies have shown that group size is an important factor (Eagles *et al.*, 2002; Hammitt & Cole, 1998), which may explain why it is used as a management technique. For example, hikers are required to travel in a tight group of six on backcountry trails at the Moraine Lake area of Banff National Park to reduce the potential for bear–human conflict (Tucker, 2001). Based on the results, limited group size is recommended for managing impacts at KYNP.

CHAPTER V
ENVIRONMENTAL IMPACTS OF TOURISM:
PERCEPTIONS OF CAMPERS, HIKERS, AND BIRDERS

5.1 Introduction

Global trends indicate to a growing popularity of national parks as tourism destinations, giving rise to a paradoxical situation where tourism development undermines the very resources on which it depends. Tourism is expected to maintain the natural integrity of the park, and, simultaneously, provide exceptional recreational opportunities to the visitors. Tourism development contributes to promoting conservation, generating income and revenue, increasing job opportunities, enhancing infrastructure development, supporting economic activities, reducing consumptive uses of forest resources by the locals, and minimizing resource conflicts between the park and local communities (Eagles *et al.*, 2002). However, when poorly managed, the development of tourism and visitor uses can cause undesirable changes to environmental conditions of a park, such as soil erosion, alteration of plant communities, habitat fragmentation, alteration of wildlife behavior, and changes in water quality (Buckley, 2004b; DNP, 2004; Hammitt & Cole, 1998; Leung & Marion, 2000). These impacts not only affect ecological sustainability of a national park but also deteriorate the quality of visitors' experience (Bushell & Eagles, 2007; Manning, 2007). Sound environmental impact management is a critical issue due to the higher number of visitors, diverse use

types, visitor behaviors concentration of visitor activities at a few locations, and the overall ecological sensitivity of the park.

Social science research on recreation resource impacts typically examine issues of appropriate visitor numbers, visitor mix, length of stay, mode of travel, spatial and temporal use patterns, visitor experience and skill levels, attitudes, beliefs, values, perceptions (Bonnes *et al.*, 2003; Cressford, 2000; Fransson & Garling, 1999; Hillery *et al.*, 2001). Understanding visitors' attitude toward general aspects of the environment, and perceptions about issues related to social settings and conditions of natural resources are thus important elements of a visitor management strategy.

This study examines how different types of visitors perceive the impacts of tourism in a national park differently. Using Thailand's Khao Yai National Park (KYNP) as an illustration, this study examines: 1) if value orientation differs between three groups of tourists, i.e., campers, hikers, and birders; 2) if differences exist in ratings of impacts between the three groups of tourists, and 3) if certain factors are more important than others in influencing visitors' impact ratings.

5.2 Literature Review

5.2.1 Environmental Value Orientation

Several studies have shown that the relationship between visitors perceived impacts on the environment and cognitive factors of environmental attitudes are determined by environmental values orientation (Fransson & Garling, 1999; Vaske *et al.*, 2001). In other words, environmental value may be a predictor of environmental

attitude (Kellert, 1996; Schultz & Zelezny, 1999), which, in turn, may predict environmental behavior (Stern, 1992).

Environmental value orientation can be arranged along anthropocentric-ecocentric or biocentrism continuum (Thompson & Barton, 1994). Anthropocentrism and ecocentrism are two philosophical orientations that many environmentalists believe could explain human attitudes, perceptions, and behaviors towards environmental crisis (Deborah, 2003; Kortenkamp & Moore, 2001). The ecocentric value orientation is nature-centered, and views ecological community as a whole (Casey & Scott, 2006; Vaske *et al.*, 2001). It places emphasis on valuing nature for its own sake. According to this view, people are inseparable from the inorganic/organic nature that encapsulates them. In its most extreme form, ecocentrism affirms the equal value of all life-forms (Deborah, 2003). The opposite position to ecocentrism is anthropocentrism, which places human beings at the center of the universe (Casey & Scott, 2006).

Anthropocentrism also supports environmental conservation but sees it as motivated by self-interest, that is, human quality of life is dependent on the preservation of natural resources and quality of the environment (Thompson & Barton, 1994). The most extreme position of anthropocentrism views human beings as the only species that has value and, therefore, it is morally acceptable for human beings to work to benefit as much as possible by exploiting the natural environment (Deborah, 2003).

The ecocentrism-anthropocentrism scale consists of 33 multiple items: 12 items on the ecocentric scale express appreciating nature for its own sake, while 12 anthropocentrism items reflect a concern for environmental issues primarily because of

their effects on human quality of life, and general apathy about the environment is measured with nine items reflecting a lack of interest in environmental issues and a general belief that problems in this area have been exaggerated. These items were constructed based on the hypothesis that ecocentrism would be associated with a higher rate of conserving behaviors rather than anthropocentrism which has a lower rate of conserving behaviors (Casey & Scott, 2006). Responses are measured at a five-point scale, from strongly disagree (1) to strongly agree (5).

Another instrument developed to measure environmental attitude is the New Environmental Paradigm (NEP) scale (Dunlap & Liere, 1978). The revised version (in 2000) of the NEP scale consists of 15 Likert-scale items: three are limits-to-growth items, three anti-anthropocentrism items, three fragility of nature's balance items, three rejection of exemptionalism items, and three possibility of ecocrisis items (Dunlap, Liere, Mertig, & Jones, 2000). The NEP scale has been used in many studies and is considered a valid measure of environmental attitudes (Dunlap *et al.*, 2000; Pelstring, 1997). A similar attitudinal measurement scale, the Environmental Attitudes Scale (EAS), was developed by Kortenkamp and Moore in 2001 to measure a fairly new environmental mind-set that researchers believed was becoming a predominant influence. This scale uses 17 items which distinguish between internally and externally motivated pro-environmental attitudes; responses are recorded at a nine-point scale (Kortenkamp & Moore, 2001).

Studies of environmental value orientation attempt to determine the association between an individual's demographic characteristics, perception, social factors, and

environmental values. Furthermore, these studies analyze the impacts of value orientation on human behavior related to the environment. These studies have helped build a knowledge base on environmental psychology. However, there are two gaps in the literature. First, environmental attitude and value orientation have been studied mostly in the context of western attitudes and values toward the environment. There has been very little application of this concept in other cultures. Second, all measurement scales of environmental attitude have been developed and applied in the USA. The validity and reliability of the measurement scale need to be tested in other settings and cultures. This proposed research aims to fill these gaps.

5.2.2 Perception of Environmental Impacts

The contemporary concept of perception in social psychology has been defined as “the processes by which people perceive one another, and is an impression, a sense, or both, of personalities and social traits of others based on their behavior” (Roeckelin, 2006: 128). Perception is unique to each person and leads to preference judgment of individual. Therefore, from a recreational perspective, what individual prefers his/her experience to be, the environment that they choose to recreate in, and the impacts they associate with, are all based on their perceptions (Kaplan & Kaplan, 1989).

Perception studies have been conducted in many disciplines, such as environmental psychology, human behavior, architecture, and education (Bechtel & Churchman, 2002). Many studies have been conducted to explore the factors affecting perception. Primary factors which have been identified to influence perceptions include

gender, education, social class, economic status (Zebroski, 2007), attitude and belief (Fazio & Roskos-Ewoldsen, 2004), knowledge, and emotional tension (Bonnes *et al.*, 2003). Perception research is very common in outdoor recreation and tourism studies (Chin *et al.*, 2000; Manning, 1999; Priskin, 2003). At least three different types of perception research have been conducted: perception of conflict, perception of crowding, and perception of environmental impacts. Perception of conflict is recognized as a primary source of psychological impact affecting visitor's experience (Eagles *et al.*, 2002). Perception of crowding refers to the restrictive aspect of limited space that is perceived by visitors (Bonnes *et al.*, 2003). Perception of environmental impacts refers to how visitors perceive about changes in environmental conditions (Symmonds *et al.*, 2000).

Understanding visitors' perception of the environmental impacts is critical for providing a quality experience. Research results can be used to develop strategies that can improve visitor's behavior to be more environmentally friendly. Past research on this topic has focused on three key aspects: 1) visitors' ability to recognize or determine the impact, 2) the perceived importance of impact conditions relative to other aspects of the setting, and 3) the evaluation of a given condition as desirable or undesirable (Graefe *et al.*, 1984). Impact perceptions have also been studied in association with issues about acceptability of impacts and satisfaction with undesirable changes in environmental conditions (Deng *et al.*, 2003; Floyd *et al.*, 1997).

5.3 Methodology

5.3.1 Study Area

Located between 14°05' – 14°15' N latitude and 101°05' – 101°50' E longitude, and approximately 200 kilometers from Bangkok, KYNP is the first national park established in Thailand in 1962. The KYNP is the third largest park in the country, covering an area of 2,166 square kilometers (DNP, 2006b). The park encompasses a wide variety of habitats and forest types. There are more than 2,500 plant species, 70 different kinds of mammals and over 350 species of birds. Because of its unique characteristics and outstanding values, KYNP was enlisted as an ASEAN Heritage Park in 1984, designated a World Heritage Site in 2005, and enlisted as an Important Bird Area (IBA) designated by Birdlife International (DNP, 2006a). There are more than 20 tourism sites in KYNP with a rich diversity of plant species, plentiful wildlife, beautiful scenery, and an interesting cultural history. These provide various types of recreational opportunities for visitors, such as wildlife observation, hiking, jungle rafting, nature education and camping (DNP, 2006b). Many visitor facilities such as camp sites, parking areas, food stations, souvenir shops, visitor center, and other types of infrastructure have been built to provide visitors a comfortable and enjoyable national park experience. During the past ten years (2000-2009) KYNP was visited annually by more than 700,000 people (DNP, 2010), generating a lot of income to national park. In recent years, environmental impacts of tourism development and visitor activities have been reported as significant concerns for KYNP management. Visitor-induced environmental impacts include impacts on soil and vegetation (especially around campgrounds and trails), water

and noise pollution, accumulation of garbage, changes in wildlife behavior and habitat destruction.

Two campsite locations (Lam Takong and Pha Kluai Mai), three trail heads (Km. 33 – Nong Phak Chi, Visitor Center – Kong Keaw Waterfall, and Haew Suwat – Pha Kluai Mai Trail), and one trail end (Haew Narok Waterfall Trail) were selected for data collection. These locations were selected based on initial observations that these were the preferred areas for the three specific visitor activities.

5.3.2 Environmental Value Orientation

To investigate the environmental value orientation of domestic visitors, the Ecocentrism-Anthropocentrism Scale developed by Thompson and Barton (1994) (Table 5-1) was applied. This scale can identify the distinction of ecocentric and anthropocentric motive of environmental concern of individual more clearly than the NEP and EAS scales. These two scales mostly focus on measuring the level of environmental attitudes, not environmental value orientation (Amérigo, Aragonés, Frutos, Sevillano, & Cortés, 2007; Casey & Scott, 2006). The statements in the scale were translated into Thai and pre-tested on site. The response scale is a Likert-type five point rating, from strongly disagree (1) to strongly agree (5). The values of Cronbach's alpha indicate the scales are reliable: the values are 0.65 for ecocentric and 0.69 for both anthropocentric and environmental apathy orientations.

Table 5-1 Ecocentrism - anthropocentrism measurement scale

Scale	Items
Ecocentric	<ol style="list-style-type: none"> 1. One of the worst things about overpopulation is that many natural areas are getting destroyed for development. 2. I can enjoy spending time in natural settings just for the sake of being out in nature. 3. Sometimes it makes me sad to see forests cleared for agriculture 4. I prefer wildlife reserves to zoos 5. I need time in nature to be happy 6. Sometimes when I am unhappy I find comfort in nature 7. It makes me sad to see natural environments destroyed 8. Nature is valuable for its own sake 9. Being out in nature is a great stress reducer for me 10. One of the most important reasons to conserve is to preserve wild areas 11. Sometimes animals seem almost human to me 12. Human are as much a part of the ecosystem as other
Anthropocentric	<ol style="list-style-type: none"> 1. The worst thing about the loss of the rain forest is that it will restrict the development of new medicines 2. The best thing about camping is that it is a cheap vacation 3. It bothers me that humans are running out of their supply of oil 4. Science and technology will eventually solve our problems with pollution, overpopulation, and diminishing resources 5. The thing that concerns me most about deforestation is that there will not be enough lumber for future generations 6. One of the most important reasons to keep lakes and rivers clean is so that people have a place to enjoy water sports 7. The most important reason for conservation is human survival 8. One of the best things about recycling is that it saves money 9. Nature is important because of what it can contribute to the pleasure and welfare of humans 10. We need to preserve resources to maintain a high quality of life 11. One of the most important reasons to conserve is to ensure a continued high standard of living 12. Continued land development is a good idea as long as a high quality of life can be preserved
Environmental apathy	<ol style="list-style-type: none"> 1. Environmental threats such as deforestation and ozone depletion have been exaggerated 2. It seems to me that most conservationists are pessimistic and somewhat paranoid. 3. It seems to me that most conservationists are pessimistic and somewhat paranoid. 4. I do not think the problem of depletion of natural resources is as bad as many people make it out to be 5. I find it hard to get too concerned about environmental issues 6. I do not feel that humans are dependent on nature to survive Items 7. Most environmental problems will solve themselves given enough time 8. I'm opposed to programs to preserve wilderness, reduce pollution and conserve resources 9. Too much emphasis has been placed on conservation

Source: Thompson & Barton (1994: 152)

5.3.3 Environmental Impact Ratings

The environmental impact ratings domestic visitors were examined across three user groups: 304 campers, 237 hikers, and 87 birdwatchers. Visitors' ratings were measured using 18 statements, on a scale of 1 (slight) – 5 (very severe), impacts on soil, vegetation, water, wildlife, and others, and one statement for overall level of environmental impact. Surveys were conducted by trained interviewers to ensure a complete response and a high response rate. To avoid interviewers' bias, self-administered interviews which draw on core principles of the cognitive interview technique, were conducted (Bernard, 2000; Gabbert *et al.*, 2010). Interview length varied between 15-20 minutes. Visitors were approached randomly and interviewed on site as they were completing their activity for the day. A total of 628 surveys of domestic visitors were completed. The on-site interviews were conducted during January to February, 2009, during weekdays and weekends. Information about respondents' demographic characteristics, past recreation experience, and preferred recreation activities were collected as well.

5.3.4 Data Analysis

Data analysis is based on 628 surveys of domestic visitors. The procedures consist of descriptive statistics and measures of differences. Apart from descriptive statistics, the analysis of variance (ANOVA) has been applied to examine the differences in environmental orientation and impact ratings between the three groups of visitors.

Data analysis consists of descriptive statistics and measures of differences. Statistical comparisons are made to test the hypothesis if differences in impact ratings exist between visitors and park officials. The comparisons are made based on the means of the total samples of each group of users. Because the dependent variable (impact rating) is in ordinal scale, the ordinal regression analysis has been performed to investigate the relationship between impact ratings and potential factors influencing the ratings. The key variables include socio-demographic (gender, education, annual income, age, and residential location), major activity that they engage in, recreation experience, KYNP visitation experience, trip motivation (anthropocentric and ecocentric approach), length of stay, group characteristic, and environmental value orientation. Socio-demographic factors include gender, age, education level, income, and residential location. Recreation experience factors include previous experience of visitors in their major activity, the length (number of years) of experience in their major activity, and the frequency (average per year) that they engage in their major activities. Group characteristics include type of group (group of friends, family, friends and family, tour group, and other) and group size (number of people in group). Environmental value orientation factors are the levels (low, medium, and high) of value orientation of visitors in each scale, including ecocentric, anthropocentric, and environmental apathy. In total, 16 variables were analyzed. SPSS (Version 16) (SPSS, 2007) was used for data coding, processing and analysis.

5.4 Results

5.4.1 Participants' Profile

Campers: Roughly 51.0% of the 304 surveyed campers is male, the majority (40.8%) is 21-30 years old, and 62.2% had completed undergraduate level education. Almost half (44.6%) of the visitors are from Bangkok, and one-fifth are local. The three major occupation groups are private company employee (34.9%), student (24.7%), and government employee (14.8%). The majority (30.3%) has annual income in the range Baht 120,000-239,999 (US\$1 = Thai Baht 33). Roughly 67.1% has visited KYNP before. The main motivations for visiting KYNP are relaxation (51.6%), return to nature (37.5%), and enhancing family and friend affinity (27.3%). The majority (41.1%) visits KYNP with friends and 63.5% stays in KYNP for one night. The majority (43.8%) travels in a group of two to five individuals (small group) with the average 7.8 individuals. Roughly 80.9% has prior camping experience; 63.8% has camping experience between one and five years, and 87.3% camp one to five times per year. The majority of campers (48.7%) is satisfied with current visit to KYNP and 85.2% has the intention to revisit KYNP in the future.

Hikers: Of the 237 hikers interviewed, roughly 54.0% is male, the majority (49.4%) is 21-30 years old, and 55.7% had completed undergraduate level education. Roughly 39.6% is from Bangkok. The three major occupation groupings are student (31.2%), private company employee (22.8%), and government employee (13.9%). The majority (37.6%) has annual income less than Baht 120,000. Roughly 53.2% has visited KYNP before. The main motivations for visiting KYNP are relaxation (46.0%), return to

nature (32.9%), and enhancing family and friend affinity (27.4%). The majority (54.9%) visits KYNP with friends and 52.3% stays in KYNP for one night. The majority of group size is between 2-5 individuals (35.0%) with the average 10.58 individuals. Roughly 49.8% has prior hiking experience; of this, 73.4% has hiked for 1-5 years and 93.9% hike 1-5 items per year. The majority (48.5%) is satisfied with their trip and 81.9% has the intention to revisit KYNP in the future.

Birders: Of the 87 birders interviewed, roughly 51.7% is male, the majority (67.8%) is 21-30 years old, and 74.7% had completed undergraduate level education. About 83% is non-local resident, of which 47.7% is from Bangkok. The three major occupation groupings are student (51.7%), private company employee (14.9%), and entrepreneur (13.8%). The majority (46.4%) has annual income less than Baht 120,000. Roughly 65.5% has visited KYNP before. The main motivations for visiting KYNP are relaxation (31.0%), return to nature (26.4%), and learn more about nature (23.0%). The majority (62.1%) visits KYNP with friends and 52.9% stays for one night. The majority (27.6%) of group size is between two to five individuals with the average 11.0 individuals. Roughly 83.9% has prior experience in bird watching, 80.0% with 1-5 years of experience, and nearly half birdwatcher 1-5 times per year. The majority (48.3%) is satisfied with their current trip and 81.6% intends to revisit KYNP in the future.

5.4.2 Environmental Value Orientation

Overall, the majority of campers (57.8%), hikers (51.1%), and birders (64.4%) is ecocentrist. Proportionately, more birders are ecocentrists than campers and hikers. More

hikers (40.1%) tend to be anthropocentrist than campers (29.0%) and birders (24.1%).

Among those with environmental apathy there are more camper (3.0%) than birders (1.1%) and hikers (0.8%). A breakdown of different type of visitors by their value orientation is shown in Table 5-2.

Based on the means of environmental value orientation, the levels of value orientation are classified into three groups; low (1-2.33), medium (2.34-3.66), and high (3.67-5.00). The majority of birders (85.4%), campers (84.9%), and hikers (83.5%) fall under high level of ecocentric attitude. Similarly, the majority of hikers (77.1%), campers (70.2%), and birders (64.6%) fall under high level of anthropocentric attitude. The majority of birders (67.5%), hikers (50.0%), and campers (48.9%) fall under low level of environmental apathy.

Table 5-2 The number of visitors classified by level of environmental value orientation

Level of Value Orientation	Campers (n = 304)		Hikers (n = 237)		Birders (n = 87)	
	% of total visitors	% within group	% of total visitors	% within group	% of total visitors	% within group
Ecocentric	57.8		51.1		64.4	
Low level		1.1		0.0		0
Medium level		14.0		16.5		14.6
High level		84.9		83.5		85.4
Total		100.0		100.0		100.0
Anthropocentric	29.0		40.1		24.1	
Low level		1.4		0.0		1.3
Medium level		28.4		22.9		34.2
High level		70.2		77.1		64.6
Total		100.0	218	100.0	79	100.0
Environmental apathy	3.0		0.8		1.1	
Low level		48.9		50.0		67.5
Medium level		48.6		47.3		30.0
High level		2.5		2.7		2.5
Total		100.0		100.0		100.0
Could not classify	10.2		8.0		10.3	
Total	100.0		100.0		100.0	

The differences in environmental value orientation amongst three groups of visitors are shown in Table 5-3. On the ecocentric value, the average scores of birders are higher than campers and hikers on six items (items 1, 3, 5, 6, 8, and 11). The average scores of hikers are higher than campers and birders on three items (items 4, 7, and 12). Similarly, the average scores of campers are higher than birders and hikers on three items (items 2, 9, and 10). The ANOVA results show that the groups of visitors differ significantly only on three items (items 2, 3, and 4).

In general, hikers seem to be more anthropocentrist than campers and birders. With the exception of two items (items 1 and 11), the mean scores of hikers are higher than campers and birders. The results of ANOVA indicate the groups differ significantly only on two items (items 6 and 7). Similarly, the mean scores of hikers are higher than campers and birders on five items (items 5-9) related to environmental apathy. On three items (items 1-3), the average scores of campers are higher than hikers and birders. The ANOVA results show that scores for four items (1-3, and 9) differ significantly between the three groups.

Table 5-3 Comparison of environmental value orientation between campers, hikers and birders

Items	Mean scores (based on five-point scale)			F	p	
	Campers	Hikers	Birders			
Ecocentric scale						
1. One of the worst things about overpopulation is that many natural areas are getting destroyed for development	3.934	3.814	4.115	2.499	0.087	
2. I can enjoy spending time in natural settings just for the sake of being out in nature	4.149	4.093	3.655	6.761	0.001*	
3. Sometimes it makes me sad to see forests cleared for agriculture	3.762	3.882	4.161	4.231	0.015*	
4. I prefer wildlife reserves to zoos	3.555	3.662	3.103	4.194	0.016*	
5. I need time in nature to be happy	4.475	4.532	4.563	0.581	0.560	
6. Sometimes when I am unhappy I find comfort in nature	3.785	3.717	4.081	1.854	0.157	
7. It makes me sad to see natural environments destroyed	4.450	4.487	4.402	0.221	0.802	
8. Nature is valuable for its own sake	4.611	4.658	4.793	2.250	0.106	
9. Being out in nature is a great stress reducer for me	4.682	4.671	4.632	0.185	0.831	
10. One of the most important reasons to conserve is to preserve wild areas	4.527	4.473	4.425	0.648	0.523	
11. Sometimes animals seem almost human to me	4.364	4.338	4.368	0.070	0.932	
12. Humans are as much a part of the ecosystem as other animals	4.532	4.464	4.609	1.084	0.339	
Average	4.011	4.025	3.974	0.425	0.654	
Anthropocentric scale						
1. The worst thing about the loss of the rain forest is that it will restrict the development of new medicines	2.877	2.941	2.943	0.312	0.732	
2. The best thing about camping is that it is a cheap vacation	3.589	3.775	3.494	2.659	0.071	
3. It bothers me that humans are running out of their supply of oil	3.295	3.515	3.448	2.555	0.078	
4. Science and technology will eventually solve our problems with pollution, overpopulation, and diminishing resources	2.894	3.059	2.943	1.401	0.247	
5. The thing that concerns me most about deforestation is that there will not be enough lumber for future generations	4.119	4.215	3.897	2.278	0.103	

Table 5-3 Continued

Items	Mean scores (based on five-point scale)			F	p
	Campers	Hikers	Birders		
6. One of the most important reasons to keep lakes and rivers clean is so that people have a place to enjoy water sports	3.862	4.096	3.575	6.359	0.002*
7. The most important reason for conservation is human survival	4.100	4.127	3.802	3.000	0.050*
8. One of the best things about recycling is that it saves money	4.003	4.034	3.782	1.898	0.151
9. Nature is important because of what it can contribute to the pleasure and welfare of humans	4.472	4.570	4.447	1.269	0.282
10. We need to preserve resources to maintain a high quality of life	4.628	4.648	4.632	0.060	0.942
11. One of the most important reasons to conserve is to ensure a continued high standard of living	4.256	4.203	4.081	1.263	0.283
12. Continued land development is a good idea as long as a high quality of life can be preserved	4.133	4.287	4.046	2.565	0.078
Average	3.850	3.956	3.755	6.203	0.002*
Environmental apathy scale					
1. Environmental threats such as deforestation and ozone depletion have been exaggerated	2.627	2.411	2.000	6.814	0.001*
2. It seems to me that most conservationists are pessimistic and somewhat paranoid.	2.897	2.798	2.540	3.281	0.038*
3. I do not think the problem of depletion of natural resources is as bad as many people make it out to be	2.515	2.422	2.115	3.379	0.035*
4. I find it hard to get too concerned about environmental issues	3.531	3.598	3.736	0.992	0.371
5. I do not feel that humans are dependent on nature to survive	1.616	1.679	1.655	0.188	0.829
6. Most environmental problems will solve themselves given enough time	2.694	2.705	2.483	1.060	0.347
7. I don't care about environmental problems	1.560	1.599	1.598	0.115	0.892
8. I'm opposed to programs to preserve wilderness, reduce pollution and conserve resources	1.636	1.646	1.483	0.703	0.495
9. Too much emphasis has been placed on conservation	2.542	2.662	2.184	4.790	0.009*
Average	2.403	2.390	2.199	3.504	0.031*

* Significant at @ 0.05 level.

5.4.3 Environmental Impact Ratings

Campers. The majority (63.5%) agrees that visitor activities cause environmental impacts in KYNP. Roughly 85% identifies all 18 items of impacts as those caused by the visitors; cooking (34.0%), camping (30.9%), and picnicking (23.0%) are rated as the major threats (Table 5-4).

The majority (41.0%) rate the overall level of impact as “moderate” with a mean of 3.30 ($n = 293$, $SD = 1.04$). The average rating score is between 2.55 (presence of non-native plant) and 4.03 (accumulation of garbage) on a five point scale. Of the 18 impact items listed on the questionnaire, 11 items are rated by the majority as “moderate”.

These are and soil erosion, bare ground, exposed tree roots, damaged trees/saplings/seedlings, presence of non-native plant, turbidity in local stream/river, seeing wildlife on the road or very close to the road, habituated deer, disturbed natural area by visitor activities, such as vehicles parked in unauthorized areas, noise pollution from vehicles, and noise from visitors. Seven items are rated by majority as “very severe”. These are suspended solid matter on water surface, solid waste in water, monkeys waiting for food from visitors, conversion of natural area into developed area, air pollution from vehicles, bad smell from toilets, bin, garbage, etc., and accumulation of garbage.

Table 5-4 Domestic visitors' ratings of the top three activities causing environmental impacts in KYNP

Activity	Number of visitors (%)		
	Campers	Hikers	Birders
The first activity causing environmental impacts			
- Water-based activities	6.7	10.0	6.9
- Picnicking	14.4	13.6	13.9
- Camping	26.3	32.1	40.3
- Cooking	34.0	27.9	25.0
- Bicycling	0.0	0.0	0.0
- Wildlife observing	10.82	8.6	8.3
- Hiking	6.7	5.0	4.2
- Sight seeing	0.0	1.4	0.0
- Rafting	0.5	0.7	0.0
- Nature education	0.0	0.7	1.4
The second activity causing environmental impacts			
- Water-based activities	4.3	5.0	5.6
- Picnicking	20.2	21.4	25.4
- Camping	30.9	29.3	21.1
- Cooking	28.2	25.7	23.9
- Bicycling	0.0	0.7	1.4
- Wildlife observing	7.4	7.1	8.5
- Hiking	5.3	7.1	9.9
- Sight seeing	1.1	0.7	1.4
- Rafting	2.1	2.1	2.8
- Photography	0.5	0.7	0.0
The third activity causing environmental impacts			
- Water-based activities	8.5	5.9	11.6
- Picnicking	23.2	25.8	20.3
- Camping	14.2	16.9	14.5
- Cooking	19.1	22.8	26.1
- Bicycling	2.3	0.0	0.0
- Wildlife observing	11.9	11.8	11.6
- Hiking	10.2	5.9	10.2
- Sight seeing	1.7	2.2	1.4
- Rafting	3.9	2.9	1.4
- Bird watching	1.1	0.0	0.0
- Photography	0.0	2.9	0.0
- Nature education	3.9	2.9	2.9

Hikers. The majority of hikers (59.5%) agrees that visitor activities do cause environmental impacts. Of the 18 impact items, eight items are reported non-existent by more than 15% of the hikers. Camping (32.1%), cooking (29.3%), and picnicking (25.7%) are rated as the top three activities causing the most impacts (Table 5-4).

