ENVIRONMENTAL RISK ASSESSMENT OF PLANNED ECOTOURISM IN SUNPUNDAN WILDLIFE SANCTUARY MAE HONG SON PROVINCE

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THIS THESIS HAS BEEN APPROVED TO BE
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ABSTRACT

Sunpundan Wildlife Sanctuary is in the process of being officially designated. The present focal point for ecotourism is a small marsh. The study area extends from this marsh to cover Huai Nam Pong Village and temporary office of the sanctuary. A mini EIA was done in the study area to determine whether the area is suitable for ecotourism development or not. Complied data consists of the physical and biological resources, as well as and human use and quality of life values of the area.

Birds should be a key resource for ecotourism there since 76 bird species were easily found and identified within this small study area. There are about 510 individuals of four dominant bird species at the marsh. According to Lekagul and Round (1991), there are no rare or endangered species. Seven mammals were observed in the study area (excluding squirrels and rats). Fishing Cat, a threatened species, is a carnivore at the top of a food chain in the area. A large mammal, the Common Barking Deer, whose tracks and vocalization were commonly observed around the marsh and hot spring.

The area is suitable for ecotourism provided that the villagers agree on tourist programs and regulations. The most serious impact of ecotourism would be on the bird and mammal communities, but because groups of tourists currently visiting the

area are small, there is no serious impact now. There may be significant impact on both the village and ecology if the number of tourists increases without proper planning. To minimize impacts of ecotourism on natural resources and the community, an ecotourism plan is recommended which includes zoning of the area, development of facilities, tourism committee, activities and carrying capacity, and some management.

Most tourists that come to Mae Hong Son are also interested in the diverse natural resources there. Bird watching should be promoted as a main activity in the area, especially for Thai tourists. It should generate enough income for local people to conserve natural resources there. Moreover, ecotourism could reduce the need for more land for future generations at Huai Nam Pong Village. It offers the villagers a way to use the resources in the Sunpundan Wildlife Sanctuary profitably and sustainably.

ชื่อเรื่องวิทยานิพนธ์	การประเมินความเสี่ยงต่อสิ่งแวดล้อมของการท่องเที่ยวเชิงนิเวศ ในเขตรักษาพันธุ์สัตว์ป่าสันปันแดน จังหวัดแม่ฮ่องสอน	
ชื่อผู้เขียน	นายอภิรัตน์ เอี่ยมศิริ	
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	นายเจมส์ เอฟ แมกซ์เวล	กรรมการ
	ดร.สตีฟ ดี เอลเลียต	กรรมการ

บทคัดย่อ

พื้นที่ศึกษาเริ่มต้นจากโป่งน้ำซึ่งอยู่ในเขตรักษาพันธุ์สัตว์ป่าสันปันแดน และขยายไปสู่หมู่บ้านห้วยน้ำโป่ง และที่ทำการชั่วคราวเขตรักษาพันธุ์สัตว์ป่าสันปันแดน นักท่องเที่ยวส่วนใหญ่ที่มาที่เขตรักษาพันธุ์สัตว์ป่าสันปันแดนมักมีจุดประสงค์เพื่อดูนกบริเวณโป่ง ข้อมูลที่ได้จากการสำรวจและสอบถามบุคคลในพื้นที่ ประกอบไปด้วยลักษณะของการท่องเที่ยวที่เกิดขึ้นในปัจจุบัน ทรัพยากรด้านกายภาพ ชีวภาพ คุณค่าการใช้ประโยชน์และคุณภาพชีวิตของประชากรบ้านห้วยน้ำโป่ง

สำรวจพบนกทั้งหมด 76 ชนิด ไม่มีชนิดที่หายากหรือใกล้สูญพันธุ์ ที่น่าสนใจคือนก 4 ชนิดหลักบริเวณโป่ง โดยมีจำนวนรวมกันประมาณ 510 ตัว พบสัตว์เลี้ยงลูกด้วยนม 7 ชนิด (ไม่รวมหนูและกระรอก) โดยมีเสือปลา เป็นชนิดที่อยู่ตอนบนของห่วงโซ่อาหาร และเก้