The majority (41.9%) rate the overall level of impact in KYNP as “moderate” with a mean of 3.23 ($n = 227$, $SD = 1.02$). The average rating of impact is between 2.26 (presence of non-native plant) and 3.86 (accumulation of garbage) on a five point scale. Of the 18 impact items listed on the questionnaire, presence of non-native plant is rated as “slight” by the majority of hikers (31.1%). Nine items are rated by the majority as “moderate”. These are soil erosion, bare ground, exposed tree roots, damaged trees/saplings/seedlings, turbidity in local stream/river, seeing wildlife on the road or very close to the road, deer habituation, vehicular noise, and noise from visitors (31.8%). The majority (27%) rates the item monkeys waiting for food from visitors as “severe”. Seven items were rated by the majority as “very severe”: suspended solid matter on water surface, solid waste in water, conversion of natural area into developed area such as vehicles parked in unauthorized areas, air pollution from vehicles, bad smell from toilets, bin, garbage, etc., and accumulation of garbage, and disturbed natural area by visitor activities, such as vehicles parked in unauthorized area.

Birders. The majority of birders (82.8%) agrees that visitor activities do cause environmental impacts. Of the 18 impact items, six items are reported non-existent by more than 15% of the birders. Camping (40.3%), picnicking (25.4%), and cooking (26.1%) are rated as the top three activities causing the most impacts (Table 5-4).

The majority rates the overall level of impact in KYNP as “moderate” (36.1%) and “severe” (36.1%) with a mean of 3.54 ($n = 83$, $SD = 0.93$). The average rating of impact is between 2.52 (presence of non-native plant) to 4.15 (accumulation of garbage) on a five point scale. Of the 18 impact items listed on the questionnaire, the majority of bird watchers (33.8%) rates presence of non-native plant as “slight.” Six items are rated by the majority as “moderate”. These are soil erosion, bare ground, exposed roots, damaged trees/saplings/seedlings, turbidity in local stream/river, bad smell from toilets, bin, garbage, etc., and noise from the visitors. Items that are rated by the majority as severe include suspended solid matter on water surface, conversion of natural area into developed area, disturbed natural area by visitor activities such as vehicles parked in unauthorized areas, and noise pollution from vehicles. Six items are rated by the majority as “very severe”. These are solid waste in water, monkeys waiting for the food from visitors, wildlife on the road or very close to the road, habituated deer, air pollution from vehicles, and accumulation of garbage.

5.4.4 Differences between Three Groups of Visitors

Results of the three surveys conducted with domestic campers, hikers, and birders are compared here to test the hypothesis that differences exist in perceptions between the three groups of visitors. Based on the average impact rating score of each item (mean values), overall, the results indicate that birders tend to perceive impacts as more severe than campers and hikers while hikers tend to perceive impacts as less severe than the other two groups (Figure 5-1).

Of 18 items of impacts, overall, birders perceive 15 types of impacts at a higher level than the other two groups. These are soil erosion, bare ground, exposed tree roots, damage tree/sapling, and seedling, presence of non-native plant, monkeys waiting for food from visitors, wildlife on the road or very close to the road, habituated deer, conversion of natural area into developed area, air pollution from vehicles, bad smell from toilets, bin, garbage, etc., accumulation of garbage, disturbed natural area by visitor activities such as vehicles parked in unauthorized areas, noise pollution from vehicles, and noise pollution from visitors. There are only three items of impacts that hikers and campers perceive as more severe than birders. These impacts are related to water quality, including suspended solid matter on water surface, solid waste in water, and turbidity.

However, the ANOVA results indicate significant differences in impact perceptions between the three groups of visitors on four items only (Table 5-5). These include wildlife on the road or very close to the road, habituated deer, conversion of natural areas into developed areas, and air pollution from vehicles. Birders rate these impacts more highly than campers and hikers.

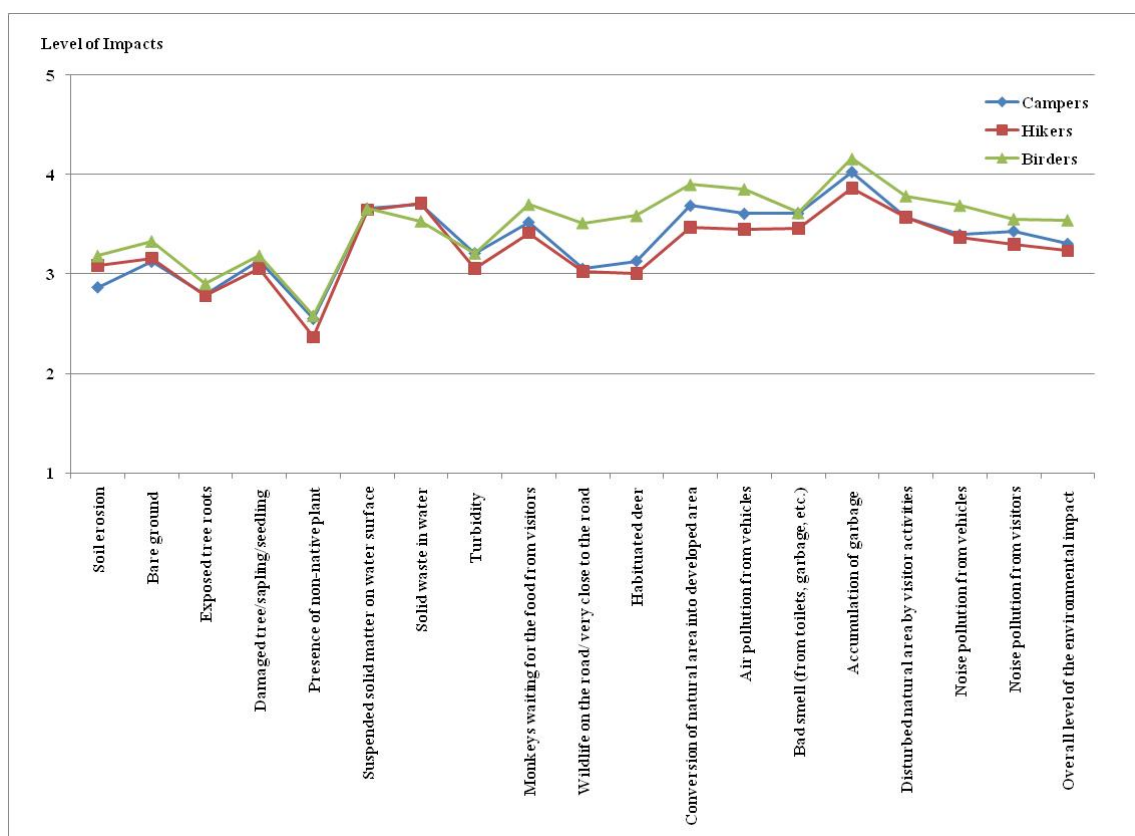


Figure 5-1 Comparison of impact ratings between campers, hikers, and birders

Table 5-5 Comparison of environmental impact ratings between campers, hikers, and birders

Impacts	Mean of Impact Perception			F	p
	Campers	Hikers	Birders		
Soil impacts					
– Soil erosion	2.866	3.088	3.182	2.813	0.061
– Bare ground	3.125	3.161	3.329	0.837	0.433
Vegetation impacts					
– Exposed tree roots	2.788	2.780	2.899	0.255	0.775
– Damaged tree/sapling/seedling	3.134	3.054	3.184	0.395	0.674
– Presence of non-native plant	2.548	2.365	2.577	1.154	0.317
Water impacts					
– Suspended solid matter on water surface	3.660	3.644	3.658	0.010	0.990
– Solid waste in water	3.706	3.710	3.532	0.592	0.554
– Turbidity	3.209	3.055	3.208	0.944	0.390
Wildlife impacts					
– Monkeys waiting for the food from visitors	3.521	3.413	3.700	1.392	0.250
– Wildlife on the road/ very close to the road	3.052	3.022	3.514	4.391	0.013*
– Habituated deer	3.130	3.006	3.587	5.277	0.005*
Other impacts					
– Conversion of natural area into developed area	3.688	3.471	3.901	3.842	0.022*
– Air pollution from vehicles	3.607	3.449	3.855	3.350	0.036*
– Bad smell (from toilets, garbage, etc.)	3.611	3.456	3.617	1.004	0.367
– Accumulation of garbage	4.028	3.861	4.161	2.172	0.115
– Disturbance to natural area by visitor activities, such as vehicles parked in unauthorized areas	3.569	3.568	3.786	1.204	0.301
– Vehicular noise	3.394	3.367	3.691	2.307	0.101
– Noise from visitors	3.431	3.300	3.554	1.555	0.212
Overall level of the environmental impact from visitors	3.304	3.233	3.542	2.790	0.062

* Significant at @ 0.05 level.

5.4.5 Factors Influencing Visitors' Rating of Environmental Impacts

This part examines factors influencing visitors' rating of environmental impacts.

Ordinal regression analysis is performed to investigate the relationship between 16 potential independent variables and impact ratings, based on the hypothesis that these factors influence perception of visitors.

The results in Table 5-6 support the hypothesis that recreation activity is a significant factor influencing impact rating; birders tend to rate the impact more severely than either hikers or campers. Income and education levels are significant factors predicting ratings; a person with higher level of education and income tends to perceive impacts more severely than a person with lower level of education and income. Similarly, frequency of visitors' activities (times per year) significantly influences impact ratings, and so do group type and group size. Impact ratings are higher with the visitors who are part of a big group, visiting the park alone, and engage in major activity more than 10 times annually.

Table 5-6 Ordinal regression analyses of factors influencing ratings of environmental impacts

Variables	Categories	Estimation	Wald	Sig.
Gender	Male	-0.001	0.000	0.994
	Female	-	-	-
Education	Lower than high school	-1.304	7.879	0.005**
	High school	-1.141	9.055	0.003**
	Vocational education	-0.437	1.564	0.211
	Undergraduate	-0.477	2.692	0.101
	Graduate	-	-	-
Annual income	Less than 120,000 Baht	-0.712	3.766	0.052*
	120,001-239,000 Baht	-0.946	7.603	0.006**
	240,000-359,999 Baht	-0.749	4.397	0.036**
	360,000-479,999 Baht	-0.562	1.871	0.171
	480,000-599,999 Baht	-0.716	2.413	0.120
	More than 600,000 Baht	-	-	-
Age	Younger than 20 years old	0.310	0.121	0.728
	21-30 years old	0.424	0.243	0.622
	31-40 years old	0.116	0.018	0.892
	41-50 years old	-0.017	0.000	0.985
	51-60 years old	0.994	0.895	0.344
	Older than 60 years old	-	-	-
Residential location	Local resident	-0.053	0.059	0.808
	Nonlocal resident	-	-	-
KYNP visitation experience	Have visited KYNP before this trip	-0.071	0.195	0.659
	Never visited KYNP before this trip	-	-	-
Trip motivation	Anthropocentric approach	-0.239	1.097	0.295
	Ecocentric approach	-	-	-
Length of stay in KYNP	One day trip (o night)	-0.088	0.096	0.757
	1 night	0.060	0.116	0.733
	More than 1 night	-	-	-
Activity	Camping	-0.449	3.521	0.061*
	Hiking	-0.458	3.384	0.066*
	Bird watching	-	-	-
Previous recreation experience	Have experience in major activity before this time	-0.954	0.251	0.616
	Never engage in major activity before this time	-	-	-

Table 5-6 Continued

Variables	Categories	Estimation	Wald	Sig.
Length of experience in major activity	1-5 years	-0.077	0.056	0.814
	6-10 years	0.176	0.240	0.624
	More than 10 years	-		
Frequency of activity	Less than 5 times per year	-0.648	0.371	0.081*
	6-10 times per year	-0.456	0.511	0.372
	More than 10 times per year	-	-	-
Group type	Group of friend	0.646	1.912	0.167
	Group of family	0.514	1.120	0.290
	Group of family and friend	0.609	1.475	0.225
	Tour group	1.384	1.354	0.245
	Visiting alone	1.831	4.535	0.033**
	Other group type	-	-	-
Group size	1-2 people	-0.065	0.056	0.813
	3-5 people	-0.503	5.216	0.022**
	6-10 people	-0.165	0.676	0.411
	More than 10 people	-	-	-
Ecocentric value orientation	Low level	-2.191	1.628	0.202
	Medium level	-0.267	1.013	0.314
	High level	-	-	-
Anthropocentric value orientation	Low level	-0.707	0.277	0.599
	Medium level	-0.021	0.009	0.923
	High level	-	-	-
Environmental apathy	Low level	0.150	0.086	0.769
	Medium level	-0.021	0.002	0.968
	High level	-	-	-

*** Significant at @ 0.000 level.

** Significant at @ 0.05 level.

* Significant at @ 0.1 level.

5.5 Discussion and Conclusion

This study examined visitors' rating of environmental impacts in KYNP. Impact ratings are compared between three groups of visitors, i.e., campers, hikers and birders, and with three different types of value orientation (anthropocentric, ecocentric, and environmental apathy). Also, the factors affecting visitors' ratings are analyzed, and some tentative conclusions on visitor management provided.

Results show that the majority of the visitors is ecocentric. Proportionately, more birders than campers or hikers are ecocentric; based on past studies this is an expected result (Thapa & Graefe, 2003; Wurzinger, 2006). This implies that visitors who involved in appreciative activities held stronger pro-environmental attitudes than visitors who involved in consumptive activities (Thapa & Graefe, 2003). Wurzinger (2006) also reported that birders belong to a harder spectrum of ecotourist that have been found to adhere more to an ecocentric than anthropocentric perspective. Previous studies on impact perception have commented that visitors are not very perceptive of the impacts that they produce; the impact that they notice are the direct impact from other visitors, such as garbage and vandalism (Hillery *et al.*, 2001; Manning, 1999). Consistent with previous work, this study also finds that visitors easily noticed the impacts, such as conversion of natural area into developed area, air pollution from vehicles, bad smell (from toilets, garbage, etc.), accumulation of garbage, vehicles parked on natural areas, vehicular noise, and noise from visitors, more than the impact such as presence of non-native plant and exposed tree roots.

Previous studies have found that gender, age, education, income, and residential location are significant predictors of perception (Casey & Scott, 2006; Deng *et al.*, 2003; Hillery *et al.*, 2001; Priskin, 2003; Vaske *et al.*, 2001). A high level of education corresponded with higher ratings of impacts. This is consistent with previous studies which indicate higher levels of education are associated with higher impact rating (Casey & Scott, 2006; Deng *et al.*, 2003; Hillery *et al.*, 2001; Priskin, 2003; Vaske *et al.*, 2001). Bushell & Eagles (2007) provided an argument supporting this association that well-educated people have high expectations from their travel; expect information-rich experiences, good service and management, and good quality of environmental conditions. Also, the result show that visitors from higher income group rated impacts more severely than visitors from lower income groups and supports previous findings (Priskin, 2003). Similarly, group size is found to be a significant predictor of impact ratings. Previous studies have shown that the size of group could influence the level of impacts, (Eagles *et al.*, 2002; Hammitt & Cole, 1998), but other studies have shown that group behavior matters more than group size. Although previous recreation experience and length of experience in a major activity did not significantly associate with impact perception in this study, studies have shown that level of skills in a particular activity influence how visitors perceive the impacts. For example, a study conducted in the Ras Mohammed National Park and at Sharm El Sheikh, South Sinai, Egypt concluded that snorkeling skills of visitors significantly affected perceptions of reef quality; a visitor with greater skills corresponded with higher ratings of impacts (Leujak & Ormond, 2007).

The results clearly indicate that KYNP needs to strengthen its environmental education programs. Visitors need to be made aware of the negative consequences of their activities, and also reinforce positive behavior amongst those who are aware of these issues. When visitors' understanding about environmental impacts is improved, they might be more aware of the outcomes of their activity and behavior. This could help reduce high-impact behavior of visitors and encourage visitors to be compliant with park rules and regulations. Additionally, environmental education programs in KYNP need to focus on intrinsic values of the park so as to instill in visitors a heightened sense of ecocentric values.

This study examined only a limited set of factors influencing impact perceptions. There are various potential factors still unclear, especially cognitive factors such as meaning of place, motive, and normative beliefs (Thompson & Barton, 1994; Vaske *et al.*, 2001). Investigating the association among these factors, environmental value orientation, and perception of impact can contribute to new understanding about visitor impact strategies. Also, the association between impact perception and behavior is a further research topic.

CHAPTER VI

ACCEPTABILITY OF ENVIRONMENTAL IMPACTS AND CURRENT MANAGEMENT PRACTICES: PERSPECTIVES FROM PARK OFFICIALS, DOMESTIC, AND INTERNATIONAL VISITORS

6.1 Introduction

Reducing the negative effects of visitor impacts, and enhancing visitor enjoyment is of vital concern to many national parks. Several visitor management strategies are currently in place in the national parks around the world. Although many national parks have implemented various types of visitor management strategies to minimize impacts, the appropriateness and the acceptability of these strategies remain a critical issue. Studies have highlighted that information about visitors' acceptability of environmental impacts and their evaluation of current management practices implemented in a national park are beneficial aspects of decision making processes (Floyd *et al.*, 1997; Marion & Reid, 2007; Miller & Twining-Ward, 2005). The evaluation of management practices can provide direct measures of their success. Using the Khao Yai National Park (KYNP) as an example, this study examines: 1) the levels of acceptability of environmental impacts from visitor activities between park officials, domestic, and international visitors, and 2) evaluation of current management strategies as determined by the three groups. Based on the results of the study, suggestions for impact management strategies and future research are provided.

6.2 Literature Review

6.2.1 Visitor Impact Acceptability

Visitor impact acceptability refers to the degree to which an environmental condition in the site is judged to be tolerable based on visitor opinions (Floyd *et al.*, 1997). In the area of visitor impacts, the study about acceptability is mostly related to quality of visitor experience and environmental quality (Floyd *et al.*, 1997; Goodnan & Manning, 2008). The acceptability of environmental impact in previous studies has been studied by applying the social norm theory. Social norms are generally defined as rules and standards that are understood and used within a society or group (Ajzen, 2005; Bonnes *et al.*, 2003). Norms are standards used for evaluating environments or management practices that is good or bad. Sometimes, norms are specifically defined as what behavior should be, rather than what the behavior actually is (Donnelly, Vaske, Whittaker, & Shelby, 2000). Norms are constructed by social network that guide and or constrain social behavior without force of laws, and can vary and evolve not only through time but also from one age group to another and between social classes and social groups (Gilbert, Fiske, & Lindzey, 1998). In visitor impact studies social norm can be used to define tolerable levels of social and ecological impacts observed at a particular site (Shelby & Heberlein, 1986).

A second approach to understanding impact acceptability is by determining the level of environmental concerns visitors have about a place or a setting. Generally, environmental concern refers to attitudes towards the natural environment (Dunlap *et al.*, 2000), and is focused on two primary topics. The first topic focuses on determining the

level of environmental concerns specific to social and demographic characteristics. The other topic relates to the impact of environmental concern on individual's behavior (Casey & Scott, 2006; Kortenkamp & Moore, 2001). Studies have shown that individuals with greater environmental concern are less tolerant to environmental impacts (Floyd *et al.*, 1997).

6.2.2 Visitor Impact Management Frameworks

Several visitor impact management frameworks have been developed to assist managers in preventing and minimizing the impacts of recreational use in natural areas. These include the Limits of Acceptable Change (LAC), Visitor Impact Management (VIM), Visitor Experience and Resource Protection (VERP), Visitor Activity and Management Process (VAMP), and Tourism Optimization Management Model (TOMM). These management frameworks are rooted in the traditional concept of carrying capacity, which is defined as the amount of use that can be accommodated in an area without significantly affecting its long term ability to maintain the social and biophysical attributes that provide a sustained quality of experience value (Lindberg, McCool, & Stankey, 1997; McCool, 1994).

The LAC has been implemented in several US wilderness areas. This model was developed in 1985 by researchers associated with the United States Forest Service (Stankey, Cole, Lucas, Petersen, & Frissell, 1985). The main focus of the LAC is on the management of visitor impacts based on acceptable resource and social conditions, and the actions needed to protect or achieve those conditions. Similarly, the VIM is a

planning framework that aims to reduce or control negative effects of use of parks areas. This model was developed in 1990 by researchers working for the U.S. National Parks and Conservation Association (Nilsen & Tayler, 1997). The main concept is to keep visitor impacts within acceptable level. It focuses on identifying problems and unsuitable conditions, likely causal factors resulting in undesired impacts, and management strategies for mitigating or preventing unacceptable effects of use (Boyd & Butler, 1996). The VIM framework addresses three key issues that are inherent to impact management, including 1) identification of problem conditions, 2) determination of potential casual factors affecting the occurrence and severity of the unacceptable impacts, and 3) selection of potential management strategies to mitigate unacceptable impacts (Chin *et al.*, 2000).

The VERP model was developed in 1993 by the US National Park Service (Hof & Lime, 1997). This model deals with carrying capacity in terms of the quality of the resources and the quality of visitor experience (Gelhenhuys, 2004). The main concept is to define what level of use is appropriate, where, when and why. Zoning is one of the key concepts of this model (Nilsen & Tayler, 1997). The VAMP model was created in 1985 by Parks Canada to guide national park planning and management (Nilsen & Tayler, 1997). Similarly to the VERP model, the VAMP is aimed at producing management decisions which are based on both ecological data and social information, and is a generic planning model, incorporating objectives, terms of reference, analysis of data, options, and recommendations and implementation (Nilsen & Tayler, 1997).

TOMM is a new model created in 1996 by the Sydney-based consulting firm Manidis Robert to apply for Kangaroo Island, Southern Australia. This model emphasizes the involvement of a diversity of stakeholders throughout the planning process. This model provides the opportunities to local communities to participate in a planning process to consider what desirable economic, marketing, environmental, community, visitor experience, and infrastructure development conditions they wish to see (Newsome *et al.*, 2002). Selecting a suitable framework for a particular park is a challenge.

6.3 Methodology

6.3.1 Study Area

Located between 14°05' – 14°15' N latitude and 101°05' – 101°50' E longitude, and approximately 200 kilometers from Bangkok, KYNP is the first national park established in Thailand in 1962. The KYNP is the third largest park in the country, covering an area of 2,166 square kilometers (DNP, 2006b). The park encompasses a wide variety of habitats and forest types. There are more than 2,500 plant species, 70 different kinds of mammals and over 350 species of birds. Because of its unique characteristics and outstanding values, KYNP was enlisted as an ASEAN Heritage Park in 1984, designated a World Heritage Site in 2005, and enlisted as an Important Bird Area (IBA) designated by Birdlife International (DNP, 2006a). There are more than 20 tourism sites in KYNP with a rich diversity of plant species, plentiful wildlife, beautiful scenery, and an interesting cultural history. These provide various types of recreational

opportunities for visitors, such as wildlife observation, hiking, jungle rafting, nature education and camping (DNP, 2006b). Many visitor facilities such as camp sites, parking areas, food stations, souvenir shops, visitor center, and other types of infrastructure have been built to provide visitors a comfortable and enjoyable national park experience. During the past ten years (1999-2009) KYNP was visited annually by more than 700,000 people (DNP, 2010), generating a lot of income to national park. In recent decades, environmental impacts of tourism development and visitor activities have been reported as significant concerns for KYNP management. Visitor-induced environmental impacts include impacts on soil and vegetation (especially around campgrounds and trails), water and noise pollution, accumulation of garbage, changes in wildlife behavior and habitat destruction.

Two campsite locations (Lam Takong and Pha Kluai Mai), three trail heads (Km. 33 – Nong Phak Chi, Visitor Center – Kong Keaw Waterfall, and Haew Suwat – Pha Kluai Mai Trail), and one trail end (Haew Narok Waterfall Trail) were selected for data collection. These locations were selected based on initial observations that these were the preferred areas for the three specific visitor activities.

6.3.2 Environmental Impact Acceptability

The environmental impact acceptability of visitors was examined across three groups: 39 KYNP officials, 628 domestic, and 40 international visitors. Additionally, park officials and repeat visitors were asked several open-ended questions to indicate any positive or negative changes that they have noticed during their five years of visit, or

since their previous visit. To measure the acceptability of impacts existing in KYNP, a questionnaire was developed in English and translated in Thai, and pilot tested before the actual survey. The acceptability in this study is measured by using 18 impact items statements covering impacts on soil, vegetation, water, wildlife, and others, and one statement for overall level of environmental impact. Respondents were required to judge their acceptability of each impact item, soliciting responses at a five-point scale: very unacceptable (1), unacceptable (2), moderately acceptable (3), acceptable (4), and very acceptable (5). Information about respondents' demographic characteristics were collected as well.

Surveys were conducted by trained interviewers to ensure a complete response and a high response rate. To avoid interviewers' bias, self-administered interviews which draw on core principles of the cognitive interview technique, were conducted (Bernard, 2000; Gabbert *et al.*, 2010). Interview length varied between 15-20 minutes. Visitors were approached randomly and interviewed on site as they were completing their activity for the day. A total of 668 surveys were completed (628 domestic and 40 international visitors). For international visitors, maximum two visitors were interviewed per one tour group; each tour group constituted an average of 15 tourists. Only English-speaking international visitors were selected. The on-site interviews were conducted during January to February, 2009, during weekdays and weekends.

6.3.3 Satisfaction with Current Impact Management Practices

To assess whether park officials and visitors are satisfied with the impact management practices currently implemented in KYNP, a set of questions was developed based on information gathered during preliminary survey conducted during summer 2008. Respondents were asked to assess nine visitor management strategies currently implemented in KYNP, and provide their rating of overall satisfaction. A Likert-type five-point rating scale was used, from very dissatisfied (1), dissatisfied (2), neutral (3), satisfied (4), and very satisfied (5). Participants were also asked to recommend potential solutions to visitor impacts.

The analysis is mostly descriptive. Statistical comparisons are made to test if differences in ratings of acceptability and satisfaction exist between park officials, domestic, and international visitors. SPSS (Version 16) was used for data coding, processing and analysis.

6.4 Results

6.4.1 Tourism Related Changes in KYNP

This section summarizes tourism-induced changes in KYNP as perceived by KYNP officials and the visitors. The park officials stated that tourism development in KYNP has been a priority ever since it was established in 1962. One of the positive changes was the park's designation in 2005 as a World Heritage Site. However, this designation also increased visitor arrivals. The park officials believe in restricting the number of visitors to a certain level to minimize the negative environmental impacts.

They have experienced a decline in negative visitor behaviors. The development of tourism infrastructure and facilities in and around KYNP has improved the quality of life of local communities. KYNP has made significant efforts to educate visitors and encouraging them to recycle. Interviews with 387 domestic and 10 international repeat visitors (within the last five years) indicate that visitors are aware of both positive and negative changes in KYNP. They listed 15 positive and 22 negative changes (Table 6-1). Top three positive changes include facility development (20.6%), reduction in visitor numbers (11.3%), and transportation development (8.5%). The negative changes frequently mentioned include environmental degradation (25.4%), crowding (19.6), and garbage (15.2%).

6.4.2 Impact Acceptability

KYNP Official. Roughly 74% of park officials is male, the majority (39.5%) is between 21-30 years old and 34.2% had completed high school. Roughly 56% is local, from Saraburi, Nakhon Nayok, Nakhon Rachasima, and Prachinburi provinces. The length of employment experience with KYNP varies between six months to 31 years, with an average of nine years. The majority (39.5%) has worked in the park less than five years.

The majority (42.1%) rates the acceptability of environmental impacts as neutral with a mean of 2.76 (SD = 0.883). Of the 18 impact items listed on the questionnaire, five items are rated by the majority as unacceptable. These are damaged trees/saplings/seedlings (39.5%), suspended solid matter on water surface (29.7%), solid

Table 6-1 Tourism-related changes in KYNP mentioned by visitors

	Positive changes (n = 141)	Negative changes (n = 138)
Bio-physical	<ul style="list-style-type: none"> - Environmental management (5.0%) - More wildlife-human interactions, such as seeing wildlife closely (2.8%) 	<ul style="list-style-type: none"> - Environmental degradation (26.1%) - Garbage (15.2%) - Changing in wildlife behaviors, such as begging monkeys and habituated deer (7.3%) - Noise pollution from visitors (2.2%) - Pollution (overall) (2.2%) - Vehicular noise (1.4%)
Visitors	<ul style="list-style-type: none"> - Control in number of visitors (14.1%) - Camping regulations, such as noise prohibition after 10:00 pm. (7.8%) - Enforcement of rules (2.8%) - Increase in environmental awareness (1.4%) 	<ul style="list-style-type: none"> - Crowding (19.6%) - Inappropriate visitor behavior (5.1%) - Lack of visitor awareness (0.7%) - Restrictions on visitor number (0.7%)
Services and facility management	<ul style="list-style-type: none"> - Facility development (27.0%) - Transportation development (8.5%) - Cleanliness (7.8%) - Service improvement (6.4%) - General tourism management (6.4%) - Increased convenience (5.0%) - Zoning in camping area, i.e. zone 1: no cooking, no drinking, zone 2: cooking no drinking, zone 3: cooking and drinking (2.8%) - More recreation activities (1.4%) - More safety (1.4%) 	<ul style="list-style-type: none"> - Too many facilities (4.3%) - Camping reservation system (3.6%) - Dirty (toilet) (2.9%) - Expensive goods (1.4%) - Bad service (1.4%) - Insufficient facilities (1.4%) - High entrance fee (0.7%) - Inappropriate facility design (0.7%) - High level of tourism development (0.7%) - Staff behavior (0.7%) - Too much convenience (0.7%) - Too many cars for wildlife observation (0.7%)

waste in water (32.4%), monkeys waiting for food from the visitors (34.2%), and accumulation of garbage (34.2%). Nine items are rated as neutral; these include bare ground (40.0%), exposed tree roots (47.2%), turbidity in local stream/river (51.4%), conversion of natural area into developed area (47.4%), air pollution (40.5), bad smell from toilets, bin, garbage, etc. (42.1%), disturbed natural area by visitor activities such as vehicles parked in unauthorized area (39.5%), vehicular noise (41.7%), and noise from the visitors (48.6%). Two items are rated by the majority as acceptable: soil erosion (41.7%) and wildlife on the road or very close to the road (35.1%). Presence of non-native plant is rated equally as either acceptable or neutral (36.8%). Deer habituation is rated equally as either unacceptable, neutral, or acceptable (25.0%).

Domestic visitors. The respondents include 48.4% campers, 37.7% hikers, and 13.9% birders; roughly 51% is male. The majority (47.8%) is 21-30 years old, 61.5% has completed undergraduate level education, and 16.3% is local. The three major occupation groupings are student (30.9%), private company employee (27.6%), and government employee (13.5%). The majority (34.3%) has annual income lower than Baht 120,000 (US\$1 = Thai Baht 33). Roughly 61.6% has visited KYNP before and 70.0% has prior experience in their major recreation activity (i.e., bird watching, hiking, and camping) before their current visit to KYNP. The majority (93.0%) has selected KYNP as their primary destination for this trip. Most of the respondents (98.7%) visit KYNP as a group, especially with friends (49.2%). The average (38.2%) group size is between 2 – 5 people. Primary activities include camping (75.8%), photography (66.4%), hiking (61.5%), sightseeing (59.4%), and relaxing (48.9%). Roughly 57.8%

stays in KYNP for one night. The main motivations for visiting KYNP are relaxation (46.7%), return to nature (34.2%), and enhancing family and friend affinity (27.2%).

Roughly (45.3% rates acceptability of environmental impacts as neutral with a mean of 2.87 (SD = 0.953). Of the 18 impact items, three items are rated by the majority as very unacceptable. These are suspended solid matter on water surface (30.4%), solid waste in water (36.7%), and accumulation of garbage (38.9%). 15 items are rated by the majority as neutral; these include soil erosion (45.9%), bare ground (47.6%), exposed tree roots (40.7%), damaged tree/sapling/seedling (40.5%), presence of non-native plant (39.4%), turbidity, monkeys waiting for food from the visitors (33.6%), wildlife on the road/very close to the road (38.3%), habituated deer (35.0%), conversion of natural area into developed area (32.0%), air pollution from vehicles (35.3%), bad smell from toilets, garbage, etc. (31.6%), disturbed natural area by visitor activities such vehicles parked in unauthorized area (38.0%), vehicular noise (38.2%), and noise from the visitors (39.2%).

International visitors. Roughly 77.5% of the surveyed visitors is male. The majority (50.0%) is 21-40 years old, and 61.5% had completed graduate level education. Roughly 20% are from the USA, 15.0% from the UK, and 10.0% each from Germany and Switzerland. The majority (51.6%) has annual income more than US\$ 60,000. Roughly 67.5% has visited Thailand and 25.0% has visited KYNP before this trip. KYNP is not the primary destination for the majority (67.5%). Roughly 45.0% is accompanied by their friends, with group size between 2 – 5 people (65.0%). The most favorite recreation activities are hiking (27.5%), sightseeing (22.5%), camping (12.5%), bird watching (12.5%), exploring nature (12.5%), wildlife watching (7.5%), and enjoy

nature/relaxing (5.0%). The majority (82.5%) has had prior experience in their activity of choice during their current visit to KYNP. Roughly 57.5% has visited for day trip only (they stay in the hotels or resorts outside the boundary of KYNP). The main motivations for visiting KYNP are experiencing new things (25.0%), relaxing (25.0%), and returning to nature (22.5%).

Roughly 45.3% rates acceptability of environmental impacts as neutral, with a mean of 3.13 ($SD = 1.174$). Of the 18 impact items, six items are rated by the majority as very unacceptable; these include presence of non-native plant (33.3%), solid waste in water (40.0%), monkeys waiting for food from the visitors (31.4%), accumulation of garbage (40.7%), disturbed natural area by visitor activities such as vehicles parked in unauthorized area (35.7%), and vehicular noise (31.0%). Two items are rated as unacceptable: damaged tree/sapling/seedling (32.0%) and suspended solid matter on water surface (38.1%). Six items are rated by the majority as neutral: soil erosion (40.0%), exposed tree roots (33.3%), turbidity (29.6%), conversion of natural area into developed area (34.4%), air pollution from vehicles (32.1%), and bad smell from toilets, garbage, etc. (30.4%). Three items are rates as acceptable; these are bare ground (33.3%), wildlife on the road/very close to the road (32.4%), and habituated deer (30.8%). Vehicular noise is rated equally as either unacceptable or neutral (34.8%).

Differences between three groups. Results of the three surveys conducted with park officials, domestic visitors, and international visitors are compared here to test the hypothesis that differences exist in impact acceptability between the three groups. Based on the average rating of each impact (mean values), overall, the results indicate that

domestic visitors tend to accept impacts at a lower level than international visitors and KYNP officials (Figure 6-1).

Overall, there are 10 types of impacts that domestic visitors accept at a lower level than the other two groups. These are soil erosion, bare ground, suspended solid matter on water surface, solid waste in water, turbidity in local stream/river, conversion of natural area into developed area, air pollution from vehicles, bad smell from toilets, bin, garbage, etc., accumulation of garbage, and disturbed natural area by visitor activities, such as vehicles parked in unauthorized area. Only two items of impacts KYNP officials accept at a lower level than the other two groups. These are damaged tree/sapling/seedling, and monkeys waiting for food from visitors. Four items are least acceptable to KYNP official. These are damaged tree/sapling/seedling, monkeys waiting for food from visitors, wildlife on the road/very close to the road, and habituated deer. Four items are least acceptable to international visitors; these include exposed tree roots, presence of non-native plant, vehicular noise, and noise from visitors.

The ANOVA results indicate differences in impact acceptability between the three groups (Table 6-2). The differences are significant for four items (presence of non-native plant, solid waste in water, wildlife on the road or very close to the road, and conversion of natural areas into developed areas) only.

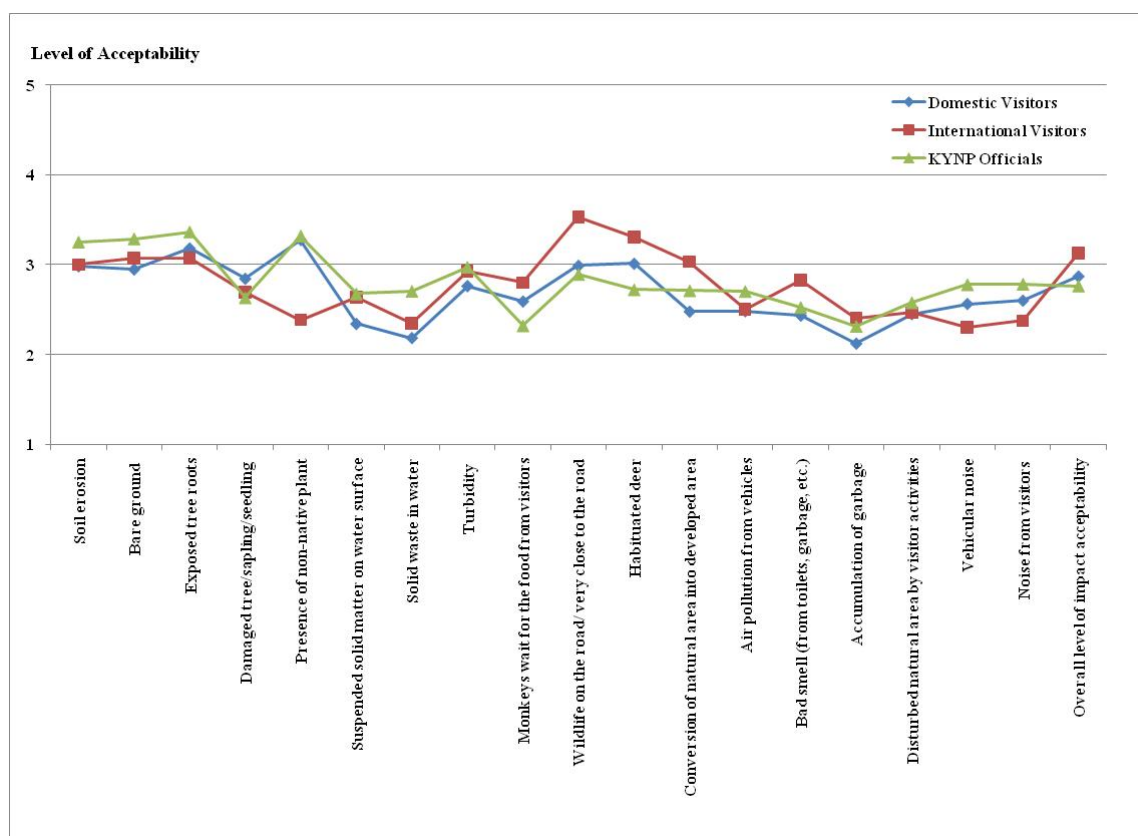


Figure 6-1 Comparison of impact acceptability ratings between KYNP officials, domestic, and international visitors

Table 6-2 Comparison of environmental impact acceptability between KYNP officials, domestic, and international visitors

	Average impact acceptability (based on five-point scale)			F	p
	Domestic visitors	International visitors	KYNP officials		
<i>Soil impacts</i>					
– Soil erosion	2.984	3.000	3.250	1.259	0.285
– Bare ground	2.949	3.074	3.286	2.085	0.125
<i>Vegetation impacts</i>					
– Exposed tree roots	3.183	3.074	3.361	0.716	0.489
– Damaged tree/sapling/seedling	2.845	2.692	2.632	0.938	0.392
– Presence of non-native plant	3.278	2.385	3.316	4.228	0.015*
<i>Water impacts</i>					
– Suspended solid matter on water surface	2.342	2.634	2.676	1.923	0.147
– Solid waste in water	2.184	2.346	2.706	3.399	0.034*
– Turbidity	2.763	2.926	2.971	0.938	0.392
<i>Wildlife impacts</i>					
– Monkeys waiting for food from the visitors	2.591	2.800	2.324	1.447	0.236
– Wildlife on the road/ very close to the road	2.990	3.529	2.892	3.655	0.026*
– Habituated deer	3.013	3.308	2.722	1.852	0.158
<i>Other impacts</i>					
– Conversion of natural area into developed area	2.479	3.031	2.711	4.011	0.019*
– Air pollution from vehicles	2.484	2.500	2.703	0.707	0.493
– Bad smell (from toilets, garbage, etc.)	2.434	2.826	2.526	1.462	0.233
– Accumulation of garbage	2.122	2.407	2.316	1.214	0.298
– Disturbed natural area by visitor activities, such as vehicles parked in natural area	2.451	2.464	2.579	0.270	0.763
– Vehicular noise	2.564	2.300	2.778	1.697	0.184
– Noise from visitors	2.601	2.375	2.784	1.085	0.339
Overall level of impact acceptability	2.871	3.128	2.763	1.598	0.203

* Significant at @ 0.05 level.

6.4.3 Satisfaction with Current Management Practices

KYNP Officials. The majority (65.8%) rates satisfaction level as neutral, with a mean of 3.11 (SD = 0.65). Average scores of satisfaction with nine management practices range between 2.68 (strict enforcement of rules concerning deviant or inappropriate behavior) and 3.40 (increasing maintenance interval of facilities). Of the nine items, two are rated by the majority as dissatisfactory; these include strict enforcement of rules concerning deviant or inappropriate behavior (39.5%) and maintaining current restrictions on visitors (36.8%). Five items are rated by the majority as neutral; reducing visitor at overused or crowded areas (52.6%), re-vegetating sites impacted by human use (39.5%), increasing maintenance interval of facilities (47.4%), providing visitor education programs (42.1%), and providing additional interpretive materials to increase understanding of geology, plants, animals, etc., associated with nature and national park (31.6%). Increasing the number of park rangers is rated by the majority (31.6%) as satisfactory. Increasing the number of visitor facilities such as toilet, parking area, trail, etc. is rated equally as either neutral or satisfactory (34.2%).

Domestic visitors. Domestic visitors' satisfaction ratings are neutral (~ 3.0) for all nine items.

International visitors. Average satisfaction scores of international visitors range between 2.38 (reducing visitor at overused or crowded areas) and 3.36 (providing appropriate and sufficient facilities). Of the nine items, seven items are rated as neutral; these include reducing visitor at overused or crowded areas (42.5%), re-vegetating sites impacted by human use (59.0%), strict enforcement of rules concerning deviant or

inappropriate behavior (35.9%), maintaining current restrictions on visitors (48.7%), increasing the number of park rangers (47.7%), providing visitor education programs (43.6%), and providing additional interpretive materials to increase understanding of geology, plants, animals, etc., associated with nature and national park (27.5%). Two items are rated by the majority as satisfactory: increasing the number of visitor facilities such as toilet, parking area, trail, etc. (35.9%) and increasing maintenance interval of facilities (25.6%).

Differences between three groups. Results of the three surveys are compared here to test the hypothesis that differences exist between the three groups in satisfaction rating scores. Overall, the results indicate that domestic visitors tend to be more satisfied than park officials and international visitors. International visitors are the least satisfied (Figure 6-2).

Overall, domestic visitors are satisfied more than international visitors and park officials with respect to six items. These include reducing visitor at overused or crowded areas, re-vegetating sites impacted by human use, strict enforcement of rules concerning deviant or inappropriate behavior, maintaining current restrictions on visitors, providing visitor education programs, and providing additional interpretive materials to increase understanding of geology, plants, animals, etc., associated with nature and national park. The KYNP officials are more satisfied than others with two items: increasing the interval of maintenance and increasing number of park rangers. International visitors are more satisfied than others with respect to number of visitor facilities such as toilet, parking area, trail, etc. The ANOVA results indicate significant differences in satisfaction levels

with three management practices (Table 6-3). These include reducing visitor at overused or crowded areas, re-vegetating sites impacted by human use, and providing visitor education programs.

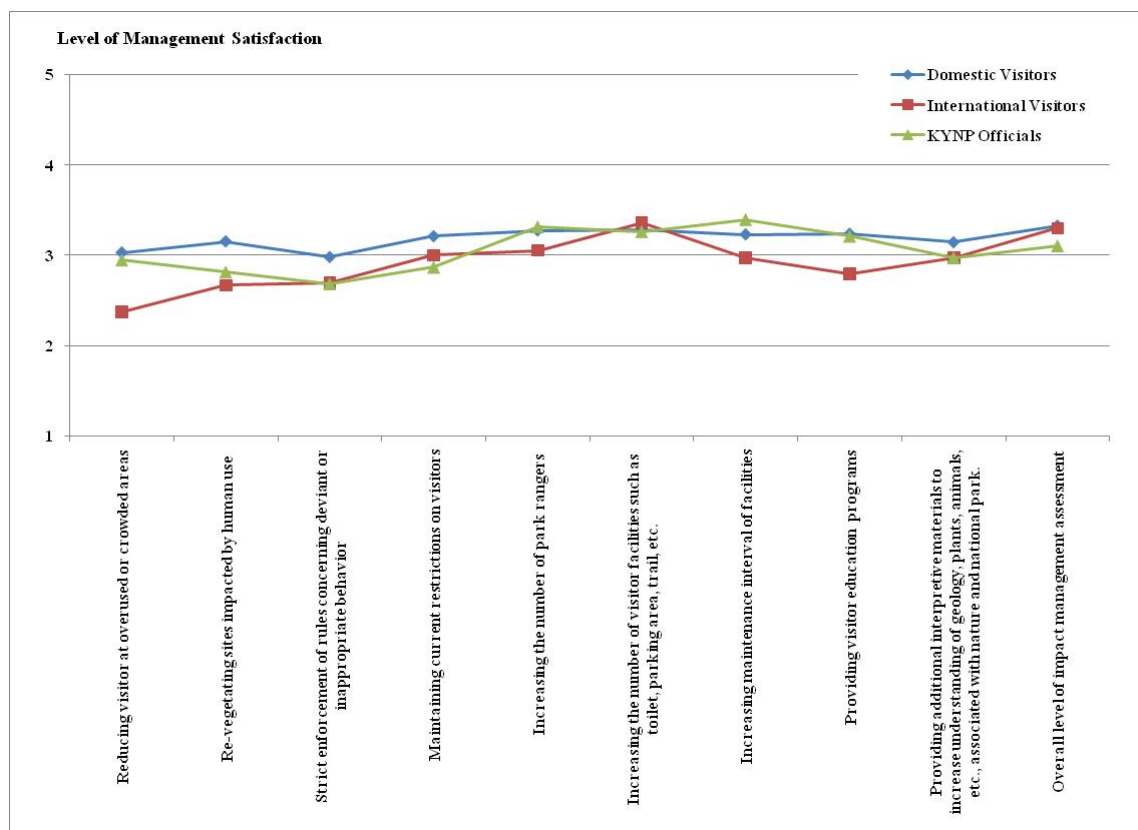


Figure 6-2 Satisfaction ratings of current impact management practices between KYNP officials, domestic, and international visitors

Table 6-3 Comparison of environmental impact management satisfaction between KYNP officials, domestic, and international visitors

Management practices	The average level of satisfaction (based on five-point scale)			F	p
	Domestic visitors	International visitors	KYNP officials		
Reducing visitor at overused or crowded areas	3.032	2.375	2.947	8.560	0.000**
Re-vegetating sites impacted by human use	3.154	2.667	2.816	5.608	0.004*
Strict enforcement of rules concerning deviant or inappropriate behavior	2.982	2.692	2.684	2.042	0.131
Maintaining current restrictions on visitors	3.210	3.000	2.868	2.179	0.114
Increasing the number of park rangers	3.275	3.053	3.316	0.725	0.485
Increasing the number of visitor facilities such as toilet, parking area, trail, etc.	3.280	3.359	3.263	0.100	0.905
Increasing maintenance interval of facilities	3.231	2.974	3.395	1.537	0.216
Providing visitor education programs	3.237	2.795	3.210	3.033	0.049*
Providing additional interpretive materials to increase understanding of geology, plants, animals, etc., associated with nature and national park.	3.144	2.975	2.974	0.819	0.441
Overall level of impact management assessment	3.325	3.300	3.105	0.926	0.397

**Significant at @ 0.00 level

*Significant at @ 0.05 level

6.4.4 Recommendations for Impact Management

Table 6-4 shows various recommendations made by the park officials and visitors to improve KYNP's current management practices. The recommendations that are most frequently stated are visitor oriented, and concern with controlling visitor numbers during holiday seasons, controlling inappropriate visitor behavior and correcting bad behaviors (12.4%), informing visitors about rules and regulations (10.9%), and educating them about minimum-impact practices (8.5%). This implies that the majority recognizes visitor use as the primary source of impacts in KYNP.

6.5 Discussion and Conclusion

According to the repeat visitors, tourism development has induced many changes in the KYNP, both positive and negative. While facility development in KYNP is recognized as an improvement in management of the park, environmental degradation due to adverse impacts of visitor activities is mentioned most frequently as a negative impact. There are also some contradictions. For example, seeing wildlife closely and placing restrictions on visitor numbers are mentioned as positive and negative at the same time.

According to overall users, this study shows that the levels of acceptability of impacts as perceived by the park officials, domestic visitors, and international visitors are in the range of either unacceptable or neutral. Across the three groups, the domestic visitors rated most impacts as least acceptable, while the KYNP officials rated these as acceptable. This finding contrasts with previous studies which indicate that park

Table 6-4 Recommendations for impact management

Recommendation	% (n = 216)
Visitor	
Controlling visitor number during holiday season	14.4
Regulating visitor behavior	13.4
Informing visitors about rules and regulations	11.6
Educating visitors about minimum-impact practices	8.8
Restricting certain visitor activities	0.9
Providing highly supervised wildlife observation opportunities	0.5
Site	
Closing sections on a rotational basis to allow for regeneration/close impacted area for rehabilitation	2.8
Zoning conservation and tourism sites	2.8
Providing more camping areas	2.3
Monitoring impacts routinely	1.4
Reforestation in certain sites	0.9
Stopping all constructions within KYNP	0.5
Administration, staff, and service	
Improving accommodation/camping reservation system	3.7
Increasing the interval of maintenance	3.7
Providing additional services and facilities	2.3
Encouraging ecotourism	2.3
Raising park officials' awareness of visitor impacts	1.9
Strengthening overall management system	1.4
Training KYNP staff about impact assessment and monitoring	1.4
Putting more emphasis on conservation than economic benefits	0.9
Providing sufficient budget for park management	0.9
Restricting big events, such as concert	0.5
Develop public transportation system to discourage the use of private vehicles	0.5

managers mostly showed the least tolerance of environmental impact (Floyd *et al.*, 1997; Manning, 1999). This difference is perhaps attributed to different group norms (Vaske *et al.*, 2001).

This study shows that the acceptability of environmental impacts also varies between domestic and international visitors. This difference could be explained in terms of the activities the domestic and international visitors engage in and the resources their activities are mostly associated with (Hillery *et al.*, 2001; Vaske *et al.*, 2001). Survey results indicated that the favorite activities for domestic visitors are camping, photographing, hiking, sightseeing, and relaxing. Expectation of a higher quality environment to perform these activities may have influenced how domestic visitors rated the level of acceptability of items (e.g., soil, water, air quality) closely associated with these activities. In contrast, international visitors' activities in KYNP focused more on forest-based activities like hiking and wildlife observation. This may explain why they rated vegetation impacts and the amount of noise as less acceptable than domestic visitors.

Overall, domestic visitors tend to be more satisfied with current impact management practices than KYNP officials and international visitors. Significant differences in satisfaction ratings of the three groups were found with respect to reducing the number of visitors at overused or crowded areas. International visitors were totally dissatisfied with current level of visitors and found the park to be still very crowded. Clearly, the norms for crowding between the domestic and international visitors are different (Graefe *et al.*, 1984). International visitors, especially from the West, are

considered more sensitive to crowding than Thai visitors (Khunluang, 2002). Re-vegetating sites impacted by visitors has been practiced in some areas in KYNP, for example, temporary closure of sites around Pha Kluai Mai Waterfall to allow for the recovery of *Renanthera coccinea*. This practice was deemed highly satisfactory by domestic visitors but was deemed unsatisfactory by the international visitors. Providing an educational program to encourage appropriate visitor behaviors was considered very satisfactory by the domestic visitors. However, it is not necessary that this can lead to their behavioral change

Although, there is no significant statistical difference in satisfaction rating between the three groups with respect to six of the nine management practices, how each group rated their satisfaction levels is still important when considering future improvements in management practices. Both the KYNP officials and domestic visitors rated low satisfaction with the enforcement of park rules and regulations, the reasons they cited were different. KYNP officials complained that most domestic visitors do not listen to their instructions or obey park rules. Domestic visitors, on the other hand, complained that there already are too many restrictions imposed upon them.

Satisfaction with interpretive materials was rated very low by international visitors. One possible reason is that the 75% of international visitors has never visited KYNP, and as such feel that the information the park is providing is inadequate. Also, most interpretive materials in KYNP are in Thai language. Satisfaction with increased maintenance interval of facilities was very high for the KYNP officials. From their

perspective, given the fiscal constraints of the park, the KYNP administration is already doing a good job of putting park rangers where they are needed the most.

Information about impact acceptability and satisfaction rating with current management practices are useful to determine the type and adequacy of future management priorities in KYNP. This study shows that garbage accumulation, solid waste in water, suspended solid matter on water surface, and monkey begging for food are least accepted by the visitors. Hence, immediate attention to these issues is required and should receive top priority for remedial actions. The results also clearly indicate that KYNP needs to strengthen its environmental education programs aimed at both domestic and international visitors.

CHAPTER VII

SUMMARY AND CONCLUSIONS

Visitor impact studies are critical to ensure that park management remains focused on its dual mandate to protect natural resources and to provide public enjoyment. Knowledge of visitors' perception of environmental impacts is an important element for the management and provision of quality recreation opportunities in national parks (Cressford, 2000). Although perception of visitors has been frequently studied in recreation and tourism contexts, literature on how visitors perceive bio-physical impacts from their activities is still limited (Manning, 1999). Perceptions of environmental impacts at a particular site are often different from reality (Deng *et al*, 2003). Also impact perceptions vary with different constituents (Farrell *et al.*, 2001; Priskin, 2003) and with different user groups (Hillery *et al.*, 2001).

However, current research on visitor impacts indicates to a gap in our understanding of impacts. Studies have been conducted either on bio-physical impacts or on perception of impacts, and are thus treated separately. There is a lack of integration of these two aspects of impact research. Thus, this dissertation aims to fill this gap, as it seeks to understand current bio-physical impacts of visitor activities in a national park, and examines how visitors perceive these impacts. The research design applied in this study integrates findings from bio-physical and social science research, and compares impact perceptions of three interest groups, and three recreation user groups. This

integrative approach objects to provide a comprehensive understanding of visitor impact issues in the Khao Yai National Park (KYNP) of Thailand.

7.1. Main Findings

Based on the results presented in Chapter II-VI, eight main findings are briefly summarized below.

1. The bio-physical impacts existing in KYNP are similar to impacts reported elsewhere in different countries.

The most common bio-physical impacts include soil compaction, removal of litter and humus layer, reduction in organic matter, erosion, plant damage, vegetation cover loss, soil and root exposure, water quality deterioration, disturbance and feeding wildlife. Other environmental impacts include noise pollution and accumulation of garbage. These types of impacts are similar to impacts reported in other studies, for example, in Australia (Buckley, 2004a; Hillery *et al.*, 2001; Sun & Walsh, 1998), China (Deng *et al.*, 2003), USA (Cole, 2004; Leung & Marion, 2000), Canada (Nepal & Way 2007), and Nepal (Nepal, 2003).

2. Differences exist in actual and perceived impacts.

Based on a review of past research on bio-physical impacts, and questionnaire interviews with park officials, domestic and international visitors, this study compared if differences exist between perceived and real (as reported by scientific research) impacts

in KYNP. The results support the hypothesis that differences exist in actual and perceived impacts. The results indicate that more than 30% of visitors did not recognize the negative results of their activities. With the exception of vegetation and water impacts, overall, visitors perceive the impacts as less severe than actual impacts. This finding supports previous perception studies which have concluded that visitors tend to perceive impacts from their activities to be less harmful than what exists in reality (Deng *et al.*, 2003; Priskin, 2003).

3. Environmental impacts are rated differently by the KYNP officials, domestic, and international visitors.

The precise knowledge about how each group of users perceives impacts in national park is very important when devising appropriate and adequate visitor impact management strategies. This study aimed to examine if there were differences in environmental perception, i.e., ratings of environmental impacts to natural resources of three interest groups – KYNP officials, domestic, and international visitors. The results support the hypothesis that differences exist in impact ratings between three groups of users. Overall, more domestic visitors than KYNP officials and international visitors rated impacts as severe; more international visitors rated the impacts to be less severe. The differences in ratings between park officials and visitors were influenced by groups of users, education levels, and age. Focusing on domestic and international visitors, group of visitors, education, park visitation experience, length of stay in KYNP, frequency of activity, and group size significantly influence impact ratings.

4. Impacts are rated differently by different recreation user groups (campers, hikers, and birders).

Results support the hypothesis that visitors who engage in different types of recreational pursuits (i.e., front country camping, backcountry hiking and bird watching) perceive impacts differently. Of the 18 items of impacts, overall, birders perceived 15 types of impacts at a higher level of severity than either campers or hikers. This finding supports the results of previous studies that differences exist in perception of impacts of a recreation activity between visitors who engage in different activities (Hillery *et al.*, 2001). Impact ratings were influenced by income levels, education levels, recreation activity, frequency of activity, group type and group size.

5. There is a difference in value orientation between campers, hikers and birders.

Results support the research expectation that birders tend to be more ecocentrists than hikers and campers. Among the hikers, there was a large group of anthropocentrists, while there were more campers classified as having environmental apathy.

6. Ratings of environmental impact acceptability differ between KYNP officials, domestic and international visitors.

The findings show that domestic visitors rated the acceptability of current impacts at the lowest level, i.e., least acceptable, than KYNP officials and international visitors. The results, therefore, do not support the expectation that KYNP officials are least tolerant of impacts, and contrasts with findings of previous studies that of all

groups park managers are the least tolerant (Floyd *et al.*, 1997; Manning, 1999).

However, of the 18 items of impacts, the statistical results indicate that the differences in impact acceptability between the three groups are significant for four items (presence of non-native plant, solid waste in water, wildlife on the road or very close to the road, and conversion of natural areas into developed areas) only.

7. Differences exist in satisfaction levels of current management practices between the KYNP officials, domestic and international visitors.

The study results show that overall, domestic visitors tend to be more satisfied than park officials and international visitors. International visitors are the least satisfied.

8. Most of the suggestions made by the park officials and visitors on how to reduce visitor impacts relate to controlling visitor numbers and inappropriate visitor behavior, and providing more opportunities for visitor education.

The recommendations that were most frequently stated by the park officials and visitors to improve KYNP's current management practices are visitor oriented, and concern with controlling visitor numbers during holiday seasons, controlling inappropriate visitor behavior and correct bad behaviors, informing visitors about rules and regulations, and educating them about minimum-impact practices. This implies that the majority recognized visitor use as the primary source of impacts in KYNP.

7.2 Implications for Further Research

The study clearly demonstrates that there has been very limited research on visitor impact research in Thailand's national parks. Thailand is not the only example in Asia. Indeed, literature on visitor impact studies has traditionally focused on North American wilderness areas, with more recent studies coming out of Australia. This type of study has been rarely conducted in Asia, Africa and South America.

The existing bio-physical research conducted in KYNP needs to be evaluated for their accuracy and reliability, which was beyond the scope of this dissertation. However, the bio-physical impacts reported in KYNP are consistent with studies conducted elsewhere. Impact studies conducted in KYNP have mostly applied descriptive surveys and comparison of used and unused sites. In-depth or experimental design is needed to construct the body of knowledge of bio-physical impact in KYNP. Most are short-term, one-time, studies conducted by independent researchers. There is a lack of integrating research to policy and management objectives. Thus, efforts to institutionalize impact study in KYNP are very limited. The priority topics for future may include determining the environmental impacts of different activities in KYNP, such as camping, hiking, trekking, bird watching, wildlife observing, bicycling, kayaking and rafting. Also, determining the levels of impacts related to visitor use patterns, such as number of visitors, distribution of uses, length of stay, and group size is important. This can provide the information about the association between recreation demand characteristics and impact patterns that can help park managers to control inappropriate use patterns and encourage low-impact practices. Site-specific environmental impacts are also needed to

determine the sensitivity of these sites. A long-term impact monitoring study at selected sites is important as well.

One limitation of this dissertation refers to the ecocentrism-anthropocentrism scale developed by Thompson and Barton (1994). This environmental attitude scale has been developed and mostly studied in the context of western attitudes. There has been very little application of this concept in other cultures. The scale, which contains 33 items and takes a while for a respondent to figure out, may not have been appropriate for this study given that the survey was implemented on site while the visitors were enjoying their visit to the park and may not have given serious thought to their environmental attitudes. Thus, the revised version of environmental attitude scale that is culture-specific might be needed for future research.

Impact perceptions in this dissertation are studied across three levels; 1) comparison between existing impacts and visitors' perception of those impacts, 2) comparison across three interest groups, i.e. KYNP official, domestic visitors, and international visitors, and 3) comparison across three recreation user groups, i.e. bird watching, hiking, and camping. There is therefore a potential for extending this research to include more activity types and further differentiating the domestic visitors between repeat and one-time visitors. Similarly, further research can be conducted exploring the effects of culture, previous recreation experience, length of experience in major activity, and trip motivation. Additionally, as a practical limitation, park officials were reluctant to speak freely about their criticisms of the management. For example, some park officials declined to answer questions related to KYNP policy. Therefore, more

appropriate methods need to be considered in future research in park settings. Also, international visitors were selected on the basis of their ability to communicate in English. Additionally, alternative approaches to surveying visitors who come as part of a tour group should be explored. These approaches may include shortening the length of the questionnaire, conducting a post-visit mail survey, interviewing visitors in hotels after their tour of KYNP, and recruiting tour guide as a facilitator for surveying the tourists.

7.3 Implications for Practice

The following recommendations are suggested based on the results of this study. These recommendations may be applicable to other national parks in Thailand as well.

Recommendation 1. Low impact Education, The results of the dissertation clearly indicate that KYNP needs to strengthen its environmental education programs, which have been strongly suggested by other scholars as an effective management tool to reduce negative impacts from visitor uses (Marion & Reid, 2007; Newsome *et al.*, 2002; Priskin, 2003). Education programs focused on encouraging visitors to consider the impacts of their actions and persuade visitors to adopt low-impact practices are essential. An advantage of education strategy is that the objective of this technique is not to control visitor behavior but ask for cooperation by providing a cognitive basis to encourage visitors to practice low impact behavior (Marion & Reid, 2007; Newsome *et al.*, 2002).

In KYNP, roughly 33.4% of the visitors indicated that visitor activities do not cause environmental impacts. Most visitors stated that either they are not aware of how their actions can cause impacts on the environment, or failed to notice existing impacts. For example, in campsites (both Lam Ta Kong and Heaw Suwat), visitors engaged in activities that were potentially harmful for the environment. These included disposing waste water into local streams, using detergent, shampoo, or soap directly in or close to water bodies, throwing trash in water, and throwing campfire ashes in the stream. To alleviate these problems, KYNP should educate visitors on low impact practices and encourage visitors to comply with park regulations. Visitors need to be made aware of the negative consequences of their activities, and also reinforce positive behavior amongst those who are aware of these issues.

Recommendation 2. Enforcement of Regulations, Dealing with illegal actions and careless or thoughtless violations is a serious issue in KYNP. Visitor actions observed in KYNP included littering, feeding wildlife, bringing pets into the park even though pets are not allowed, shouting, bringing food and beverage in restricted areas, making loud noise after 10:00 pm., and parking in restricted areas. Although, KYNP has posted many signs informing visitors about park regulations (Figure 7-1), many visitors continue to ignore these signs. Therefore, strict enforcement of rules and regulations are sometimes necessary to prevent visitors from engaging in activities not suited to a national park.



Figure 7-1 The signs located in recreation settings to inform the visitors about park regulations

Recommendation 3. Controlling Visitor Use, Based on the studies conducted in KYNP, it appears that visitor numbers have increased dramatically over the last decade. In recent years, the KYNP administration has attempted to control visitor numbers according to the capacity of each site. Campers are required to make on-line reservation in advance. Unfortunately, campsite crowding remains a problem, especially during high season. Also, when designing campsites and trails, the prevailing topography and

landform characteristics need to be taken into consideration as indicated by previous research conducted in KYNP (Nuampukdee, 2002; Sangjun *et al.*, 2006).

Recommendation 4. Facility Constructions, According to the research results, there are two issues about facility construction in KYNP. The first issue is that the locations of some facilities are inappropriate, for example, they are very close to water sources. Secondly, KYNP should post a limit to its current level of construction within the park. The park administration is simply responding to visitor demands and not taking into consideration the type, number and location of such facilities. For new facility constructions, environmental impact assessment should be required.

Recommendation 5. Training Course on Environmental Impacts, The study results indicate that KYNP officials are not knowledgeable about several aspects of the park, especially issues related to visitor impacts. Therefore, periodic training courses and workshops are necessary to improve their knowledge and understanding of visitor impact issues.

Recommendation 6. Research Cooperation, The KYNP does not have sufficient budget and research capacity to undertake impact studies. The KYNP administration through the Department of National Park, Wildlife and Plant Conservation needs to extend cooperation with outside institutions, such as universities and nonprofit organizations.

Recommendation 7. Khao Yai National Park Visitor Impact Management Model, Based on the findings of this study, a planning model is proposed for implementation at KYNP and Thailand's other national parks. The objective of this

model is to balance the two goals of KYNP establishment; preserving ecological stability and providing recreation opportunities and good experience to people, and is based on current conditions in KYNP including its financial situation. It should be clarified here that the model suggested below is not based on the findings of this research, but is presented as part of a further research agenda. Additional research on indicator selections and setting standards are necessary.

The suggested model comprises of 11 steps (Figure 7-2). The first five steps are called problem identification phase. Step I is to review existing data, organize a database for describing site ecosystems and setting, review recreation/tourism policy, and identify area's value and management purposes including visitor activities and opportunities and resource management objectives. Step II is to inventory and analyze existing environmental conditions and visitor uses. Step III focuses on the KYNP administration. This step is to assess management potential and constraints. Step IV is to identify impacts and management issues. Step V is defining the appropriate use patterns for the site. Step VI to Step XI are included in the monitoring phase. Step VI is to specify the indicators and standards for measuring existing site and social conditions. The indicators that will be selected should 1) be clear in content meaning, simple and understandable, 2) have reliability, predictive capability, and integrative ability, 3) measurable at reasonable cost at acceptable level of accuracy, and 4) reflect some relationship to the level of use occurring in the site (Meadows, 1998; Miller & Twining-Ward, 2005; Newsome *et al.*, 2002; Stankey *et al.*, 1985). The suggested bio-physical indicators for KYNP are water quality, soil compaction, soil erosion, the area of vegetation cover,

accumulation of garbage, the frequency of wildlife sights near garbage bins, and the natural area that has been converted to developed area or disturbed by visitor uses. Number of visitors, the loudness of noise, number of visitors performing inappropriate behavior, and visitors' satisfaction are suggested as social condition indicators. The combination of bio-physical and social impact indicators are essential components of an integrative impact monitoring model, as opposed to either strictly bio-physical impact monitoring model like VIM or social impact monitoring like VERP. Step VII involves the observation of current conditions specific to indicators selected in Step VI. Comparing existing conditions with the standards of each indicator is the major task in this step. If the existing conditions do not exceeded the standards set for each indicator, park management may continue to implement current practices and continue monitoring of impact indicators. On the other hand, if the existing conditions exceed the standards then a further step is necessary. Step VIII is problem analysis; the possible causes of impacts need to be determined. In this step, the study or knowledge about impact and visitor use patterns are necessary. Step IX is to develop management alternatives to solve the problems that are identified in Step VIII. In Step X, appropriate management actions are selected and implemented. The techniques should be selected based on resource management objectives, site conditions, the capability of KYNP administration, and visitor preferences and satisfaction.

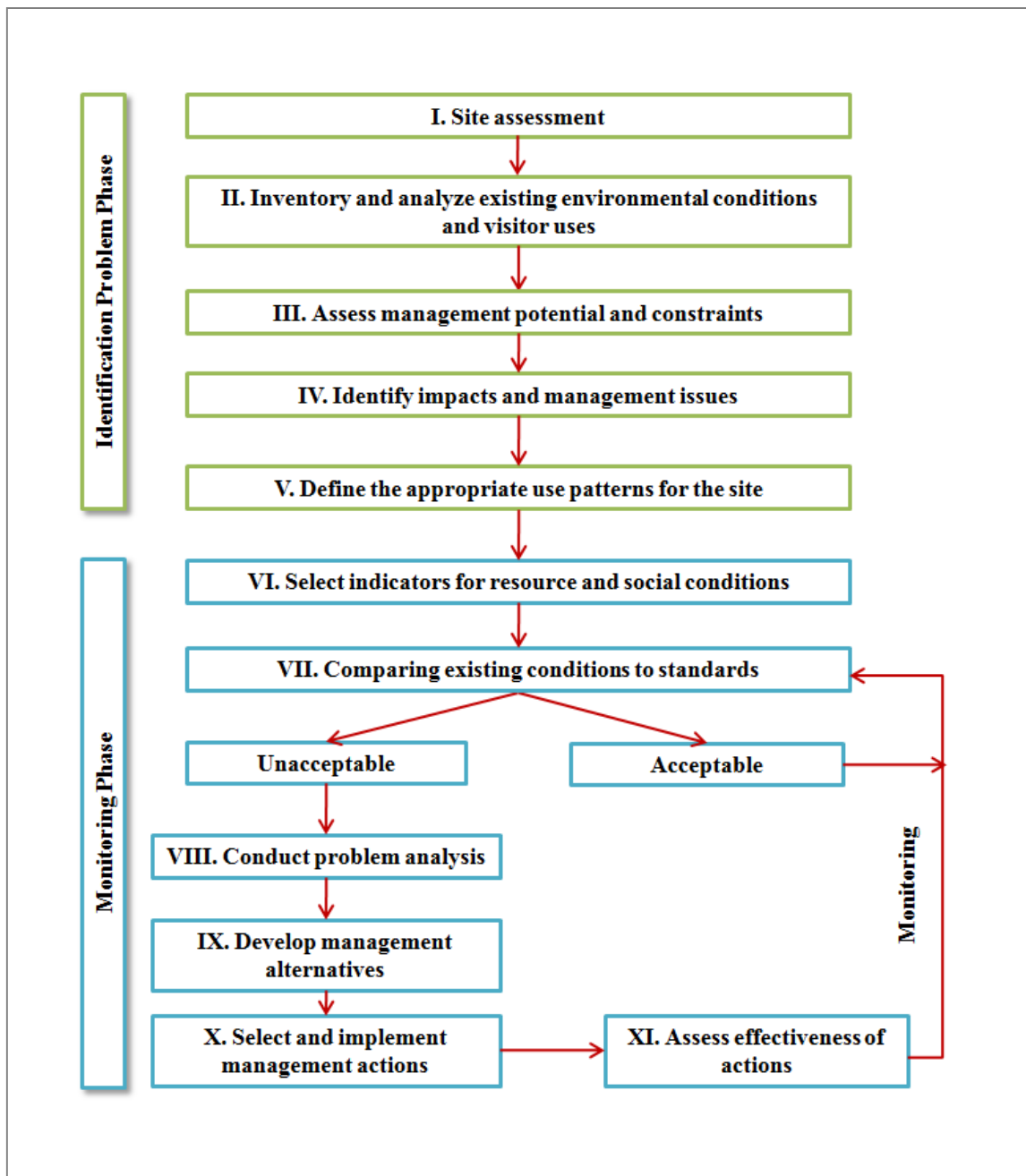


Figure 7-2 Khao Yai National Park Visitor Impact Management Model

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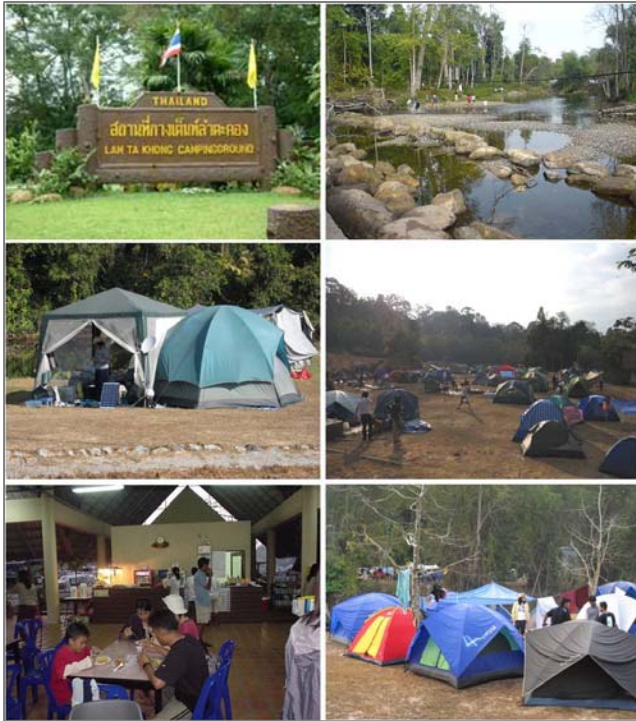
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APPENDIX A
STUDY SITES IN KHAO YAI NATIONAL PARK

Site 1: Lam Takong Campsite



This campsite is located three kilometers from the visitor center, and covers an area 7,710 square meters. KYNP has provided 3,348 square meters parking area for 400 cars and 70 motorcycles, 30,000 liter tank of water, 41 toilets and bathrooms, one food shop, one convenient shop, one visitor center, and tent and camping equipment rental service.

The attraction of this site is Lam Takong Canal, which also provides water supply for this campsite. The major activities at Lam Takong Campsite are camping, cooking, picnicking, hiking, bird watching, relaxing, swimming and photographing. Additionally, this site is also a good place for star gazing. Recreation carrying capacity of Lam Takong Campsite is approximate 2,170 visitors per day (DNP, 2004; KYNP, 2008).

Site 2: Pha Kluai Mai Campsite



This campsite is located seven kilometers from the visitor center, and covers an area of 6,441.82 square meters. KYNP has provided 2,457 square meters parking area for 300 cars and 50 motorcycles, 60,000 liters of water per day, 34 toilets and bathrooms, one food shop, one convenient shop, one visitor center, and camping equipment rental service.

This campsite is surrounded by forest. The attraction of this site is Pha Kluai Mai waterfall, walkable distance from the campsite. The major recreation activities at Pha Kluai Mai campsite are camping, cooking, picnicking, hiking, bird watching, photographing, and relaxing. Recreation carrying capacity of Pha Kluai Mai campsite is approximate 1,932 visitors per day (DNP, 2004; KYNP, 2008).

Site 3: Km. 33 – Nong Phak Chi Hiking Trail



This hiking trail is located seven kilometers from the KYNP visitor center. This trail is three kilometer long; the gradient is 0-10%. It takes 1.5 – 2 hours to complete hiking the trail. Some parts of this trail are not marked well, so inexperienced hiker needs to be careful. This trail is very popular for nature education, wildlife watching, and bird watching.

Hikers will experience the diversity of dry evergreen forest. The important species of plants are *Ficus annulata* Bl., *Dipterocarpus* spp., *Cinnamomum subavenium* Miq., *Milusa lineata* (Craib) Alston, *Clausena harmandiana* (Pierre), *Pierreex Guillaumin*, *Nephelium melliiferum* Gagnap, *Syzygium cumini* (L.) Skeels, etc. (Nunsong, 2006).

This area is an important habitat for hornbills. In KYNP, there are four species of hornbills, including *Buceros bicornis*, *Rhyticeros undulates*, *Ptilolaemus ticeilli*, and *Anthraceros albirostris*. There also found Red-wattled Lapwing (*Vanellus indicus*), Mountain Hawk Eagle (*Nisaetus nipalensis*), Blue-winged Leafbird (*Chloropsis cochinchinensis*), Black-headed Bulbul (*Pycnonotus atriceps*), Greater Yellownappe (*Picus flavinucha*), etc. (Poonswad & Tsuji, 1994). Additionally, there is a wildlife watch tower, located at the edge of the grassland, adjacent to Nong Phak Chi reservoir. From this tower, visitors can view saltlick and the reservoir – two important food sources for the wildlife. Moreover, this trail is popular for nature interpretation with 19 stations under the theme “The Love of Horn Bills.” Except for a small parking facility at the trail head, trail end and a wildlife watching tower, there are no facilities. This trail is semi-primitive, so it is a good site for experiencing nature.

Site 4: Pha Kluai Mai – Haew Suwat Hiking Trail

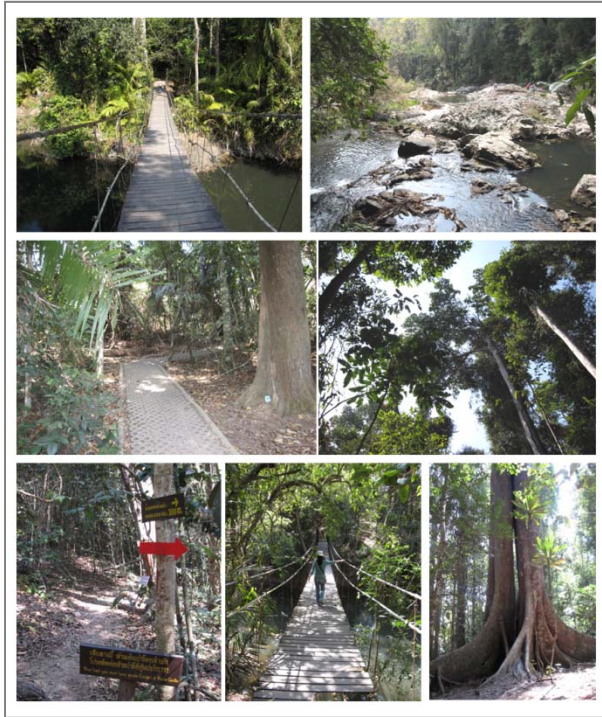


Total length is three kilometers and will take approximately two hours to complete the trip from Pha Kluai Mai campsite to Haew Suwat Waterfall. Along this trail, hikers will pass through evergreen forest. The important plant species are *Cinnamomum subavenium* Miq., *Clausena harmandiana* (Pierre) Pierre ex Guillaumin, *Aglaia odoratissima* Blume, etc. (Nuampukdee, 2002).

This is a good site to observe gibbons, macaques, kingfishers and hornbills. There is also the chance of seeing wildlife along the Lam Takong creek, such as Indo-Chinese Water Dragon (*Physignathus cocincinus*), otter (*Lutrogale perspicillata*), and Siamese fresh-water crocodile (*Crocodylus siamensis*).

One kilometer from Pha Kluai Mai campsite, hikers will pass Pha Kluai Mai Waterfall which is a major attraction on this trail. This waterfall is famous for wonderful orchids like *Renanthera coccinea*. The waterfall is named after the orchid (Kluai means orchid in Thai). It is a good location for swimming. Along this trail, there are 13 stations of nature interpretation. The theme of this trail is focused on the diversity of life that has strong relationship with water and stream. Therefore the trail is named “Water for Life.” The major recreation activities in this trail are hiking, bird watching, butterfly observing, and photographing. There are some facilities such as food shops, parking area, toilet, bathroom, souvenir shop, and visitor center.

Site 5:Kong Kaew Waterfall Nature Trail



This is a self-guided interpretive trail, located behind the visitor center. It is 1.2 kilometer long and follows the Lam Takong Canal. It is paved most of the way. It takes approximately 30 minutes to hike the trail. At the trail head, a map of the trail is posted. Hiker will find interpretive signs along the trail explaining environmental surroundings. The prominent plants frequently seen along this trail are *Tetrameles nudiflora*, *Achasma macrocheilos*, *Cinnamomum glaucescens*, and *Ficus annulata* (DNP, 2004).

Near the end of this trail, hiker will reach Kong Keaw Waterfall. The waterfall site is also good for swimming. Because this trail is close

to the visitor center, is short, and is easy to access, there is a high amount of visitor traffic. The major recreation activities for this site are nature education, photographing, bird watching, and picnicking at the trail head.

Site 6: Haew Narok Trail



This trail is one km. long, taking about 30-45 minutes to complete. It is well paved with boardwalks. Almost halfway, there is a view point which provides magnificent views of the Haew Narok Waterfall, the biggest waterfall in Khao Yai. The last 100 meters of the trail, hikers climb a narrow ladder that is very steep and slippery before reaching the first floor of Haew Narok Waterfall located at the end of this trail. The major recreation activities are hiking, bird watching, and photographing. This trail is largely covered with tropical rainforest. Several Dipterocarpaceae tree species are found along this trail. Fern, mosses, and lichens are prominent (Chayamarit & Puff, 2006). There are some facilities located at the trail head and includes food shops, parking area, toilets, bathrooms, souvenir shop, and picnic area.

APPENDIX B

LISTS OF STUDIES CONDUCTED IN KHAO YAI NATIONAL PARK

DURING 1963 TO 2008

Appendix B Lists of studies conducted in KYNP during 1963 to 2008

No	Title	Authors	Year	Institute
1	A Preliminary List of the Orchids of Khao Yai National Park	Cumberlege, P.F. & V.M.S. Cumberlege	1963	Natural History Bulletin, The Siam Society, Vol. 20 No. 3
2	A Preliminary List of the Birds of Khao Yai National Park	Dickinson, E.C.	1963	Natural History Bulletin, The Siam Society, Vol. 20 No. 3
3	Some Additions and Corrections to the Preliminary List of the Birds of Khao Yai National Park	Dickinson, E.C. & J.A. Tubb	1964	Natural History Bulletin, The Siam Society, Vol. 20 No. 4
4	Environmental Description II of Jansky & Bailey Test Site at Khao Yai, Thailand	Knud Christensen and Don Neal	1966	Joint Thai-U.S. Military Research and Development Center, Bangkok, Thailand
5	Two Little Known Snakes from Khao Yai	Soderberg, Paul	1966	Natural History Bulletin, The Siam Society, Vol. 21 No. 1
6	Notes on the Butterflies of Khao Yai National Park – Part I	Reeves, Philip A.	1966	Natural History Bulletin, The Siam Society, Vol. 21 No. 1
7	Notes on the Butterflies of Khao Yai National Park – Part II (including additions and corrections to Part I)	Reeves, Philip A.	1967	Natural History Bulletin, The Siam Society, Vol. 22 No. 1
8	A Further Contribution on the Birds of Khao Yai National Park	Dickinson, E.C.	1967	Natural History Bulletin, The Siam Society, Vol. 22 No. 1
9	Khao Yai National Park Management Plan	Suwannakorn, Piroj	1971	Royal Forest Department, Thailand
10	The Geological History of Khao Yai	Wood, Leonard	1971	Natural History Bulletin, The Siam Society, Vol. 24 No. 1
11	Report on Khao Yai National Park	McClure, H.E.	1972	Royal Forest Department, Thailand
12	Mammals of Khao Yai National Park and Checklist of Birds	Friends of Khao Yai National Park Association	1974	Friends of Khao Yai National Park Association, Thailand
13	Some of Bionomics of the Birds of Khao Yai National Park, Thailand	McClure, H.E.	1974	Natural History Bulletin, The Siam Society, Vol. 25 No. 3
14	Khao Yai National Park Implementation Plan	Yanpirat, Wjit	1975	Royal Forest Department, Thailand
15	Plant of Khao Yai National Park	Smitinand, Tem	1977	Friends of Khao Yai National Park Association, Thailand
16	Evaluation of Land-Use, Its Change and Impact of Khao Yai National Park	Laohadej, Sutep	1977	Kasetsart University, Thailand

No	Title	Authors	Year	Institute
17	Habitat Relations of the Sambar Deer (<i>Cervus unicolor</i>) in Khao Yai National Park, Thailand	Ngampongsai, Choempol	1978	Michigan State University, USA
18	Applications of Remote Sensing Techniques to Ecological Research at Khao Yai National Park	Ratanasermpong, Surachai	1978	Kasetsart University, Thailand
19	Gibbons of Khao Yai National Park	Brockelman, W.Y.	1978	Royal Forest Department, Thailand
20	Some Butterflies of Khai Yai National Park	Nuhn, Robert L. and Philip A. Reeves	1980	White Lotus Press, Bangkok, Thailand
21	Birds in Khao Yai National Park	Songkakul, Wittaya	1980	Royal Forest Department, Thailand
22	Local People's Attitude towards Khao-Yai National Park Environment : A Case Study of People in Pak-Chong District Nakhonratchasima	Chantarapoomarin, Suttiwan	1980	Kasetsart University, Thailand
23	Structure and Population Change of Sambar Deer (<i>Cervus unicolor</i>) in Khao Yai National Park	Ngampongsai, Choempol	1980	Faculty of Forestry, Kasetsart University, Thailand
24	Khao Yai Ecosystem Project Volume I: Surface Hydrology	Ruangpanit, Niwat and Tangtham, Nipon	1982	Faculty of Forestry, Kasetsart University, Thailand
25	Khao Yai Ecosystem Project Volume II: Meteorological and Hydrological data	Ruangpanit, Niwat and Tangtham, Nipon	1982	Faculty of Forestry, Kasetsart University, Thailand
26	Khao Yai Ecosystem Project Volume III: Soil and Vegetation	Suwannapinunt, Wisut and Siripattanadilok, Somkriat	1982	Faculty of Forestry, Kasetsart University, Thailand
27	Study of Sambar Population and Its Group Structure in Khao Yai National Park	Ruangchan, Surasak	1982	Kasetsart University, Thailand
28	Recreation Benefits of Khao Yai National Park	Loturatana, Sophon	1982	Kasetsart University, Thailand
29	Preliminary Treks in Khao Yai National Park with Local Villagers	Brockelman, W.Y.	1983	Royal Forest Department, Thailand
30	Vocal Interaction between Two Male Gibbons, <i>Hylobates lar</i>	Raemaekers, P.M. and Raemaekers, J.J.	1984	Natural History Bulletin, The Siam Society, Vol. 32 No. 2
31	Environmental Impact Consequencing from the Highway Construction in Khao Yai National Park	Grandstaff, S. W., Ratket, Phakarat and Thomas, Churirat	1984	Ministry of Science, Technology and Energy, Office of the National environmental Board, Thailand
32	Effects of Topography and Land Use on Water Balance of Khao Yai National Park	Kaeochada, Chamnong	1984	Kasetsart University, Thailand

No	Title	Authors	Year	Institute
33	Biophysical Land Classification and Assessment for Mangement Planning at Khao Yai National Park and Its Surroundings	Tippayasakdi, Treephop	1984	Kasetsart University, Thailand
34	National Parks (Khao-Yai and Arawan) and their Effects on Economy of the Communities and on Educational and Psychological Envelopment of the Tourists	Somroop, Manita	1985	Kasetsart University, Thailand
35	Opinions of Villagers around Khao Yai National Park on the Conservation Natural Resources	Hamakom, Amaravdee	1985	Kasetsart University, Thailand
36	Impact of Land-Use on Stream Water Quality at Khao Yai National Park	Thongtab, Uan	1985	Kasetsart University, Thailand
37	Tourists' Satisfaction toward Geophysical Condition at Khao Yai National Park	Sujariya, Wichunee and Petprom, Anattaya	1985	Prince of Songkla University, Thailand
38	Khao Yai National Park Management Plan (1987-1991)	Royal Forest Department	1986	Royal Forest Department, Thailand
39	Labor Utilization and Migration of Population in Villages Surrounding Khao Yai National Park	Duangsoongneun, Termsiri	1986	Kasetsart University, Thailand
40	The Visitors' Opinions on Facilities Development Prospect at Khao Yai National Park	Chompradist, Pantipa	1987	Kasetsart University, Thailand
41	Factors Effecting Tourists' Perception of Forest Resource Conservation in Khao Yai National Park	Kraiwieng, Chuleeporn	1988	Kasetsart University, Thailand
42	Vegetative Pattern and Soil Relationship in a Tropical Grass Land of Kho Yai National Park	Pattanakiat, Sura	1988	Kasetsart University, Thailand
43	The Comparative Study of Some Characteristics of Nests and Nest Sites of Four Hornbill Species (Aves : Bucerotidae) at Khao Yai National Park	Liewviriyakit, Rung-Arun	1989	Kasetsart University, Thailand
44	The Efficiency of the Nature Interpretation for the Tourists' Knowledge Concerning with the Area and Natural Resources of Khao Yai National Pak, Changwat Nakhon Ratchasima	Jiemwijuck, Darakorn	1989	Kasetsart University, Thailand
45	Feasibility Study: Tourism Development in Khao Yai National Park	Office Academic Service	1989	Chulalongkorn University
46	The Hydrology Role of Khao Yai National park	Tangtham, Nipon	1990	Kasetsart University, Thailand

No	Title	Authors	Year	Institute
47	Visitor's Opinion on Improvement and Development of Accommodation at Khao Yai National Park	Keingkwa, Apiwat	1991	Kasetsart University, Thailand
48	Study on Psychological Carrying Capacity for Recreational Use of Heo Suwat Waterfall, Khao Yai National Park	Duangngern, Komkrit	1991	Kasetsart University, Thailand
49	Water Quantity and Suspended Sediment Quantity of Evergreen Forest, Khao Yai National Park	Songwattana, Wichai	1992	Royal Forest Department, Thailand
50	Khao Yai National Park Management Plan (1997-1998)	Royal Forest Department	1993	Royal Forest Department, Thailand
51	Taxonomy of Broad-Winged Damselflies (Calopterygoidea : Odonata) in Khao Yai National Park	Divasiri, Sirichai	1993	Kasetsart University, Thailand
52	Wild Elephant in Khao Yai National Park, Nakornrachasima, Prachinburi, Nakhonnayok, and Saraburi Provinces	Wildlife Fund Thailand Under the Royal Patronage of H.M. the Queen	1994	Wildlife Fund Thailand Under the Royal Patronage of H.M. the Queen, Thailand
53	The Analysis of Factors Effecting Protected Forest Condition in Central Thailand: Khao Yai, Tab Lan, Pangseeda, and Tapraya National Park	Wittayasak, Wijarn	1994	Royal Forest Department, Thailand
54	Fuel Characteristics in Mixed Deciduous Forest at Khao Yai National Park	Akka-akara, Siri	1994	Royal Forest Department, Thailand
55	Ranges of Males of the Great Hornbill (<i>Buceros bicornis</i>), Brown Hornbill (<i>Ptilolaemus tickelli</i>) and Wreathed Hornbill (<i>Rhyticeros undulates</i>) in Khao Yai National Park, Thailand	Poonswad, P. and Tsuji, A.	1995	Mahidol University Meijo University, Nagoya, Japan
56	Green Finance: Case Study of Khao Yai National Park	Kaosa-ard, Mingsarn	1995	Thailand Development Research Institute, Thailand
57	Valuation of Natural Resources of Khao Yai National Park	Pattamasiriwat, Direk	1995	Thailand Economic Association
58	A Geographical Study of Wildlife Abundances in Khao Yai National Park, Thailand	Trisurat, Y., Eiumnoh, A., Tharnchai, P. and Phongpanit, K.	1996	ASEAN Institute of Technology, Thailand
59	Species Diversity of Amphibians and Reptiles at Khao Yai National Park	Nabhitabhata, Jarujin	1996	Office of the National Research Council of Thailand
60	Ecotouristic Behavior of the Tourists at Khao Yai National Park	Pochanapan, Lalita	1996	Mahidol University, Thailand

No	Title	Authors	Year	Institute
61	Population Structural Characteristic of Rats in Evergreen Forest and Grassland, Khao Yai National Park	Soontornpitakkool, Somkiat	1996	Kasetsart University, Thailand
62	Demand for Outdoor Recreation Services : A Case Study of Khao Yai National Park	Saehae, Sombat	1996	Chulalongkorn University
63	Mammals of Khao Yai National Park	Srikosamart, Sompoj and Hensell, Troy	1996	Amarin Printing & Publishing Public Company Limited, Bangkok Thailand
64	The Development of Nature Trail Guide Book in Khao Yai National Park	wangyaichim, Yuppared	1997	Mahidol University, Thailand
65	Bird Watching Guide Book in Khao Yai National Park	Royal Forest Department, Thailand	1997	Royal Forest Department, Thailand
66	A comparison of the enforcement of access restrictions between Xishuangbanna Nature Reserve (China) and Khao Yai National Park (Thailand)	Heidi J. Albers and Elisabeth Grinspoon (No permission)	1997	Stanford University, USA University of California at Berkeley, USA
67	Behavioral Study of Maturation of White-Handed Gibbons (<i>Hylobates lar</i>) at Khao Yai National Park, Thailand	Suwanvecho, Udomlux	1997	Mahidol University, Thailand
68	Using the Single-Site Travel Cost Model to Value Recreation: An Application to Khao Yai National Park	DeShazo, J. R.	1997	EEPSEA, Singapore
69	Management Information System for Conservation of Hornbills in Khao Yai National Park	Aksornkitti, Nantiya	1998	Mahidol University, Thailand
70	Visitors' Expectation towards Recreational Services in Khao Yai National Park, Nakonnayok, Prachinburi, Saburi and Nakon Ratchasima Provinces	Poorahong, Precha	1998	Maejo University, Thailand
71	A Study of the Impacts of Economic Crisis on Ecotourism in Khao Yai National Park	Jintana, V., Tinnaphan, C. and Traynor, C.	1998	Faculty of Forestry, Kasetsart University, Thailand
72	Valuation of Natural Resources in Protected Areas: A Case Study of Khao Yai National Park	Forest Research Center	1998	Faculty of Forestry, Kasetsart University, Thailand
73	Seed Dispersal by Hornbills in Khao Yai National Park	Kitamaru, S. and Yumamoto, T.	1998	Kyoto University, Japan
74	Biodiversity Information System for Khao Yai National Park Management	Chayanukrao, Songsakda	1999	Mahidol University, Thailand

No	Title	Authors	Year	Institute
75	Rafting patterns in the Central Part of Thailand and tourist companies' opinions about developments of Hin Perng rafting area, Khao Yai National Park	Panyathanakun, Rachen	1999	Kasetsart University, Thailand
76	Feeding and Ranging Behavior of the White-handed Gibbon (<i>Hylobates lar</i>) in Khao Yai National Park, Thailand	Bartlett, T.Q.	1999	Washington University, USA
77	Characteristics of Fruits Consumed by the White Handed Gibbon (<i>Hylobates Lar</i>) in Khao Yai National Park, Thailand	Kanwatanakid, Chuti-on	2000	Mahidol University, Thailand
78	Genetic Structure of Thai Gibbon Groups at Mo Singto, Khao Yai National Park, Thailand	Reichard, Ulrich	2000	Department of Primatology, Max Planck Institute for Evolutionary Anthropology, Germany
79	Biodiversity of Ants in Khao Yai National Park	Wiwatwittaya, Decha	2000	Faculty of Forestry, Kasetsart University, Thailand
80	The study on existing resources and database development of Khao Yai, Tab Lan, Pangseeda, and Tapraya National Park	GEOASIA Company Limited	2000	GEOASIA Company Limited
81	Ecological Niches of some BULBULS (Family Pycnonotidae) in Khao Yai National Park	Chaikuad, Krisana	2000	Kasetsart University, Thailand
82	Insect Succession and Diversity on Carrion in Different Habitats at Khao Yai National Park	Areekul, Buntika	2000	Mahidol University, Thailand
83	The Tourist Satisfaction in Khao Yai National Park for Recreation Purposes	Charoensawat, Yaowaree	2000	Mahidol University, Thailand
84	The Study of Landscape Design of Service Area at Hin-Perng Rafting Area, Sai-Yai River, Khao-Yai National Park	Panyathanakun, Rachen	2000	Kasetsart University, Thailand
85	A Study of Vocalization Patterns of Great Hornbills (<i>Buceros bicornis</i>) at Khao Yai National Park	Nakkuntod, Siriwan	2000	Kasetsart University, Thailand
86	Behavior, Bird Watching Activity and Bird Watchers' Opinions in Recreation Resources Management : A Case Study of Khao Yai National Park	Naksiri, Apinya	2000	Kasetsart University, Thailand
87	Taxonomic Study of Family Annonaceae in Some Area of Khao Yai National Park Chang Wat Nakhon Ratchasima	Plongmai, Kamol	2001	Kasetsart University, Thailand

No	Title	Authors	Year	Institute
88	Solid Waste Management: Case study of Pha Kluay Mai and Suwat Waterfall, Khao Yai National Park	Jaihao, Peerachai and Panklang, Banjong	2001	King Momgkut's University of Technology North Bangkok
89	Tourist's Socio-Economic Relating Ecotourism Activities in Khao Yai National Park	Tinnaphan, Chorprae	2001	Kasetsart University, Thailand
90	Identification Guide to the Ant Genera of Khao Yai National Park	Wiwatwittaya, Decha and Jaitrong, Weeyawat	2001	Faculty of Forestry, Kasetsart University, Thailand
91	Staff Satisfaction toward Tourism Service Job at Khao Yai National Park	Eawpanich, Thanit	2001	Kasetsart University, Thailand
92	The Role of Tourism Industry In Nakorn Rachasima to Job Employment: Case Studies Khao Yai National Park and Pimai National Historical Park	Kedsuk, Wachiraporn	2001	Research and Development Institute, Khon Kaen University Thailand
93	An Identification of Plant Communities as Related to Soil Properties And Toposequence in Rangeland of Khao Yai National Park	Supachoksahakul, Wirot	2001	Khon Kaen University, Thailand
94	Impact of Tourism and Management of Ecotourism at Head Quarters-Nong Phak Chi Trail, Khao Yai National Park	Utarasakul, Tassanawalai	2001	Chulalongkorn University, Thailand
95	Diversity of Fly in Water Resources in Khao Yai National Park	Chanpaisang, Jariya	2001	Kasetsart University, Thailand
96	A Spatial-Intertemporal Model for Tropical Forest Management Applied to Khao Yai National Park, Thailand	Heidi J. Albers	2001	Washington D.C., USA
97	Species Diversity, Distribution and Effect of Physical Factors on Populations of Haemadipsid Land Leeches in Thailand	Ngamprasertwong, Thongchai	2001	Chulalongkorn University, Thailand
98	Relationship between Land Use and Level of Organic Carbon in Watershed Area	Cho, K.M.	2001	Justus-Liebig University of Giessen, Germany
99	Impacts of Forest Hiking Activity on Vegetation and Some Physical Properties of Soil in Khao Yai National Park	Nuampukdee, Ratikorn	2002	Kasetsart University, Thailand
100	Using Ants as Indicators of Plant Communities at Khao Yai National Park	Phoonjumpa, Rungnapa	2002	Kasetsart University, Thailand

No	Title	Authors	Year	Institute
101	Environmental Graphic Design for a Thai National Park, Case Study : Khao Yai National Park, Nakhon Ratchasima Province	Sae-Tia, Wisilp	2002	Silpakorn University, Thailand
102	Diversity of Lichen in Khao Yai National Park	Boonprokob, Kansri	2002	Ramkhamhaeng University, Thailand
103	Diversity and Population of Birds and Exploitation of their Habitat in Khao Yai National park	Naksathit, Amara	2002	Mahidol University, thailand
104	Ecology of Sympatric Carnivores in Khao Yai National Park, Thailand	Austin, S.C.	2002	Texas A&M University, USA
105	Fungal Colonization of Wood in a Freshwater Stream at Tad Ta Phu, Khao Yai National Park, Thailand	Sivichai S, Jones EBG, Hywel-Jones N.	2002	National Center for Genetic Engineering and Biotechnology, Thailand
106	Type, Quantity of Solid Waste, and Littering Behavior of Tourists and Entrepreneurs in Khao Yai National Park	Phaiboonsombut, Pranee	2003	Kasetsart University, Thailand
107	Analysis of Tourists' Motivation in Choosing Site and Tour Season in Nature-Based Recreation Areas : Case Studies of Doi Inthanon and Khao Yai National Parks	Kanjansomranwong, Foosak	2003	Kasetsart University, Thailand
108	Ecology of Gibbons and Other Herbivores and Theirs on Forest Plant in Khao Yai National Park I	Brockelman, W.Y.	2003	Mahidol University, Thailand
109	Ecological Study of Lianas and Some Vines in Mo Singto Biodiversity Research Plot, Khao Yai National Park, Thailand	Lertpanich, Kanok	2003	Mahidol University, Thailand
110	Species Diversity of Terrestrial Earthworms in Khao Yai National Park	Kosawititkul, Prasobsuk	2003	Department of Biology, Naresuan University, Thailand
111	Differences between Family and Population of Animal in Humus and Soil in Primary and Secondary Forest at Mo Sing To, Khao Yai National Park	Thirakhupt, Vacharobon	2003	Faculty of Science, Mahidol University, Thailand
112	Subproject on Ecology of Evian Herbivores at Mo Sing To, Khao Yai National Park	Round, P.D.	2003	Mahidol University, Thailand
113	Interactions Between Fruit and Frugivores in a Tropical Seasonal Forest in Khao Yai National Park: Special Reference to Seed Dispersal by Hornbills	Kitamura, Shumpei	2003	Kyoto University, Japan

No	Title	Authors	Year	Institute
114	Observations on Wildlife and Plant: Khao Yai - Tab Lan Corridor Project	Khao Yai National Park	2003	Khao Yai National Park
115	Wild Elephant Management In Khao Yai National Park	Woharndee, Prawat	2003	Khao Yai National Park
116	Observation on Agarwood (<i>Aquilaria crassna</i> Pierre ex.) in Khao Yai National Park	Woharndee, Prawat	2003	Khao Yai National Park
117	Diversity of Butterfly Population at PHA at Kluai Mai-Haew Suwat Waterfall Trail, Khao Yai National Park, Thailand	Ratiwiriyaopong, Premsak	2004	Mahidol University, Thailand
118	Social Behaviour and Ecology of the Siamese Fireback (<i>Lophura diardi</i>) in Khao Yai National Park, Thailand	Praditsup, Nichaya	2004	Mahidol University, Thailand
119	Carnivore Project	Khao Yai National Park	2004	Khao Yai National Park
120	Firefly Research Project	Khao Yai National Park	2004	Khao Yai National Park
121	Aroma Rasin Stimulation of Agarwood (<i>Aquilaria crassna</i>) by Fungi and Chemical	Khao Yai National Park	2004	Khao Yai National Park
122	Plant Community Analysis for Nature Interpretation Designing in the Nature Trails at Khao Yai National Park	Cheablam, Onanong	2004	Kasetsart University, Thailand
123	Opinion of Tourists Toward Ecotourism at Khao Yai National Park	Anatachaimontree, Anothai	2004	Srinakarinwirot University, Thailand
124	Impacts of Wildlife Feeding in Khao Yai National Park: Case Study of Pig-tailed Macaque (<i>Macaca nemestrina</i>).	Kanurai, P.	2004	Kasetsart University, Thailand
125	Assessment of the Management Effectiveness of Khao Yai National Park	Saranet, Saowanee	2004	Kasetsart University, Thailand
126	Study of Recreation Carrying Capacity, Khao Yai National Park	National Park Research Division	2004	National Park, Wildlife and Plant Conservation Department, Thailand
127	Habitat Use Behavior of Wild Elephant, Khao Yai National Park	Brockelman, W.Y.	2005	Mahidol University, Thailand
128	Responses to Burning and Edge Effects of Small Mammals at Klong E Tao Substation, Khao Yai National Park	Kaewprom, W., Gale, G. A. and Lynam, A. J.	2005	School of Bioresources and Technology, King Mongkut's University of Technology, Thailand
129	Study on Physiology of Endocrine System and its effect to Rutting Period of Male Elephant	Wingate, L. and Sookasem, C.	2005	USA

No	Title	Authors	Year	Institute
130	Suitability Analysis of Design and Utilization of Visitor Centers in National Parks	Unjit, Songsee	2005	Kasetsart University, Thailand
131	Decision Support System for Sustainable Management Planning of Nature-based Recreation Areas, Phase I	Tanakanjana, N. et. al.	2005	Kasetsart University, Thailand
132	Visitor Satisfaction at Campground: A Case Study of Lam Ta Klong Campground, Khao Yai National Park	Kappelle, P.D.	2005	National Park, Wildlife and Plant Conservation Department, Thailand
133	Tourist Expectations and satisfaction Towards Wildlife Night Spotting at Khao Yai National Park	Phugsachart, Noppawong	2005	National Park, Wildlife and Plant Conservation Department, Thailand
134	Diversity of Ferns and Fern Allies at Khao Khiao Area in Khao Yai National Park	Khwaiphan, Wasinee	2005	Chulalongkorn University, Thailand
135	Elephant Monitoring in Khao Yai National Park	Khao Yai National Park	2006	Khao Yai National Park
136	Responses of Annual Ring of <i>Podocarpus neriifolius</i>	Suwanpattra, Kamol	2006	Khao Yai National Park
137	The Ecotourism Behavior of Thai Tourist at Khao yai National park	Rimphati, Wannapat	2006	Suan Dusit Rajabhat University, Thailand
138	Assessment of Forest-Based Recreation Resource Potential	Nunsong, Nitas	2006	Kasetsart University, Thailand
139	Relationships Between Mammal Abundance and Diversity and Distribution of Hard Ticks(<i>Acari:Ixodidae</i>) in Khao Yai National Park	Ariyakulwong, Phawinee	2006	Kasetsart University, Thailand
140	Khao Yai National Park Service Enhancement Scheme	Kanjula, Chidchom	2006	Suan Dusit Rajabhat University, Thailand
141	Impacts of recreation Activities on sambar Deer Behavior and Habitat Utilization in Khao Yai National Park	Sangjun, N.; Tanakanjana, N., Pattनावibool, A.; Bhumpakphan, N.	2006	Kasetsart University, Thailand
142	Species Diversity and Altitudinal Distribution of Amphibians along Lam Ta Klong Watershed Area in Khao Yai National Park	Kongiaroen, Wanwipa	2007	Kasetsart University, Thailand
143	Khao Yai National Park Management Plan (2007-2016)	Royal Forest Department	2007	Royal Forest Department, Thailand
144	Diversity of Xyleborus sp. In Khao Yai National Park	Sonthichai, Saowapa	2007	Chiang Mai University, Thailand

No	Title	Authors	Year	Institute
145	Recreation and Tourism Carrying Capacity of Khao Yai National Park: Ecological Carrying Capacity	Nimsantichareun, Sompoj	2007	Khao Yai National Park
146	Changes in the Status of Lophura Pheasants in Khao Yai National Park, Thailand: A Response to Warming Climate	Round, P.D, and Gale, G.A.	2008	Mahidol University, Thailand
147	Values and behaviors relating to wildlife of visitors to Khao Yai National Park	Keawwan, Nuannuch	2008	King Naresuan University, Thailand
148	Thai-Gibbon-Genetics-Project (TGGP)	Barelli, Claudia	2008	Department of Primatology, Max Planck Institute for Evolutionary Anthropology, Göttingen, Germany
149	Renanthera spp. Rehabilitation at Pha Kluai Mai, Khao Yai National Park	Praphan, Saroej	2008	Khao Yai National Park
150	Ecology of Gibbons and Other Herbivores and Theirs on Forest Plant in Khao Yai National Park II	Brockelman, W.Y.	2008	Mahidol University, Thailand
151	Reproductive Ecology and Pollination Ecology of Agarwood (<i>Aquilaria crassna</i>)	Tangmitchareun, Suwan	2008	Royal Forest Department, Thailand

APPENDIX C

BIO-PHYSICAL IMPACT STUDIES CONDUCTED IN

KHAO YAI NATIONAL PARK

The Guidelines for Solid Waste Management in Khao Yai National Park Case Study: Pha Kluay Mai Campsite and Haew Suwat Waterfall

This study aimed to assess solid waste management in KYNP. Pha Kluay Mai Campsite and Haew Suwat Waterfall were selected for study sites. Then, the suggestions for solid waste management for the future were outlined.

Questionnaire surveys were applied to collect the data. The study found that the major problem was the increasing in the amount of solid waste that was proportional to the increasing number of visitors. Also, there were not enough bins in study locations. For more effective solid waste management, KYNP encouraged visitors to separate the garbage. However, the study reported that there were difficulties in distinguishing the different types of rubbish bins. Furthermore, the wasteful spending on transportation and disposal of solid waste, recycle, and littering behaviors of visitors were also determined as significant problems of waste management.

Several management practices were suggested. There included conducting public information to reduce solid wastes, putting up signs to prevent littering in inappropriate places, encouraging visitors to collect the solid waste in separated bins, arranging for the collection of solid waste in the time of visitors go outside of the rest camps, and gathering some solid waste that can be reused and conducting public information for the visitors to know about the laws and the penalty of littering. Additionally, to reduce pollution, the use of an incinerator for solid waste disposal was recommended.

Source: Jaihaw and Panklang (2001)

Impact of Tourism and the Management of Ecotourism at Headquarter - Nong Phak Chi Trail, Khao Yai National Park

The objective of this study was to investigate the impacts of tourism and ecotourism management in KYNP. Headquarters - Nong Phak Chi Trail was selected for research location. This trail was 4.7 kilometer long and passed through evergreen forest, dipterocarp forest, and grass land. The data was collected every three days for each month during February 2001 to January 2002.

The first part of this study focused on examining biodiversity of the trail. 80 species of plants, 66 species of birds, and 13 species of mammals were observed. The Great Hornbill (*Anthracoceros albirostris*) and butterflies was most likely seen throughout the year. According to visitor's appreciation, frequency of observing, striking, and uniqueness, the prominent plants of this trail were *Tetrameters nudiflora*, *Achasma macrocheilos*, *Cinnamomum glaucis*, *Melastoma malabathricum*, *Ficus. Annulata*, *Cyathea nodophylla*, and *Sandoricum koetjape*. The prominent wildlife observed on this trail were *Buceros bicornis*, *Anthracoceros albirostris*, *Haemadipsa sp.*, *Hylobates Lar*, *Hylobates pileatus*, *Carpococcyx renauldi*, *Lophura diardi*, *Lophura ignita*, and *Elephas maximus*.

The second part of the study examined the impacts of visitors' activities existing along the trail. Amount of garbage was used as an indicator. The result showed that plastic (63.9%) and paper garbage (22.9%) were most commonly found on the trail. The correlation between garbage and visitor was analyzed. There were significant correlations between the number of visitors and amount of garbage ($R^2 = 0.85$) and the number of visitors and weight of garbage ($R^2 = 0.89$) at p-value 0.05. On average, the quantity of garbage was eight pieces per person. Additionally, bio-physical impacts found in the area included some muddiness spots, soil erosion, removal of shrub and tree stem, clearing seedling on the trail, habituated wildlife, and disturbance of wildlife. However, these bio-physical impacts were determined as slightly-impacted.

Visitor's characteristics and behaviors also were observed. Roughly 52.7% of the surveyed visitors were male and 47.3% female. The majority (30.3%) was 31-40 years old, 60.0% had completed undergraduate level education, and 62.4% are domestic visitors. The three major activities for hiking in this trail were wildlife observing, relaxing, bird watching, and studying nature. Roughly 66.1% never hiked before. For hiking behavior, 84.2% brought food and beverage during hiking.

Several management strategies for ecotourism were presented. These included impact monitoring, reducing amount of use, providing information to visitors, educating visitors about impacts from their activities, and providing nature education to visitors.

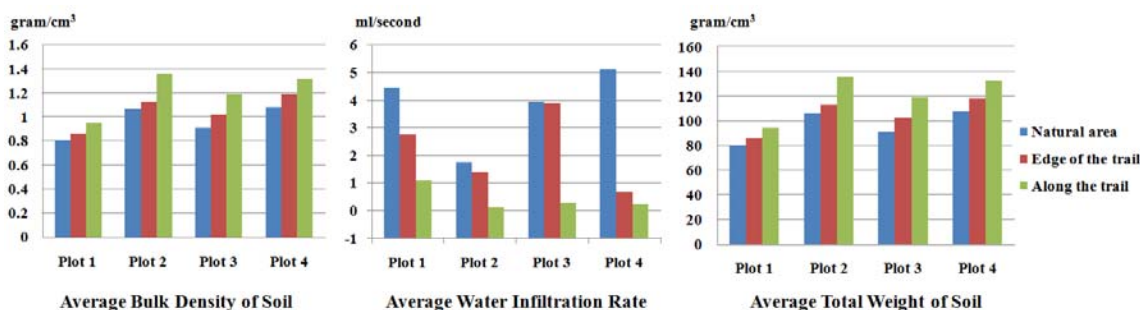
Source: Utarasakul (2002)

Impacts of Forest Hiking Activity on Vegetation and Some Physical Properties of Soil in Khao Yai National Park

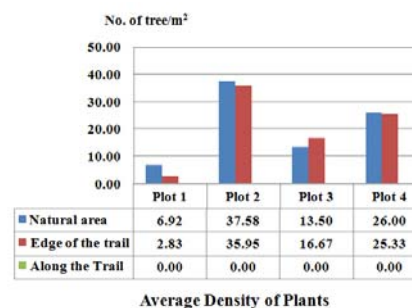
This study examined impacts from hiking on some physical properties of soil and vegetation in KYNP. Two hiking trails, Headquarters - Nong Phak Chi Trail and Pha Kluai Mail-Haew Suwat Trail, with different levels of use were chosen as study sites. Additionally, to investigate factors influencing the levels of impacts, four 10 x 20 m. plots with different forest types, levels of use, and slopes were set across the trails. The details of each plot were presented below.

Plot	Trail	Slope	Level of use	Forest type
1	Headquarters - Nong Phak Chi Trail	40%	26.98 %	Dry evergreen forest
2	Headquarters - Nong Phak Chi Trail	0-5%	26.98 %	Rehabilitation area
3	Headquarters - Nong Phak Chi Trail	0-5%	26.98 %	Dry evergreen forest
4	Pha Kluai Mail-Haew Suwat Trail	0-5%	55.56 %	Dry evergreen forest

For soil impacts, bulk density, total weight of soil, and water infiltration rate were measured. The results presented that bulk density and total weight of soil along the trail were significantly larger than findings in natural area. While infiltration rate along the trail was significantly lower than the rate measured in natural area. In comparison of the differences of impacts in properties of soil, significantly different soil impacts were found in the trail that had differences in slope and level of use while there was no significant difference of the impacts with different forest type. This concluded that hiking activities affected soil conditions along the trail and slope and level of use influenced the level of impacts.



For vegetation impacts, the results show that the type and the average density of plants in undisturbed locations were significantly higher compared to disturbed locations. However, the results could not clearly determine if the differences could be attributed to varying degrees of slope, plant communities and level of use.

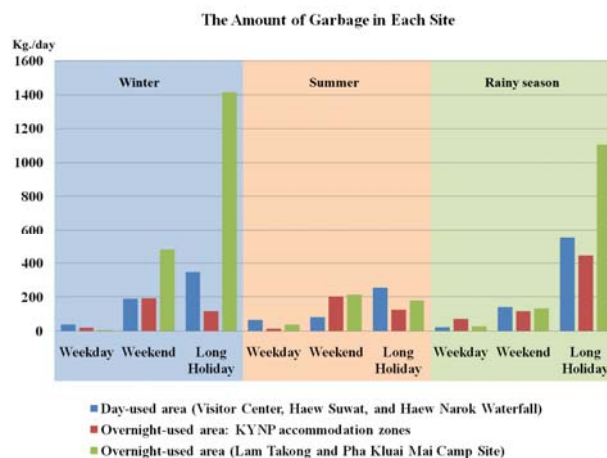


Source: Nuampukdee (2002)

Type, Quantity of Solid Waste, and Littering Behavior of Tourists and Entrepreneurs in Khao Yai National Park

The objectives of this research were to assess type and quantity of solid wastes in KYNP and investigate littering behaviors of visitors and entrepreneurs in the park. The littering data was collected in three seasons; rainy, winter, and summer, covering three different times; weekday, weekend, and long holiday, both day-used and overnight-used zone (KYNP accommodation zones and camp sites). For littering behavior, 417 questionnaires were delivered to 417 visitors and 11 entrepreneurs.

The study found that three major types of solid waste from visitors were left-over food, grass, and plastic bag respectively. The descriptive comparison was made across three seasons. The study reported that in winter season and rainy season, the highest quantities of solid wastes were collected from camping areas during long holidays (1,415.0 and 1,104.8 kg./day respectively) while the highest quantity of solid wastes (256.2 kg./day) was from day-used sites in summer season during long holidays.



For the rate of solid waste producing, the results demonstrated that producing rate of overnight-used area (1.19 kg./person/day) was higher than day-use area (0.13 kg./person/day). Additionally, there was a significant correlation between number of visitors and amount of solid waste. The linear regression equations to predict solid waste producing rate were

$$Y1 = 14.915 + 0.0149X1 \quad \text{for day-used area}$$

$$Y2 = -3.297 + 0.574X2 \quad \text{for overnight-used area}$$

when $X1$ and $X2$ = number of visitors in day-used and over-night used time respectively and $Y1$ and $Y2$ = expected amount of solid waste in day-used and over-night used time respectively.

Littering behaviors were also investigated. The study reported that most visitors brought plastic bag by themselves and put all garbage in the bags without separate wet and dry garbage before dumping. While the entrepreneurs separated wet and dry waste before dumping in the containers. Hypothesis testing presented that littering behavior had insignificant correlation with type of group (friend, family, combination between friend and family group), group size, and type of stay (one day trip and overnight trip).

Source: Phaiboonsombat (2003)

Impacts of Wildlife Feeding in Khao Yai National Park: Case study of Pig-tailed Macaque (*Macaca nemestrina*)



This study focused on impacts of wildlife feeding to the numbers and behavior of macaques (*Macaca nemestrina*) in KYNP. The behavior of macaques and their presence along the road were observed during May to October, 2002 at visitor use zones in the park. Two roads with different conditions (Road A: 20-45° slope and frequency of 5.4 vehicles per hour, Road B: 0-10° slope and frequency of 17.4 vehicles per hour) were selected for study locations. Questionnaires were delivered to 200 visitors to study feeding behavior, opinion, and knowledge about wildlife feeding.

The study suggested that macaques were found along the roads 83.3% of all observations. They were mostly found during 2:00 to 6:00 pm when recorded as most crowded vehicles on the roads, and with a frequency of 6.0 macaques per hour.

The comparisons of the presences of macaques in different sites, during weekday and weekend, and time of observation were made. The results examined that the average frequencies of the presence of macaques per hour were significantly different due to the different sites and times of observation ($t = 3.79$, sig. = 0.000 and $F = 12.56$, sig. = 0.000 respectively). The study reported that the frequency of macaques per hour on road B (5.6 macaques per hour) was significantly higher than road A (2.7 macaques per hour). Considered the presence of macaques in different times of observation, the average frequency of the presence of macaques per hour during 2:00-6:00 pm (6.0 macaques per hour) was higher than 10:00 am-2:00 pm (5.3 macaques per hour) and 6:00-10:00 am (2.1 macaques per hour) respectively. While the average number of the presences of macaques per hour during weekend and weekday was no significantly different.

For wildlife feeding behavior of KYNP visitors, according to the questionnaire survey, 59.0% of respondents wanted to see the macaques on the roads, 94% answered that they did not feed the macaques, and 94.0% recognized the impacts of wildlife feeding. So, they did not feed the macaques. This was consistent to the observation that the macaques received 2.2 pieces of food items per head. However, the researcher recommended that strict control over wildlife feeding in KYNP should be implemented.

Source: Kanurai (2004)

Study of Recreation Carrying Capacity, Khao Yai National Park

This study assessed carrying capacity and visitor impacts in 16 primary tourist sites at KYNP. Carrying capacity was determined based on three aspects, including ecological, physical and facility, and psychological. Visitor impacts were assessed to improve understanding of many ways that visitors caused negative impacts to environmental conditions in the park. To define carrying capacity and visitor impacts, 17 factors were considered, including:

Carrying capacity aspect	Indicators
Ecological carrying capacity	<ol style="list-style-type: none"> 1. Diversity of sapling and seedling 2. Diversity of wildlife species 3. Freshwater ecosystem 4. Water quality
Physical and facility carrying capacity	<ol style="list-style-type: none"> 5. Recreation area 6. Quantity of water for visitor use 7. Parking area 8. Soil erosion 9. Air quality (Suspended particulate (TSP) and smell) 10. Equivalent continuous sound level in a 24 hours time frame (L_{eq} 24 hr) 11. Garbage 12. Accommodation/camping area 13. Number of restroom and bathroom 14. Capacity of food shop 15. Capacity of visitor center
Psychological and social carrying capacity	<ol style="list-style-type: none"> 16. Attitude of visitors 17. Attitude of local people

The maximum acceptable numbers of visitors based on carrying capacity and initial impact assessment of 16 sites were presented as follow.

Tourism site	Carrying capacity (number of visitor /day)	Visitor impacts
Sarika Waterfall	1,764	<ul style="list-style-type: none"> - Crowded people at parking area, waterfall area, hiking trail, visitor center, and view point - Impact to quantity of water for visitor use
Kong Kaew Waterfall	4,050	<ul style="list-style-type: none"> - Crowded people at view point, visitor center, and hiking trail - Impact to fresh water ecosystem
Pha Kluai Mai Waterfall and Pha Kluai Mai Camping Area	1,932	<ul style="list-style-type: none"> - Crowded people at parking area, convenient shop, and camping area - Garbage accumulation - Wildlife disturbance - Impact to vegetation around camp sites and hiking trail - Noise pollution at camping area - Impact to fresh water ecosystem

Tourism site	Carrying capacity (number of visitor /day)	Visitor impacts
Lam Takong Camping Area	2,170	<ul style="list-style-type: none"> - Crowded people at parking area, convenient shop, and camping area - Garbage accumulation - Wildlife disturbance - Impact to vegetation around camping areas and hiking trails - Noise pollution
Haew Suwat Waterfall	4,023	<ul style="list-style-type: none"> - Crowded people at convenient shop, rest room, and view point - Garbage accumulation - Impact to fresh water ecosystem and water quality
Haew Sai Waterfall	3,870	<ul style="list-style-type: none"> - Noise pollution
Haew Pratoon Waterfall	405	<ul style="list-style-type: none"> - Noise pollution
Haew Narok Waterfall	1,683	<ul style="list-style-type: none"> - Crowded people at recreation area, parking area, and rest room - Noise pollution
Ta Krow Waterfall	1,440	<ul style="list-style-type: none"> - Crowded people at rest room - Noise pollution at parking area - Impact to fresh water ecosystem and water quality
Hin Phoeng Creek	2,700	<ul style="list-style-type: none"> - Crowded people at parking area and rest room - Impact to quantity of water for visitor use - Impact to fresh water ecosystem
Pha Diew Dai View Point	210	<ul style="list-style-type: none"> - Crowded people at view point - Impact to vegetation along hiking trails
Km 33 – Nong Phak Chee Trail	900	<ul style="list-style-type: none"> - Impact to vegetation along hiking trails - Wildlife disturbance
Dong Tiew - Nong Phak Chee Trail	675	<ul style="list-style-type: none"> - Impact to vegetation along hiking trails - Wildlife disturbance
Dong Tiew – Mo Sing To Trail	1,053	<ul style="list-style-type: none"> - Impact to vegetation along hiking trails - Wildlife disturbance
Pha Kluai Mai – Haew Suwat Trail	675	<ul style="list-style-type: none"> - Impact to vegetation along hiking trails - Wildlife disturbance
Khong Kaew Trail	360	<ul style="list-style-type: none"> - Impact to vegetation along hiking trails - Wildlife disturbance

In conclusion, this study provided the knowledge of visitor impacts that is necessary for sustainable tourism management for KYNP. Firstly, crowding seems to be a serious psychological impact in KYNP. For environmental impacts, the changes in soil properties, soil erosion, and exposure of plants and tree roots were outlined, especially at camp sites and hiking trail. Water quality and freshwater ecosystem could be degraded by visitor activities. Amount of garbage was another serious impact in KYNP that can be harmful to environment in the park. Wildlife disturbance was mention as well, especially impact to birds, deer, monkeys, and elephants. Additionally, noise pollution from visitors and vehicles has been pointed out as a serious impact as well.

Several management actions to reduce the visitor impacts were determined. Firstly, researchers suggested that KYNP must control the number of visitors to be below carrying capacity of each site. Secondly, temporary site closures and rehabilitation are required for severely impacted sites. Thirdly, visitor education about impacts from their activities and how severe of these impacts is important tool for visitor impact management. Finally, impact monitoring is necessary to control impact and effective impact management.

Source: DNP (2004)

Impacts of recreation Activities on sambar Deer Behavior and Habitat Utilization in Khao Yai National Park

This research examined the effects of wildlife spotlighting and hiking on Sambar Deer (*Cervus unicolor*). This research was conducted in KYNP during July 2004 to September 2005.

For wildlife spotlighting, the researchers investigated how Sambar Deer responded to night spotlights on Sambar Deer behavior. The study found that there were no differences in the quantity of Sambar Deer between high and low use days and the frequency of spotlights from wildlife spotlighting cars did not affect deer responses. However, there were significant differences in the amount of time that the deer stopped eating when they were spotlighted between high and low season ($t = 3.127$, $p = 0.008$); the average time was 11 seconds/hour in high season and 2.5 seconds/hour in low season. Also, this behavior significantly correlated to the distance from the road ($\chi^2=103.259$, $df = 6$, $P = 0.000$); closer to the road deer stopped eating longer than those further away from the road.

The intensity of habitat utilization of Sambar Deer was analyzed by using, the deer tracks appeared on sites. Two trails with different levels of use (low and high levels) and forest types (dry evergreen forest and grassland) were selected for study areas. The results demonstrated that there were significant differences in habitat utilization of Sambar Deer between the high and low level of use trail, both in dry evergreen forest ($t=4.937$, $P=0.000$) and grassland ($t=2.960$, $P=0.008$). Also, the study indicated that season affected habitat utilization of the deer in both high use trail (in dry evergreen forest $t=8.831$, $P= 0.000$ in grassland $t=12.120$, $P= 0.000$) and low use trail (in dry evergreen forest $t=7.674$, $P= 0.000$ in grassland $t=16.066$, $P= 0.000$). The intensity of habitat utilization of Sambar Deer (tracks/hectare) in different site conditions is presented below.

Trail		Forest type	
		Dry evergreen forest	Grassland
High-used trail	Raining season	27.8	73.7
	Dry season	44.2	250.6
	Average	36.0	162.2
Low-used trail	Raining season	36.6	59.7
	Dry season	67.3	217.1
	Average	52.0	138.4

Source: Sangjun, Tanakanjana, Pattanavibool, and Bhumpakphan (2006)

Recreation and Tourism Carrying Capacity of Khao Yai National Park: Ecological Carrying Capacity

This study examined visitor impact on physical properties of soil and water quality. Five hiking trails and six water resources in KYNP were selected to be research sites. This study was conducted in August, 2007. To measure soil impacts, on each trail, three plots with three different levels of use were set, including reference point in natural area (low level of use), on trial (moderate level of use), and interpretative stations (high level of use). The saturated soil hydraulic (K_s) was measured and compared across three plots. The trends of results of five trails appeared to be the same. The results presented that the K_s of interpretative stations were significantly higher than on trial and natural area respectively, as presented below. Additionally, the researcher assessed the impact on soil in KYNP to be severely impacted.

Plot	Dong Tiew-Mo Sing To	Dong Tiew-Nong Pak Chee	Km 33 - Nong Pak Chee	Pha Kluai Mai – Heaw Suwat	Pha Diew Dai
Interpretative stations (high level of use)	52,975.3	1,945.4	5,873.6	2,850.7	3,258.5
On trial (moderate level of use)	1,421	311	197.7	139.6	373.7
Natural area (low level of use)	89.3	123.7	26.7	59.7	0 (sandy soil could not measure K_s)

To assess water impact in KYNP, six sites: five waterfalls and one camping area, representing the areas potentially affected by visitor activities were selected. The water temperature, pH, dissolved oxygen (DO), biochemical oxygen demand (BOD), transparency, and total coliform bacteria (TCB) were measured. When comparing with standard quality of surface water (National Environmental Board, 1992), the result demonstrated that the visitor activities affected water quality in low level.

Site	Water temperature (°C)	pH	DO (mg/l)	Transparency (cm)	BOD (mg/l)	TCB MPN/100 ml of Coliform
Pha Kluai Mai Waterfall	22.6	6.2	8.1	62.5	0.8	50.0
Haew Suwat Waterfall	22.6	6.4	8.2	64.5	0.5	35.0
Lam Takong	23.2	6.3	7.8	61.2	0.6	55.0
Kong Kaew Waterfall	22.7	6.8	8.1	89	0.6	14.5
Hin Phoeng Creek	25.2	6.7	8.6	31	0.6	55.0
Sarika Waterfall	23.4	6.7	8.2	79.5	0.6	50.0

Source: Nimsantichareun (2007)

APPENDIX D
SURVEY INSTRUMENTS

Interview ID.....
 Date.....
 Time for interview:minutes
 Site.....

Interview Checklist Questions for Park Official
Environmental Impacts of Tourism, in Khao Yai National Park, Thailand

This interview is a part of the study on the environmental impacts of tourism in Khao Yai National Park. The purpose of this interview is to collect data on park official perception of tourism impacts and the opinion about impact management in the park. Results of this study will provide important information to develop appropriate policies and strategies for sustainable tourism management in Khao Yai National Park.

The questions are divided into FOUR parts.

Part 1: Park official' working experience

Part 2: General information and park official' opinions
 about tourism in Khao Yai national Park

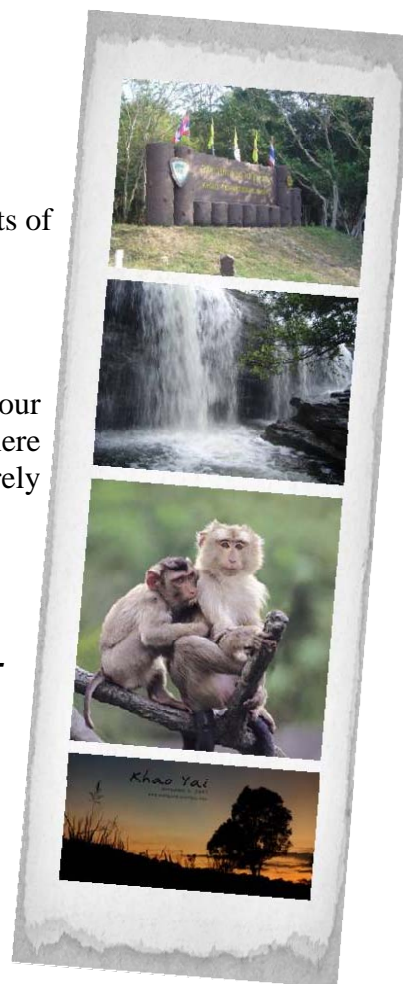
Part 3: Park official' opinions on environmental impacts of
 tourism and tourism management in park

Part 4: Park official' socio-demographic background

We will greatly appreciate it if you can provide your responses to the questions on the following pages. There are no correct or incorrect responses; we are merely interested in your personal point of view.

- Thank you for your participation in this study- -

Texas A&M University
Kasetsart University
Khao Yai National Park



Part 1: Park official' working experience

1. Your job position in Khao Yai National Park

What sector are you working?

2. How long (number of years) have you been involved in your current job?

.....Years

3. Please provide a brief of your current job and working experience in Khao Yai National Park.

[illegible]

Part 2: Park official' opinions about tourism in KYNP

1. Please describe Khao Yai National Park's current tourism/visitor management problems.

2. How has tourism developed in Khao Yai National Park (since you started working here)?

3. What are the major tourism destinations in Khao Yai National Park? Please provide names.

4. What are the different types of visitor activities occurring in Khao Yai National Park? Which activities are more popular and why?

5. Based on your current understanding, is tourism important to Khao Yai National Park? How?

Part 3: Opinion on the environmental impact and tourism management

1. What are the main impacts of tourism development in Khao Yai National Park? Please specify both positive and negative impacts.

Positive	Negative

2. According to the main tourism destinations that you mentioned before, please indicate what type of visitor-induced impacts are occurring at these locations. How severe are these impacts? (1: slight, 2: somewhat, 3: moderate, 4: severe, and 5: very severe)

Locations	Visitor-induced Impacts	How severe is it?				
1.....	1	1	2	3	4	5
	2	1	2	3	4	5
	3	1	2	3	4	5
2.....	1	1	2	3	4	5
	2	1	2	3	4	5
	3	1	2	3	4	5
3.....	1	1	2	3	4	5
	2	1	2	3	4	5
	3	1	2	3	4	5
4.....	1	1	2	3	4	5
	2	1	2	3	4	5
	3	1	2	3	4	5

3. If you think visitors' activities are the causes of environmental impacts, which visitor activities are causing what types of impacts?

Visitors' activities	Environmental impacts
1.	
2.	
3.	
4.	
5.	

4. How KYNP manages environmental impacts that caused by tourism activity?

5. Based on your opinion, what are the primary reasons of environmental impacts in Khao Yai National park?

6. Listed below are some potential impacts from visitor activities. Based on your current experience, for each type of impacts, please circle the number that best reflects the level of severity that you perceive. And please circle the number that best reflects how much you can accept the level you noticed. Additionally, if you think it is not impact (for each item), please mark ✓ in “It is not impact” and do not assess the level of impact.

Level of Impact

1 = slight

2 = somewhat

3 = moderate

4 = severe

5 = very severe

Level of Acceptability

1 = very unacceptable

2 = unacceptable

3 = neutral

4 = acceptable

5 = very acceptable

Impacts	It is not impact	Level of Impact	Level of acceptability
<i>Soil impacts</i>			
– Soil erosion		1 2 3 4 5	1 2 3 4 5
– Bare ground		1 2 3 4 5	1 2 3 4 5
<i>Vegetation impacts</i>			
– Exposed tree roots		1 2 3 4 5	1 2 3 4 5
– Damaged tree/sapling/seedling		1 2 3 4 5	1 2 3 4 5
– Presence of non-native plant		1 2 3 4 5	1 2 3 4 5
<i>Water impacts</i>			
– Suspended solid matter on water surface		1 2 3 4 5	1 2 3 4 5
– Solid waste in water		1 2 3 4 5	1 2 3 4 5
– Turbidity		1 2 3 4 5	1 2 3 4 5
<i>Wildlife impacts</i>			
– Monkeys waiting for food from visitors		1 2 3 4 5	1 2 3 4 5
– Wildlife on the road/very close to the road		1 2 3 4 5	1 2 3 4 5
– Habituated deer		1 2 3 4 5	1 2 3 4 5
<i>Other impacts</i>			
– Conversion of natural area into developed area		1 2 3 4 5	1 2 3 4 5
– Air pollution from vehicles		1 2 3 4 5	1 2 3 4 5
– Bad smell from toilets, garbage, etc.		1 2 3 4 5	1 2 3 4 5
– Accumulation of garbage		1 2 3 4 5	1 2 3 4 5
– Disturbance to natural area by visitor activities, such as vehicles parked in unauthorized areas		1 2 3 4 5	1 2 3 4 5
– Vehicular noise		1 2 3 4 5	1 2 3 4 5
– Noise from visitors		1 2 3 4 5	1 2 3 4 5
<i>Overall level of the environmental impact from visitors</i>		1 2 3 4 5	1 2 3 4 5

7. Please assess current visitor management strategies in Khao Yai National Park by circling the number that best describes your opinion.

1 = very dissatisfied, 2 = dissatisfied, 3 = neutral, 4 = satisfied, 5 = very satisfied

Items	Level of assessment				
1. Reducing visitor at overused or crowded areas	1	2	3	4	5
2. Re-vegetating sites impacted by human use	1	2	3	4	5
3. Strict enforcement of rules concerning deviant or inappropriate behavior	1	2	3	4	5
4. Maintaining current restrictions on visitors	1	2	3	4	5
5. Increasing the number of park rangers	1	2	3	4	5
6. Increasing the number of visitor facilities such as toilet, parking area, trail, etc.	1	2	3	4	5
7. Increasing maintenance interval of facilities	1	2	3	4	5
8. Providing visitor education programs	1	2	3	4	5
9. Providing additional interpretive materials to increase understanding of geology, plants, animals, etc., associated with nature and national park.	1	2	3	4	5
10. Overall assessment of management practices	1	2	3	4	5

8. Do you agree with this statement “The Khao Yai National Park administration should be more concerned about visitor impacts”? Please circle the number that best reflects your opinion.

Strongly disagree

Not sure

Strongly agree

1

2

3

4

5

9. Please provide some recommendations/guidelines for tourism impact management in the park

Part 4: Park official' socio-demographic background

Instruction: Please mark ✓ for your answer or fill your information in each question

1. Your gender
☐ Male ☐ Female
2. What is your current age?years
3. What is the highest level of education that you have completed so far?
☐ Elementary school
☐ High school
☐ Vocational education
☐ Undergraduate
☐ Graduate
4. Your hometown:

- -Thank you for your participation in this study- -

Questionnaire ID.....
 Activity.....
 Date.....
 Site.....

***Visitors' Perception of Environmental Impacts of Tourism
 In Khao Yai National Park, Thailand***

This survey is part of a study on the environmental impacts of tourism in Khao Yai National Park. The purpose of this questionnaire is to solicit your impressions of and opinion about visitor related activities in the park. This survey consists of questions about your recreation activities during this visit, your observations of environmental impacts in the park, your attitude toward the natural environment, and other relevant questions about visitor and park management issues.

We hope that the results of this study will provide important information to develop appropriate policies and strategies for sustainable tourism management in Khao Yai National Park.

This questionnaire consists of FOUR parts:

- Part 1: general information about your recreation activities and experience in the park
- Part 2: some of your feelings about the environment
- Part 3: your perception and acceptability of possible impacts in the park, and
- Part 4: your demographic and socio-economic background

We would greatly appreciate your responses to the questions on the following pages. There are no correct or incorrect responses; we are merely interested in your point of view.

- -Thank you for your participation in this study- -

***Texas A&M University
 Kasetsart University
 Khao Yai National Park***



Part I: General information about your recreation activities and experience in KYNP

Instruction: Please check the appropriate boxes below with a ✓

1. Is this trip your first visit to Thailand? (For international visitors)

☐ Yes → go to question 3

☐ No

- What year did you first visit Thailand?

.....

- How many times have you visited Thailand before this time?times

2. Have you ever been to Khao Yai National Park before your visit today?

☐ Yes

- What year did you first visit Khao Yai National Park?

- What year did you last visit Khao Yai National Park?

- In 2008, how many times did you visit Khao Yai National Park?times

☐ No

3. Is Khao Yai National Park your primary destination for this trip?

☐ Yes

☐ No

If no, what is your primary destination?

4. What are your top three purposes for visiting Khao Yai National Park? Please list in order of importance (1, 2, and 3)

..... Experiencing new different things

..... Introspection

..... Experiencing excitement

..... Meeting new and interesting people

..... Developing skills and abilities

..... Being away from the crowds and noise

..... Relaxation

..... Viewing scenery

..... Experiencing tranquility

..... To be care free

..... Return to nature

..... Learn more about nature

..... Enhancing family and friend affinity

5. Are you visiting Khao Yai National Park alone or with a group?

☐ Visiting alone

☐ with group

If part of a group, please select one of the choices below:

☐ Friends

☐ Family

☐ Friends + Family

☐ Tour group

☐ Other, please specify

How many people are in your group (including yourself)?person

6. Was your trip today?

☐ A day trip

☐ An overnight trip

How many nights do you plan to stay? nights

7. To enjoy your preferred recreation activities, which areas/locations of the park are important for you (please circle locations on map)?



8. During this trip, what activities did you engage in (please check all activities that apply)?
- | | |
|--|--|
| <input type="checkbox"/> Rafting | <input type="checkbox"/> Swimming |
| <input type="checkbox"/> Camping | <input type="checkbox"/> Day-hiking/Trekking |
| <input type="checkbox"/> Bicycling/Mountain biking | <input type="checkbox"/> Picking |
| <input type="checkbox"/> Bird watching | <input type="checkbox"/> Sight seeing |
| <input type="checkbox"/> Wildlife watching | <input type="checkbox"/> Nature education |
| <input type="checkbox"/> Photography | <input type="checkbox"/> Other, please specify |
9. What is your primary activity?
10. Have you ever engaged in this activity before? ☐ Yes ☐ No (Skip to question 12)
11. How long have you engaged in this activity?years
12. On average, how often do you engage in this activity?times/year
13. In 2008, how many times did you engage in this activity?times
14. Except Khao Yai National Park, have you visited other national parks for this activity?
- ☐ No ☐ Yes
- Please specify: 1.....
- 2.....
- 3.....
15. Please rate the satisfaction level of your current visit to the park (Circle the number that best rates your satisfaction level)
- | | |
|---|----------------|
| Very dissatisfied | Very satisfied |
| <hr style="border: 0; border-top: 1px solid black; margin: 5px 0;"/> <div style="display: flex; justify-content: space-around; width: 100%;"> 1 2 3 4 5 </div> | |
16. What did you like most about your visit? (Fill in Blank)
-
-
17. What did you like least about your visit? (Fill in Blank)
-
-
18. Will you return to Khao Yai National Park?
- ☐ Yes please provide your reason.....
- ☐ Not sure please provide your reason.....
- ☐ No please provide your reason.....

Part 2: Environmental value orientation

Instruction: The items listed below are used to measure your environmental value orientation. There is no right or wrong answer, please circle the number that best represents your view

1 = strongly disagree 3 = neutral 5 = strongly agree

Items	Strongly disagree		Neither / neutral		Strongly agree
1. One of the worst things about overpopulation is that many natural areas are getting destroyed for development	1	2	3	4	5
2. I can enjoy spending time in natural settings just for the sake of being out in nature	1	2	3	4	5
3. Environmental threats such as deforestation and ozone depletion have been exaggerated	1	2	3	4	5
4. The worst thing about the loss of the rain forest is that it will restrict the development of new medicines	1	2	3	4	5
5. Sometimes it makes me sad to see forests cleared for agriculture	1	2	3	4	5
6. It seems to me that most conservationists are pessimistic and somewhat paranoid.	1	2	3	4	5
7. I prefer wildlife reserves to zoos	1	2	3	4	5
8. The best thing about camping is that it is a cheap vacation	1	2	3	4	5
9. I do not think the problem of depletion of natural resources is as bad as many people make it out to be	1	2	3	4	5
10. I find it hard to get too concerned about environmental issues	1	2	3	4	5
11. It bothers me that humans are running out of their supply of oil	1	2	3	4	5
12. I need time in nature to be happy	1	2	3	4	5
13. Science and technology will eventually solve our problems with pollution, overpopulation, and diminishing resources	1	2	3	4	5
14. The thing that concerns me most about deforestation is that there will not be enough lumber for future generations	1	2	3	4	5
15. I do not feel that humans are dependent on nature to survive	1	2	3	4	5

Cont'd ...next page

Items	Strongly disagree		Neither / neutral		Strongly agree
16. Sometimes when I am unhappy I find comfort in nature	1	2	3	4	5
17. Most environmental problems will solve themselves given enough time	1	2	3	4	5
18. I don't care about environmental problems	1	2	3	4	5
19. One of the most important reasons to keep lakes and rivers clean is so that people have a place to enjoy water sports	1	2	3	4	5
20. I'm opposed to programs to preserve wilderness, reduce pollution and conserve resources	1	2	3	4	5
21. It makes me sad to see natural environments destroyed	1	2	3	4	5
22. The most important reason for conservation is human survival	1	2	3	4	5
23. One of the best things about recycling is that it saves money	1	2	3	4	5
24. Nature is important because of what it can contribute to the pleasure and welfare of humans	1	2	3	4	5
25. Too much emphasis has been placed on conservation	1	2	3	4	5
26. Nature is valuable for its own sake	1	2	3	4	5
27. We need to preserve resources to maintain a high quality of life	1	2	3	4	5
28. Being out in nature is a great stress reducer for me	1	2	3	4	5
29. One of the most important reasons to conserve is to ensure a continued high standard of living	1	2	3	4	5
30. One of the most important reasons to conserve is to preserve wild areas	1	2	3	4	5
31. Continued land development is a good idea as long as a high quality of life can be preserved	1	2	3	4	5
32. Sometimes animals seem almost human to me	1	2	3	4	5
33. Humans are as much a part of the ecosystem as other animals	1	2	3	4	5

Part 3: Perception of visitor-induced environmental impacts in the park
--

1. Do you think visitor activities cause environmental impacts in Khao Yai National Park?

☐ Yes ☐ No (skip to #2 below)

If yes, which visitor activities do you think have the most impact? Please list three activities in the order of importance. For example, if camping is the number one threat to the park, list it as number 1, and so on.

.....RaftingSwimming
.....CampingDay-hiking/Trekking
.....Bicycling/Mountain BikingPicking
.....Bird watchingSight seeing
.....Wildlife watchingNature education
.....PhotographyOther, please specify

2. If you have ever visited Khao Yai before, have you noticed any positive or negative changes at Khao Yai in the last five years or from your previous visit?

☐ Yes ☐ No

Can you describe those changes?

Positive.....

Negative.....

3. Listed below are some potential impacts from visitor activities. Based on your current experience, for each type of impacts, please circle the number that best reflects the level of severity that you perceive. And please circle the number that best reflects how much you can accept the level you noticed. Additionally, if you think it is not impact (for each item), please mark ✓ in “It is not impact” and do not assess the level of impact.

Level of Impact

1 = slight
2 = somewhat
3 = moderate
4 = severe
5 = very severe

Level of Acceptability

1 = very unacceptable
2 = unacceptable
3 = neutral
4 = acceptable
5 = very acceptable

Impacts	It is not impact	Level of Impact					Level of acceptability				
<i>Soil impacts</i>											
– Soil erosion		1	2	3	4	5	1	2	3	4	5
– Bare ground		1	2	3	4	5	1	2	3	4	5

Cont'd ...next page

Impacts	It is not impact	Level of Impact					Level of acceptability				
<i>Vegetation impacts</i>											
– Exposed tree roots		1	2	3	4	5	1	2	3	4	5
– Damaged tree/sapling/seedling		1	2	3	4	5	1	2	3	4	5
– Presence of non-native plant		1	2	3	4	5	1	2	3	4	5
<i>Water impacts</i>											
– Suspended solid matter on water surface		1	2	3	4	5	1	2	3	4	5
– Solid waste in water		1	2	3	4	5	1	2	3	4	5
– Turbidity		1	2	3	4	5	1	2	3	4	5
<i>Wildlife impacts</i>											
– Monkeys waiting for the food from visitors		1	2	3	4	5	1	2	3	4	5
– Wildlife on the road/very close to the road		1	2	3	4	5	1	2	3	4	5
– Habituated deer		1	2	3	4	5	1	2	3	4	5
<i>Other impacts</i>											
– Conversion of natural area into developed area		1	2	3	4	5	1	2	3	4	5
– Air pollution from vehicles		1	2	3	4	5	1	2	3	4	5
– Bad smell from toilets, garbage, etc.		1	2	3	4	5	1	2	3	4	5
– Accumulation of garbage		1	2	3	4	5	1	2	3	4	5
– Disturbance to natural area by visitor activities, such as vehicles parked on natural areas		1	2	3	4	5	1	2	3	4	5
– Vehicular noise		1	2	3	4	5	1	2	3	4	5
– Noise from visitors		1	2	3	4	5	1	2	3	4	5
<i>Overall level of the environmental impact from visitors</i>		1	2	3	4	5	1	2	3	4	5

Based on your opinion, what are the primary reasons of these impacts?

- 1.....
- 2.....
- 3.....
- 4.....
- 5.....

4. Please assess current visitor management strategies in Khao Yai National Park by circling the number that best describes your opinion.

1 = very dissatisfied, 2 = dissatisfied, 3 = neutral, 4 = satisfied, 5 = very satisfied

Visitor management strategies	Level of satisfaction				
1. Reducing visitor at overused or crowded areas	1	2	3	4	5
2. Re-vegetating sites impacted by human use	1	2	3	4	5
3. Strict enforcement of rules concerning deviant or inappropriate behavior	1	2	3	4	5
4. Maintaining current restrictions on visitors	1	2	3	4	5
5. Increasing the number of park rangers	1	2	3	4	5
6. Increasing the number of visitor facilities such as toilet, parking area, trail, etc.	1	2	3	4	5
7. Increasing maintenance interval of facilities	1	2	3	4	5
8. Providing visitor education programs	1	2	3	4	5
9. Providing additional interpretive materials to increase understanding of geology, plants, animals, etc., associated with nature and national park.	1	2	3	4	5
10. Overall assessment of management practices	1	2	3	4	5

5. The Khao Yai National Park administration should be more concerned about visitor impacts

Strongly disagree		Not sure		Strongly agree
1	2	3	4	5

6. Please provide some recommendations/guidelines for tourism impact management in the park

.....

.....

.....

.....

.....

.....

Part 4: Your demographic and socio-economic background

Instruction: Please mark ✓ for your answer or fill your information in each question

1. Your gender
☐ Male ☐ Female
2. What is your current age?years
3. What is the highest level of education that you have completed so far?
☐ Elementary school
☐ High school
☐ Vocational education
☐ Undergraduate
☐ Graduate
4. What is your current occupation?
5. Which of the following income levels best describe your annual income before taxes?

For domestic visitors

- ☐ Less than 120,000 Baht
- ☐ 120,000 - 239,999 Baht
- ☐ 240,000 - 359,999 Baht
- ☐ 360,000 - 479,999 Baht
- ☐ 480,000 - 599,999 Baht
- ☐ More than 600,000 Baht

For international visitor

- ☐ Less than \$20,000
- ☐ \$20,000 to \$39,999
- ☐ \$40,000 to \$59,999
- ☐ \$60,000 to \$79,999
- ☐ More than \$80,000

6. Your residential location

For domestic visitors:

- ☐ Bangkok
- ☐ Local area
- ☐ North of Thailand
- ☐ Central of Thailand
- ☐ Northeast of Thailand
- ☐ South of Thailand
- ☐ East of Thailand
- ☐ West of Thailand

For international visitor

Please specify your country.....

- -Thank you for your participation in this study- -

APPENDIX E
PARTICIPANTS' PROFILES

Appendix E-1 Socio-demographic background of domestic visitors

		Number of visitors (%)			
		Campers (n = 304)	Hikers (n = 237)	Birders (n = 87)	Total (n = 628)
Gender					
	Male	49.01	54.01	51.27	51.27
	Female	50.99	45.99	48.73	48.73
	Total	100.00	100.00	100.00	100.00
Age					
	18 - 20 year old	16.45	19.0	16.24	16.24
	21 - 30 year old	40.79	49.4	47.77	47.77
	31 - 40 year old	30.92	17.3	22.93	22.93
	41 - 50 year old	9.54	11.4	10.03	10.03
	51 - 60 year old	0.99	2.5	2.07	2.07
	more than 60 year old	1.32	0.4	0.96	0.96
	Total	100.00	100.00	100.00	100.00
Education					
	Elementary school	0.33	2.11	1.11	1.11
	Secondary school	4.28	4.22	3.66	3.66
	High school	11.18	13.92	11.62	11.62
	Vocational Education	13.82	16.46	13.85	13.85
	Undergraduate	62.17	55.70	61.46	61.46
	Graduate	8.22	7.59	8.28	8.28
	Total	100.00	100.00	100.00	100.00
Occupation					
	Government employee	14.80	13.92	13.54	13.54
	State enterprise employee	4.61	5.49	4.62	4.62
	Private company employee	34.87	22.78	27.55	27.55
	General employee	3.62	8.02	5.25	5.25
	Agriculturalist	0.99	0.00	0.48	0.48
	Entrepreneur	10.53	12.24	11.62	11.62
	Student	24.67	31.22	30.89	30.89
	Housewife	2.96	2.95	2.55	2.55
	Retired	1.32	0.42	1.11	1.11
	Unemployed	1.32	1.27	1.43	1.43
	Other	0.33	1.69	0.96	0.96
	Total	100.00	100.00	100.00	100.00

	Number of visitors (%)			
	Campers (n = 304)	Hikers (n = 237)	Birders (n = 87)	Total (n = 628)
Annual income				
Less than 120,000 Baht	28.23	37.61	34.27	34.27
120,000 - 239,999 Baht	30.27	31.86	30.46	30.46
240,000 - 359,999 Baht	20.07	13.72	16.06	16.06
360,000 - 479,999 Baht	8.50	7.08	7.28	7.28
480,000 - 599,999 Baht	4.76	3.98	4.64	4.64
More than 600,000 Baht	8.16	5.75	7.28	7.28
Total	100.00	100.00	100.00	100.00
Residential location				
Bangkok	44.55	41.95	44.00	44.00
Local area	13.86	19.07	16.32	16.32
North of Thailand	0.66	2.97	2.08	2.08
Central of Thailand	26.40	19.92	22.40	22.40
Northeast of Thailand	3.30	8.47	5.60	5.60
South of Thailand	1.65	2.54	2.56	2.56
East of Thailand	8.91	5.08	6.72	6.72
West of Thailand	0.66	0.00	0.32	0.32
Total	100.00	100.00	100.00	100.00

Appendix E-2 Socio-demographic background of international visitors

	Number of visitors (%)
Gender (n = 40)	
Male	77.50
Female	22.50
Total	100.00
Age (n = 40)	
18 - 20 year old	7.50
21 - 30 year old	25.00
31 - 40 year old	25.00
41 - 50 year old	15.00
51 - 60 year old	15.00
more than 60 year old	12.50
Total	100.00
Education (n = 39)	
Elementary school	0.00
Secondary school	0.00
High school	7.69
Vocational Education	12.82
Undergraduate	17.95
Graduate	61.54
Total	100.00
Occupation (n = 36)	
Artist	2.78
Biologist	2.78
Company Owner	2.78
Constructor	2.78
Consultant	8.33
Cook	2.78
Engineer	11.11
Justice	2.78
Lawyer	5.56
Manager	5.56
Model	2.78
Psychologist	2.78
Retired	13.89
Seller	2.78
Student	5.56
Teacher	22.22
Writer	2.78
Total	100.00

	Number of visitors (%)
<hr/>	
Income (n = 31)	
Less than \$20,000	19.35
\$20,000 - \$39,999	9.68
\$40,000 - \$59,999	19.35
\$60,000 - \$79,999	25.81
More than \$80,000	25.81
Total	100.00
<hr/>	
Residential location (n = 40)	
North America	
USA	20.00
Canada	2.50
South America	
Brazil	2.50
Europe	
Belgium	5.00
Denmark	5.00
England	15.00
Finland	5.00
Germany	10.00
Holland	5.00
Ireland	2.50
Netherlands	7.50
Switzerland	10.00
Russia	2.50
Australia	
Australia	5.00
New Zealand	2.50
Total	100.00
<hr/>	

Appendix E-3 Socio-demographic background of KYNP officials

	Number of KYNP officials % (n = 38)
Gender	
Male	73.7
Female	26.3
Total	100.0
Age	
21-30	39.5
31-40	26.3
41-50	26.3
More than 50	7.9
Total	100.0
(\bar{x} = 35 years old)	
Education	
Elementary school	2.6
Secondary school	18.4
High school	34.2
Vocational school	23.7
Undergraduate	18.4
Graduate	2.6
Total	100.0
Residential location	
Local: Saraburi, Nakhon Nayok, Nakhon Rachasima, and Prachinburi	52.6
Other provinces	47.4
Total	100.0
Numbers of years working in KYNP	
Less than 5 years	39.5
5 – 10 years	23.7
11 – 15 years	15.8
16 – 20 years	13.2
More than 20 years	7.9
Total	100.0
(\bar{x} = 9.21 years)	

Appendix E-4 KYNP visitation experience of domestic visitors

	Number of visitors (%)			
	Campers	Hikers	Birders	Total
KYNP visitation experience				
have visited KYNP before	67.11	53.16	65.52	61.62
Never visited KYNP before	32.89	46.84	34.48	38.38
Total	100.00	100.00	100.00	100.00
	(n=304)	(n=237)	(n=87)	(n=628)
The first visitation experience				
2005 – 2009 (0 - 4 years)	38.83	43.22	40.38	40.50
2000 – 2004 (5 - 9 years)	20.21	21.19	28.85	21.79
1995 – 1999 (10 - 14 years)	26.06	14.41	15.38	20.67
1990 – 1994 (15 – 19 years)	3.72	10.17	9.62	6.70
1985 – 1989 (20 - 24 years)	6.38	5.08	1.92	5.31
1980 – 1984 (25 - 29 years)	1.06	4.24	0.00	1.96
1975 – 1979 (30 - 34 years)	1.06	0.85	1.92	1.12
1970 – 1974 (35 - 39 years)	1.60	0.00	1.92	1.12
before 1969 (> 40 years)	1.06	0.85	0.00	0.84
Total	100.00	100.00	100.00	100.00
	(n=188)	(n=118)	(n=52)	(n =627)
The last visitation experience				
2005 – 2009 (0 - 4 years)	92.63	90.98	96.15	92.58
2000 – 2004 (5 - 9 years)	5.26	5.74	1.92	4.95
1995 – 1999 (10 - 14 years)	1.58	0.82	1.92	1.37
1990 – 1994 (15 – 19 years)	0.00	0.82	0.00	0.27
1985 – 1989 (20 - 24 years)	0.53	0.82	0.00	0.55
before 1984 (> 24 years)	0.00	0.82	0.00	0.27
Total	100.00	100.00	100.00	100.00
	(n=190)	(n=122)	(n=52)	(n =364)
Frequency of visiting KYNP in last 12 months				
0 time	29.53	33.07	16.36	28.80
1 – 5 times	59.59	60.63	74.55	62.13
6 – 10 times	6.74	3.15	5.45	5.33
11 – 15 times	2.07	0.00	0.00	1.07
16 – 20 times	1.04	3.15	0.00	1.60
More than 20 times	1.04	0.00	3.64	1.07
Total	100.00	100.00	100.00	100.00
	(n=193)	(n=127)	(n=55)	(n =375)

	Number of visitors (%)			
	Campers	Hikers	Birders	Total
Is KYNP the primary destination for this trip?				
Yes	94.39	89.45	97.70	92.98
No	5.61	10.55	2.30	7.02
Total	100.00	100.00	100.00	100.00
	(n=303)	(n=237)	(n=87)	(n =627)

Appendix E-5 Thailand and KYNP visitation experience of international visitors

	Number of visitors (%)
Thailand visitation experience (n=40)	
Have visited Thailand before this trip	67.50
Never visited Thailand before this trip	32.50
Total	100.00
Thailand first visitation experience (n=27)	
1989	14.81
1992	3.70
2000	11.11
2001	3.70
2002	11.11
2003	7.41
2004	7.41
2005	11.11
2006	11.11
2008	18.52
Total	100.00
KYNP visitation experience (n=40)	
Have visited KYNP before this trip	25.00
Never visited KYNP before this trip	75.00
Total	100.00
KYNP first visitation experience (n=40)	
1998	10.00
2000	10.00
2004	30.00
2006	10.00
2007	10.00
2008	30.00
Total	100.00
KYN last visitation experience (n=10)	
1998	10.00
2004	10.00
2007	10.00
2008	40.00
2009	30.00
Total	100.00
Frequency of visiting KYNP in last 12 months (n=10)	
0 time	50.00
1 – 5 times	30.00
6 – 10 times	10.00
11 – 15 times	10.00
Total	100.00

	Number of visitors (%)
KYNP was the primary destination for this trip (n=40)	
Yes	32.50
No	67.50
Total	100.00

Appendix E-6 Three major visitor motivations in KYNP

	Domestic visitor (%)				International visitor (%) (n=40)
	Campers (n=304)	Hikers (n=237)	Birders (n=87)	Total (n=328)	
The first motivation for visiting KYNP					
Experiencing new different things	7.24	12.66	9.20	9.55	25.00
Introspection	1.64	1.27	3.45	1.75	5.00
Experiencing excitement	0.99	4.64	5.75	3.03	2.50
Meeting new and interesting people	1.32	0.84	0.00	0.96	0.00
Developing skills and abilities	0.33	1.69	8.05	1.91	0.00
Being away from the crowds and noise	7.24	5.06	4.60	6.05	7.50
Relaxation	51.64	45.99	31.03	46.66	17.50
Experiencing tranquility	1.32	0.42	0.00	0.80	2.50
To be care free	0.66	0.42	0.00	0.48	0.00
Return to nature	14.47	20.25	13.79	16.56	20.00
Learn more about nature	1.64	0.84	19.54	3.82	17.50
Enhancing family and friend affinity	11.51	5.91	4.60	8.44	2.50
Total	100.00	100.00	100.00	100.00	100.00
The second motivation for visiting KYNP					
Experiencing new different things	4.61	4.64	16.09	6.21	20.00
Introspection	0.99	0.84	0.00	0.80	2.50
Experiencing excitement	4.61	4.22	2.30	4.14	5.00
Meeting new and interesting people	2.96	1.27	1.15	2.07	0.00
Developing skills and abilities	0.33	2.53	4.60	1.75	2.50
Being away from the crowds and noise	7.24	5.91	2.30	6.05	7.50
Relaxation	17.43	21.94	12.64	18.47	25.00
Experiencing tranquility	1.97	5.91	3.45	3.66	5.00
To be care free	2.96	2.53	2.30	2.71	2.50
Return to nature	37.50	32.91	26.44	34.24	15.00
Learn more about nature	3.29	5.06	16.09	5.73	12.50
Enhancing family and friend affinity	16.12	12.24	12.64	14.17	2.50
Total	100.00	100.00	100.00	100.00	100.00

	Domestic visitor (%)				International visitor (%) (n=40)
	Campers (n=304)	Hikers (n=237)	Birders (n=87)	Total (n=328)	
The third motivation for visiting KYNP					
Experiencing new different things	7.89	6.75	6.90	7.32	12.50
Introspection	1.32	2.11	2.30	1.75	0.00
Experiencing excitement	2.96	3.80	8.05	3.98	2.50
Meeting new and interesting people	1.97	1.69	3.45	2.07	0.00
Developing skills and abilities	1.32	2.53	4.60	2.23	5.00
Being away from the crowds and noise	11.18	6.75	3.45	8.44	10.00
Relaxation	11.51	10.55	13.79	11.46	12.50
Experiencing tranquility	2.96	2.53	2.30	2.71	12.50
To be care free	1.97	2.11	2.30	2.07	5.00
Return to nature	23.03	24.47	10.34	21.82	22.50
Learn more about nature	4.28	9.28	22.99	8.76	10.00
Enhancing family and friend affinity	29.28	27.43	19.54	27.23	7.50
Other (such as business meeting)	0.33	0.00	0.00	0.16	0.00
Total	100.00	100.00	100.00	100.00	100.00

Appendix E-7 Group characteristics and length of stay in KYNP

Appendix E-7: Group characteristics and length of stay in KYNP

	Domestic visitor (%)				International visitor (%)
	Campers (n=304)	Hikers (n=237)	Birders (n=87)	Total (n=328)	(n=40)
Group of travel					
Visiting alone	0.00	1.69	4.60	1.27	10.00
Visiting with friends	41.12	54.85	62.07	49.20	45.00
Visiting with family	39.47	27.00	18.39	31.85	25.00
Visiting with family and friends	16.78	13.50	8.05	14.33	7.50
Visiting with tour group	0.66	0.42	0.00	0.48	2.50
Other groups	1.97	2.53	6.90	2.87	10.00
Total	100.00	100.00	100.00	100.00	100.00
Number of people in group					
1 people	0.00	1.69	4.60	1.27	10.00
2 - 5 people	43.75	35.02	27.59	38.22	65.00
6 - 10 people	35.53	34.60	29.89	34.39	22.50
11 - 20 people	17.76	18.57	32.18	20.06	2.50
21 - 30 people	1.64	5.49	2.30	3.18	0.00
31 - 50 people	1.32	2.95	1.15	1.91	0.00
More than 50 people	0.00	1.69	2.30	0.96	0.00
Total	100.00	100.00	100.00	100.00	100.00
\bar{x}	7.80	10.55	11.03	9.29	2.38
Length of visit to KYNP					
one day trip	0.00	30.80	8.05	12.74	57.50
1 night	63.49	52.32	52.87	57.80	17.50
2 nights	34.54	16.46	35.63	27.87	12.50
3 nights	0.99	0.00	3.45	0.96	5.00
4 nights	0.33	0.42	0.00	0.32	2.50
5 nights	0.33	0.00	0.00	0.16	5.00
6 nights	0.33	0.00	0.00	0.16	0.00
Total	100.00	100.00	100.00	100.00	100.00

Appendix E-8 Favorite sites in KYNP

Tourism sites	Domestic visitor (%)				International visitor (%)
	Campers	Hikers	Birders	Total	
Haew Suwat Waterfall	50.00	74.68	45.98	58.76	85.00
Pha Kluai Mai Campsite	59.87	46.41	54.02	53.98	27.50
Pha Kluai Mai Waterfall	40.13	42.62	36.78	40.61	37.50
Lam Takong Campsite	53.62	22.78	34.48	39.33	20.00
Visitor Center	21.38	37.55	54.02	32.01	62.50
Haew Narok Waterfall	21.05	42.19	18.39	28.66	37.50
Kong Kaew Waterfall	8.55	30.38	31.03	19.90	50.00
Mo Sing To Reservoir	18.42	13.50	21.84	17.04	17.50
Diew Dai View Point	15.13	17.30	13.79	15.76	17.50
View Point Km 30	10.53	13.08	10.34	11.46	20.00
Nong Pak Chi	6.58	5.91	34.48	10.19	42.50
Chao Phor Khao Khiew Spirit House	10.20	8.86	4.60	8.92	0.00
Khao Khiew View Point	10.20	6.75	8.05	8.60	2.50
Deer Field	7.57	5.06	8.05	6.69	5.00
Wang Jum Pee	2.63	3.38	17.24	4.94	12.50
Suratsawadee Youth Camp	4.28	2.95	11.49	4.78	0.00
Research and training Center	2.63	2.95	8.05	3.50	2.50
Haew Sai Waterfall	4.28	1.27	5.75	3.34	27.50
Dan Chang	1.97	1.69	4.60	2.23	12.50
Haew Pratoon Waterfall	2.96	0.84	2.30	2.07	22.50
Thanarat Lodge	0.99	1.69	3.45	1.59	2.50
Km. 33	0.66	0.42	6.90	1.43	12.50
Pha Krajai Waterfall	0.33	0.84	0.00	0.48	2.50

Appendix E-9 Favorite activities

Recreation activities	Domestic visitor (%)				International visitor (%)
	Campers	Hikers	Birders	Total	
Camping	100.00	55.27	52.87	75.80	32.50
Photography	64.47	69.62	64.37	66.40	70.00
Hiking	28.95	100.00	72.41	61.15	70.00
Sight seeing	52.63	70.46	52.87	59.39	62.50
Relaxing	54.28	47.26	34.48	48.89	7.50
Picnicking	53.29	25.74	14.94	37.58	7.50
Nature education	24.01	32.49	59.77	32.17	15.00
Wildlife observing	26.97	15.61	52.87	26.27	62.00
Bird watching	12.83	9.70	100.00	23.73	37.50
Water based activities	25.99	21.52	13.79	22.61	17.50
Other (such as group meeting, youth camp)	4.93	8.86	32.18	10.19	7.50
Bicycling	3.62	2.11	1.15	2.71	0.00
Rafting	1.32	0.42	2.30	1.11	0.00

Appendix E-10 Visitors' previous experience with their primary activity of choice

	Domestic visitor (%)				International visitor (%)
	Campers	Hikers	Birders	Total	
Previous experience					
Have experience in your major activity before this time	80.92	49.79	83.91	69.59	82.50
No experience	19.08	50.21	16.09	30.41	17.50
Total	100.00	100.00	100.00	100.00	100.00
	(n=304)	(n=237)	(n=87)	(n=628)	(n=40)
Length of experience in activity					
1 - 5 years	63.75	73.39	80.00	68.97	10.71
6 - 10 years	23.75	22.94	11.43	21.48	10.71
11 - 15 years	6.67	0.92	4.29	4.77	17.86
16 - 20 years	5.42	1.83	2.86	4.06	32.14
More than 20 years	0.42	0.92	1.43	0.72	28.57
Total	100.00	100.00	100.00	100.00	100.00
	(n=240)	(n=109)	(n=70)	(n=419)	(n=28)
Frequency of engaging in activities (times/year)					
1 - 5 times	87.30	93.91	71.43	86.48	57.14
6 - 10 times	6.97	3.48	8.57	6.29	21.43
11 - 15 times	2.87	0.87	11.43	3.73	7.14
16 - 20 times	2.46	0.00	4.29	2.10	3.57
More than 20 times	0.41	1.74	4.29	1.40	10.71
Total	100.00	100.00	100.00	100.00	100.00
	(n=244)	(n=115)	(n=70)	(n=429)	(n=28)
Frequency of engaging in activities in last 12 months (times)					
0 time	11.07	14.53	7.14	11.37	7.14
1 - 5 times	77.46	81.20	64.29	76.33	53.57
6 - 10 times	8.20	1.71	12.86	7.19	17.86
11 - 15 times	2.46	0.00	8.57	2.78	7.14
16 - 20 times	0.82	0.85	2.86	1.16	3.57
More than 20 times	0.00	1.71	4.29	1.16	10.71
Total	100.00	100.00	100.00	100.00	100.00
	(n=244)	(n=117)	(n=70)	(n=431)	(n=28)
Have you visited other national parks for engaging your primary activities					
Yes	72.76	73.73	84.51	74.94	100.00
No	27.24	26.27	15.49	25.06	0.00
Total	100.00	100.00	100.00	100.00	100.00
	(n=246)	(n=118)	(n=71)	(n=435)	(n=28)

Appendix E-11 Visitors' satisfaction and intention to revisit

	Domestic visitor (%)				International visitor (%) (n=40)
	Campers (n=304)	Hikers (n=237)	Birders (n=87)	Total (n=328)	
KYNP visitation Satisfaction					
Very dissatisfied	0.99	0.00	2.30	0.80	0.00
Dissatisfied	2.30	2.53	0.00	2.07	0.00
Neutral	17.43	10.97	21.84	15.61	17.50
Satisfied	48.68	48.52	48.28	48.57	57.50
Very satisfied	30.59	37.97	27.59	32.96	25.00
Total	100.00	100.00	100.00	100.00	100.00
\bar{x}	4.06	4.22	3.99	4.11	4.08
KYNP revisit					
Yes	85.20	81.86	81.61	83.44	47.50
Not sure	14.80	18.14	18.39	16.56	52.50
Not return	0.00	0.00	0.00	0.00	0.00
Total	100.00	100.00	100.00	100.00	100.00

Appendix E-12 KYNP officials' rating of environmental impacts in KYNP

Impacts	n	Level of Impact (%)*					Mean	SD
		1	2	3	4	5		
Soil impacts								
– Soil erosion	36	25.0	33.3	25.0	13.9	2.8	2.36	1.10
– Bare ground	35	28.6	17.1	28.6	22.9	2.9	2.54	1.22
Vegetation impacts								
– Exposed tree roots	37	21.6	29.7	37.8	8.1	2.7	2.41	1.01
– Damaged tree/sapling/seedling	38	7.9	18.4	31.6	26.3	15.8	3.24	1.17
– Presence of non-native plant	38	26.3	21.1	44.7	7.9	0.0	2.34	0.97
Water impacts								
– Suspended solid matter on water surface	38	7.9	21.1	34.2	21.1	15.8	3.16	1.18
– Solid waste in water	36	25.0	30.6	16.7	19.4	8.3	2.56	1.30
– Turbidity	35	14.3	8.6	45.7	25.7	5.7	3.00	1.08
Wildlife impacts								
– Monkeys waiting for food from the visitors	37	5.4	10.8	13.5	24.3	45.9	3.95	1.25
– Wildlife on the road/ very close to the road	37	10.8	18.9	32.4	24.3	13.5	3.11	1.20
– Habituated deer	36	13.9	22.2	19.4	25.0	19.4	3.14	1.36
Other impacts								
– Conversion of natural area into developed area	38	15.8	13.2	39.5	23.7	7.9	2.94	1.16
– Air pollution from vehicles	37	5.4	16.2	37.8	35.1	5.4	3.19	0.97
– Bad smell (from toilets, garbage, etc.)	38	7.9	13.2	39.5	31.6	7.9	3.18	1.04
– Accumulation of garbage	38	5.3	5.3	15.8	42.1	31.6	3.89	1.08
– Disturbance to natural area by visitor activities, such as vehicles parked in unauthorized natural areas	38	10.5	15.8	23.7	34.2	15.8	3.29	1.23
– Vehicular noise	37	8.1	8.1	35.1	35.1	13.5	3.38	1.09
– Noise from visitors	36	7.9	15.8	42.1	26.3	7.9	3.11	1.03
Overall level of the environmental impact from visitors	38	0.0	5.3	55.3	39.5	0.0	3.34	0.58

*level of impact 1 = slight, 2 = somewhat, 3 = moderate, 4= severe, 5 = very severe

Appendix E-13 Domestic visitors' rating of environmental impact in KYNP

Impacts	N	Level of Impact (%)*					Mean	SD
		1	2	3	4	5		
Soil impacts								
– Soil erosion	478	13.2	18.0	37.0	19.9	11.9	2.99	1.18
– Bare ground	507	11.4	14.2	35.1	24.7	14.6	3.17	1.19
Vegetation impacts								
– Exposed tree roots	459	17.2	24.6	29.2	18.7	10.2	2.81	1.22
– Damaged tree/sapling/seedling	547	13.7	15.2	32.4	23.8	15.0	3.11	1.24
– Presence of non-native plant	399	28.1	22.1	28.8	15.5	5.5	2.48	1.21
Water impacts								
– Suspended solid matter on water surface	531	8.9	10.2	22.8	23.2	35.0	3.65	1.29
– Solid waste in water	565	10.3	9.6	19.5	23.0	37.7	3.68	1.33
– Turbidity	499	11.0	16.8	33.5	23.2	15.4	3.15	1.20
Wildlife impacts								
– Monkey waiting for food from the visitors	530	10.9	10.2	24.9	24.9	29.1	3.51	1.30
– Wildlife on the road/ very close to the road	506	14.8	15.6	30.8	21.3	17.4	3.11	1.28
– Habituated deer	497	14.5	16.7	27.8	20.9	20.1	3.15	1.32
Other impacts								
– Conversion of natural area into developed area	578	7.8	12.5	22.8	22.3	34.6	3.63	1.28
– Air pollution from vehicles	590	8.0	11.0	26.8	23.4	30.8	3.58	1.25
– Bad smell (from toilets, garbage, etc.)	581	9.5	11.9	22.5	26.0	30.1	3.55	1.29
– Accumulation of garbage	608	6.9	7.6	14.5	22.4	48.7	3.98	1.25
– Disturbance to natural area by visitor activities, such as vehicles parked in unauthorized natural areas	580	6.0	11.7	26.9	26.9	28.4	3.60	1.87
– Vehicular noise	578	8.1	13.1	30.3	24.9	23.5	3.43	1.21
– Noise from visitors	583	8.4	12.3	31.9	25.6	21.8	3.40	1.20
Overall level of the environmental impact from visitors	603	5.6	11.9	41.0	28.7	12.8	3.31	1.02

*level of impact 1 = slight, 2 = somewhat, 3 = moderate, 4= severe, 5 = very severe

Appendix E-14 International visitors' rating of environmental impact in KYNP

Impacts	n	Level of Impact (%)*					Mean	SD
		1	2	3	4	5		
<i>Soil impacts</i>								
– Soil erosion	39	43.6	12.8	20.5	20.5	2.6	2.26	1.29
– Bare ground	39	46.2	25.6	2.6	20.5	5.1	2.13	1.34
<i>Vegetation impacts</i>								
– Exposed tree roots	39	43.6	17.9	20.5	17.9	0.0	2.13	1.17
– Damaged tree/sapling/seedling	39	48.7	10.3	17.9	17.9	5.1	2.21	1.36
– Presence of non-native plant	38	76.3	13.2	2.6	2.6	5.3	1.47	1.06
<i>Water impacts</i>								
– Suspended solid matter on water surface	39	56.4	15.4	12.8	10.3	5.1	1.92	1.26
– Solid waste in water	39	51.3	5.1	17.9	7.7	17.9	2.36	1.60
– Turbidity	39	48.7	15.4	23.1	2.6	10.3	2.10	1.33
<i>Wildlife impacts</i>								
– Monkeys waiting for food from the visitors	39	23.1	10.3	20.5	15.4	30.8	3.21	1.56
– Wildlife on the road/ very close to the road	39	33.3	15.4	23.1	2.6	25.6	2.72	1.59
– Habituated deer	39	48.7	17.9	5.1	12.8	15.4	2.28	1.56
<i>Other impacts</i>								
– Conversion of natural area into developed area	39	26.3	21.1	31.6	15.8	5.3	2.53	1.20
– Air pollution from vehicles	39	35.9	17.9	17.9	12.8	15.4	2.54	1.48
– Bad smell (from toilets, garbage, etc.)	39	61.5	2.6	15.4	5.1	15.4	2.10	1.55
– Accumulation of garbage	39	46.2	10.3	15.4	12.8	15.4	2.41	1.55
– Disturbance to natural area by visitor activities, such as vehicles parked in unauthorized natural areas	39	46.2	10.3	15.4	10.3	18.0	2.44	1.59
– Vehicular noise	39	43.6	17.9	12.8	10.3	15.4	2.36	1.51
– Noise from visitors	39	59.0	10.3	12.8	10.3	7.7	1.97	1.37
Overall level of the environmental impact from visitors	40	15.0	30.0	32.5	12.5	10.0	2.72	1.18

*level of impact 1 = slight, 2 = somewhat, 3 = moderate, 4= severe, 5 = very severe

Appendix E-15 Domestic campers' ratings of environmental impacts in KYNP

Impacts	n	Level of Impact (%)*					Mean	SD
		1	2	3	4	5		
Soil impacts								
– Soil erosion	231	16.9	15.6	41.6	16.0	10.0	2.87	1.17
– Bare ground	248	14.1	13.7	34.3	21.4	16.5	3.13	1.25
Vegetation impacts								
– Exposed tree roots	226	16.8	25.2	31.4	15.5	11.1	2.79	1.22
– Damaged tree/sapling/seedling	268	12.3	14.6	35.4	22.8	14.9	3.13	1.20
– Presence of non-native plant	199	25.1	22.6	30.7	15.6	6.0	2.55	1.20
Water impacts								
– Suspended solid matter on water surface	256	10.2	8.2	23.4	21.9	36.3	3.66	1.32
– Solid waste in water	272	8.8	9.6	20.6	24.3	36.8	3.71	1.29
– Turbidity	245	10.6	13.9	34.7	25.7	15.1	3.21	1.18
Wildlife impacts								
– Monkeys waiting for food from the visitors	261	10.0	11.5	25.3	23.0	30.3	3.52	1.30
– Wildlife on the road/ very close to the road	252	15.9	15.9	30.6	22.6	15.1	3.05	1.28
– Habituated deer	246	14.2	16.3	29.7	22.0	17.9	3.15	1.29
Other impacts								
– Conversion of natural area into developed area	276	6.9	11.2	23.9	22.1	35.9	3.69	1.26
– Air pollution from vehicles	280	7.9	10.0	27.1	23.6	31.4	3.61	1.24
– Bad smell (from toilets, garbage, etc.)	283	9.5	10.2	22.3	25.4	32.5	3.61	1.29
– Accumulation of garbage	290	6.2	7.6	13.8	22.1	50.3	4.03	1.23
– Disturbance to natural area by visitor activities, such as vehicles parked in unauthorized areas	274	7.3	9.9	29.2	25.9	27.7	3.57	1.20
– Vehicular noise	279	9.0	14.0	29.7	23.3	24.0	3.39	1.24
– Noise from visitors	283	8.5	11.3	31.8	25.4	23.0	3.43	1.20
Overall level of the environmental impact from visitors	293	6.5	10.9	41.6	27.6	13.3	3.30	1.04

*level of impact 1 = slight, 2 = somewhat, 3 = moderate, 4= severe, 5 = very severe

Appendix E-16 Domestic hikers' ratings of environmental impacts in KYNP

Impacts	n	Level of Impact (%)*					Mean	SD
		1	2	3	4	5		
Soil impacts								
– Soil erosion	181	10.5	21.0	32.0	22.1	14.4	3.09	1.19
– Bare ground	186	8.6	16.1	37.1	26.9	11.3	3.16	1.10
Vegetation impacts								
– Exposed tree roots	164	17.1	26.2	27.4	20.1	9.1	2.78	1.21
– Damaged tree/sapling/seedling	203	15.3	17.2	28.1	25.6	13.8	3.05	1.26
– Presence of non-native plant	148	33.8	18.2	31.1	11.5	5.4	2.36	1.21
Water impacts								
– Suspended solid matter on water surface	202	8.9	12.9	20.3	20.8	37.1	3.64	1.33
– Solid waste in water	214	10.7	9.3	19.2	19.6	41.1	3.71	1.37
– Turbidity	182	10.4	23.6	31.9	18.1	15.9	3.05	1.22
Wildlife impacts								
– Monkeys waiting for the food from visitors	189	12.7	10.1	25.4	27.0	24.9	3.41	1.31
– Wildlife on the road/ very close to the road	180	14.4	16.7	35.0	20.0	13.9	3.02	1.23
– Habituated deer	176	16.5	20.5	26.7	18.8	17.6	3.01	1.33
Other impacts								
– Conversion of natural area into developed area	221	10.9	16.3	22.2	16.3	34.4	3.47	1.39
– Air pollution from vehicles	227	9.3	14.5	26.9	20.7	28.6	3.45	1.29
– Bad smell (from toilets, garbage, etc.)	217	10.6	15.2	20.3	25.8	28.1	3.46	1.33
– Accumulation of garbage	231	9.1	7.8	15.6	22.9	44.6	3.86	1.31
– Disturbance to natural area by visitor activities, such as vehicles parked in unauthorized areas	222	4.5	15.8	27.0	23.9	28.8	3.57	1.19
– Vehicular noise	218	7.8	14.7	31.7	24.8	21.1	3.37	1.19
– Noise from visitors	217	8.8	15.2	31.8	25.8	18.4	3.30	1.19
Overall level of the environmental impact from visitors	227	6.2	13.7	41.9	27.3	11.0	3.23	1.02

*level of impact 1 = slight, 2 = somewhat, 3 = moderate, 4= severe, 5 = very severe

Appendix E-17 Domestic birders' ratings of environmental impacts in KYNP

Impacts	n	Level of Impact (%)*					Mean	SD
		1	2	3	4	5		
Soil impacts								
– Soil erosion	66	7.6	18.2	34.8	27.3	12.1	3.18	1.11
– Bare ground	73	9.6	11.0	32.9	30.1	16.4	3.33	1.17
Vegetation impacts								
– Exposed tree roots	69	18.8	18.8	26.1	26.1	10.1	2.90	1.27
– Damaged tree/sapling/seedling	76	14.5	11.8	32.9	22.4	18.4	3.18	1.28
– Presence of non-native plant	52	23.1	30.8	15.4	26.9	3.8	2.58	1.23
Water impacts								
– Suspended solid matter on water surface	73	4.1	9.6	27.4	34.2	24.7	3.66	1.08
– Solid waste in water	79	13.9	10.1	16.5	27.8	31.6	3.53	1.39
– Turbidity	72	13.9	9.7	33.3	27.8	15.3	3.21	1.23
Wildlife impacts								
– Monkeys waiting for the food from visitors	80	10.0	6.3	22.5	26.3	35.0	3.70	1.29
– Wildlife on the road/ very close to the road	74	12.2	12.2	21.6	20.3	33.8	3.51	1.39
– Habituated deer	75	10.7	9.3	24.0	22.7	33.3	3.59	1.33
Other impacts								
– Conversion of natural area into developed area	81	2.5	6.2	21.0	39.5	30.9	3.90	1.00
– Air pollution from vehicles	83	4.8	4.8	25.3	30.1	34.9	3.86	1.11
– Bad smell (from toilets, garbage, etc.)	81	6.2	8.6	29.6	28.4	27.2	3.62	1.16
– Accumulation of garbage	87	3.4	6.9	13.8	21.8	54.0	4.16	1.12
– Disturbance to natural area by visitor activities, such as vehicles parked in unauthorized areas	84	6.0	7.1	19.0	38.1	29.8	3.79	1.13
– Vehicular noise	81	6.2	6.2	28.4	30.9	28.4	3.69	1.14
– Noise from visitors	83	7.2	8.4	32.5	25.3	26.5	3.55	1.18
Overall level of the environmental impact from visitors	83	1.2	10.8	36.1	36.1	15.7	3.54	0.93

*level of impact 1 = slight, 2 = somewhat, 3 = moderate, 4= severe, 5 = very severe

Appendix E-18 KYNP officials' rating of environmental impact acceptability

Impacts	n	Level of acceptability (%)*					Mean	SD
		1	2	3	4	5		
Soil impacts								
– Soil erosion	36	5.6	16.7	30.6	41.7	5.6	3.25	1.00
– Bare ground	35	0.0	22.9	40.0	22.9	14.3	3.29	0.99
Vegetation impacts								
– Exposed tree roots	36	0.0	13.9	47.2	27.8	11.1	3.36	0.87
– Damaged tree/sapling/seedling	38	7.9	39.5	36.8	13.2	2.6	2.63	0.91
– Presence of non-native plant	38	2.6	15.8	36.8	36.8	7.9	3.32	0.93
Water impacts								
– Suspended solid matter on water surface	37	18.9	29.7	21.6	24.3	5.4	2.68	1.20
– Solid waste in water	34	14.7	32.4	29.4	14.7	8.8	2.71	1.17
– Turbidity	35	5.7	20.0	51.4	17.1	5.7	2.97	0.92
Wildlife impacts								
– Monkeys waiting for food from the visitors	37	29.7	34.2	13.2	15.8	5.3	2.32	1.23
– Wildlife on the road/ very close to the road	37	16.2	18.9	27.0	35.1	2.7	2.89	1.15
– Habituated deer	36	19.4	25.0	25.0	25.0	5.6	2.72	1.21
Other impacts								
– Conversion of natural area into developed area	38	13.2	23.7	47.4	10.5	5.3	2.71	1.01
– Air pollution from vehicles	37	10.8	29.7	40.5	16.2	2.7	2.70	0.97
– Bad smell (from toilets, garbage, etc.)	38	13.2	34.2	42.1	7.9	2.6	2.53	0.92
– Accumulation of garbage	38	26.3	34.2	23.7	13.2	2.6	2.32	1.09
– Disturbed natural area by visitor activities, such as vehicles parked in unauthorized areas	38	21.1	21.1	39.5	15.8	2.6	2.55	1.13
– Vehicular noise	36	2.8	38.9	41.7	11.1	5.6	2.78	0.90
– Noise from the visitors	37	16.2	13.5	48.6	18.9	2.7	2.78	1.03
Overall level of the environmental impact from visitors	38	7.9	28.9	42.1	21.1	0.0	2.76	0.88

*Level of acceptability 1 = very unacceptable, 2 = unacceptable, 3 = neutral, 4 = acceptable, 5 = very acceptable

Appendix E-19 Domestic visitors' rating of environmental impact acceptability

Impacts	n	Level of acceptability (%)*					Mean	SD
		1	2	3	4	5		
<i>Soil impacts</i>								
– Soil erosion	438	7.3	19.9	45.9	21.0	5.9	2.98	0.97
– Bare ground	466	7.9	19.7	47.6	18.9	5.8	2.95	0.97
<i>Vegetation impacts</i>								
– Exposed tree roots	427	7.3	13.6	40.7	30.4	8.0	3.18	1.01
– Damaged tree/sapling/seedling	509	10.4	25.3	40.5	16.9	6.9	2.85	1.05
– Presence of non-native plant	378	7.1	13.2	39.4	25.1	15.1	3.28	1.10
<i>Water impacts</i>								
– Suspended solid matter on water surface	503	30.4	26.4	26.4	11.9	4.8	2.34	1.17
– Solid waste in water	528	36.7	25.2	23.9	11.4	2.8	2.18	1.13
– Turbidity	472	13.8	21.4	43.9	16.7	4.2	2.76	1.02
<i>Wildlife impacts</i>								
– Monkeys wait for food from the visitors	503	21.7	24.9	33.6	12.5	7.4	2.59	1.17
– Wildlife on the road/ very close to the road	478	11.1	20.9	38.3	17.4	12.3	2.99	1.15
– Habituated deer	474	11.8	20.9	35.0	18.8	13.5	3.01	1.19
<i>Other impacts</i>								
– Conversion of natural area into developed area	537	25.1	25.5	32.0	11.0	6.3	2.48	1.16
– Air pollution from vehicles	550	23.3	24.9	35.3	13.3	3.3	2.48	1.09
– Bad smell (from toilets, garbage, etc.)	541	23.7	29.4	31.6	10.5	4.8	2.43	1.11
– Accumulation of garbage	568	38.9	27.1	22.0	6.9	5.1	2.12	1.15
– Disturbed natural area by visitor activities, such as vehicles parked in unauthorized areas	539	21.3	27.8	38.0	10.0	2.8	2.45	1.02
– Vehicular noise	537	18.4	26.5	38.2	13.0	3.5	2.56	1.04
– Noise from the visitors	546	18.5	24.7	39.2	13.4	4.2	2.60	1.07
Overall level of the environmental impact from visitors	574	8.0	24.0	45.3	18.1	4.5	2.87	0.96

*Level of acceptability 1 = very unacceptable, 2 = unacceptable, 3 = neutral, 4 = acceptable, 5 = very acceptable

Appendix E-20 International visitors' rating of environmental impact acceptability

Impacts	n	Level of acceptability (%)*					Mean	SD
		1	2	3	4	5		
Soil impacts								
– Soil erosion	25	0.0	32.0	40.0	24.0	4.0	3.00	0.87
– Bare ground	27	7.4	25.9	25.9	33.3	7.4	3.07	1.11
Vegetation impacts								
– Exposed tree roots	27	7.4	22.2	33.3	29.6	7.4	3.07	1.07
– Damaged tree/sapling/seedling	25	16.0	32.0	16.0	28.0	8.0	2.80	1.26
– Presence of non-native plant	12	33.3	16.7	16.7	25.0	8.3	2.58	1.44
Water impacts								
– Suspended solid matter on water surface	21	19.0	38.1	9.5	14.3	19.0	2.76	1.45
– Solid waste in water	25	40.0	20.0	16.0	4.0	20.0	2.44	1.56
– Turbidity	27	14.8	22.2	29.6	22.2	11.1	2.93	1.24
Wildlife impacts								
– Monkeys wait for food from the visitors	35	31.4	14.3	11.4	28.6	14.3	2.80	1.51
– Wildlife on the road/ very close to the road	34	14.7	2.9	23.5	32.4	26.5	3.53	1.33
– Habituated deer	26	11.5	15.4	23.1	30.8	19.2	3.31	1.29
Other impacts								
– Conversion of natural area into developed area	32	9.4	21.9	34.4	25.0	9.4	3.03	1.12
– Air pollution from vehicles	28	25.0	25.0	32.1	10.7	7.1	2.50	1.20
– Bad smell (from toilets, garbage, etc.)	23	26.1	13.0	30.4	13.0	17.4	2.83	1.44
– Accumulation of garbage	27	40.7	14.8	14.8	22.2	7.4	2.41	1.42
– Disturbed natural area by visitor activities, such as vehicles parked in authorized areas	28	35.7	10.7	28.6	21.4	3.6	2.46	1.29
– Vehicular noise	29	31.0	27.6	17.2	20.7	3.4	2.38	1.24
– Noise from the visitors	23	17.4	34.8	34.8	8.7	4.3	2.48	1.04
Overall level of the environmental impact from visitors	39	15.4	10.3	25.6	43.6	5.1	3.13	1.17

*Level of acceptability 1 = very unacceptable, 2 = unacceptable, 3 = neutral, 4 = acceptable, 5 = very acceptable

Appendix E-21 KYNP officials' satisfaction rating of current management practices

Management practices	n	Level of assessment (%)*					Mean	SD
		1	2	3	4	5		
Reducing visitor at overused or crowded areas	38	10.5	13.2	52.6	18.4	5.3	2.95	0.98
Re-vegetating sites impacted by human use	38	10.5	26.3	39.5	18.4	5.3	2.82	1.04
Strict enforcement of rules concerning deviant or inappropriate behavior	38	13.2	39.5	23.7	13.2	10.5	2.68	1.19
Maintaining current restrictions on visitors	38	7.9	36.8	26.3	18.4	10.5	2.87	1.14
Increasing the number of park rangers	38	5.3	21.1	26.3	31.6	15.8	3.32	1.14
Increasing the number of visitor facilities such as toilet, parking area, trail, etc.	38	7.9	15.8	34.2	34.2	7.9	3.26	1.289
Increasing maintenance interval of facilities	38	0.0	10.5	47.4	34.2	7.9	3.40	0.79
Providing visitor education programs	38	5.3	15.8	42.1	26.3	10.5	3.21	1.02
Providing additional interpretive materials to increase understanding of geology, plants, animals, etc., associated with nature and national park.	38	13.2	21.1	31.6	23.7	10.5	2.97	1.20
Overall assessment of management practices	38	2.6	7.9	65.8	23.7	0.0	3.11	0.65

*Level of assessment 1 = very dissatisfied, 2 = dissatisfied, 3 = neutral, 4 = satisfied, 5 = very satisfied

Appendix E-22 Domestic visitors' satisfaction rating of current management practices

Management practices	n	Level of assessment (%)*					Mean	SD
		1	2	3	4	5		
Reducing visitor at overused or crowded areas	623	9.0	11.2	54.6	18.0	7.2	3.03	0.97
Re-vegetating sites impacted by human use	622	8.7	12.9	42.8	25.7	25.7	3.15	1.05
Strict enforcement of rules concerning deviant or inappropriate behavior	623	14.6	17.5	34.7	21.5	11.7	2.98	1.20
Maintaining current restrictions on visitors	618	9.2	15.0	34.1	28.6	12.9	3.21	1.13
Increasing the number of park rangers	622	9.8	11.6	34.2	30.1	14.3	3.28	1.14
Increasing the number of visitor facilities such as toilet, parking area, trail, etc.	622	7.4	12.9	37.5	28.9	13.3	3.28	1.08
Increasing maintenance interval of facilities	623	7.5	14.6	36.3	30.3	11.2	3.23	1.07
Providing visitor education programs	621	7.6	14.7	36.9	28.3	12.6	3.24	1.09
Providing additional interpretive materials to increase understanding of geology, plants, animals, etc., associated with nature and national park.	623	8.5	16.7	36.9	27.6	10.3	3.14	1.08
Overall assessment of management practices	624	5.0	12.5	37.7	34.8	10.1	3.33	0.98

*Level of assessment 1 = very dissatisfied, 2 = dissatisfied, 3 = neutral, 4 = satisfied, 5 = very satisfied

Appendix E-23 International visitors' satisfaction rating of current management practices

Management practices	n	Level of assessment (%)*					Mean	SD
		1	2	3	4	5		
Reducing visitor at overused or crowded areas	40	30.0	15.0	42.5	12.5	0.0	2.38	1.06
Re-vegetating sites impacted by human use	39	12.8	17.9	59.0	10.3	0.0	2.67	0.84
Strict enforcement of rules concerning deviant or inappropriate behavior	39	23.1	17.9	35.9	12.8	10.3	2.69	1.26
Maintaining current restrictions on visitors	39	10.3	12.8	48.7	23.1	5.1	3.00	1.00
Increasing the number of park rangers	38	7.9	15.8	47.4	21.1	7.9	3.05	1.01
Increasing the number of visitor facilities such as toilet, parking area, trail, etc.	39	17.9	5.1	20.5	35.9	20.5	3.36	1.37
Increasing maintenance interval of facilities	39	17.9	23.1	17.0	25.6	15.4	2.97	1.37
Providing visitor education programs	39	15.4	20.5	43.6	10.3	10.3	2.80	1.15
Providing additional interpretive materials to increase understanding of geology, plants, animals, etc., associated with nature and national park.	40	20.0	15.0	27.5	22.5	15.0	2.98	1.35
Overall assessment of management practices	40	7.5	5.0	45.0	35.0	7.5	3.30	0.97

*Level of assessment 1 = very dissatisfied, 2 = dissatisfied, 3 = neutral, 4 = satisfied, 5 = very satisfied

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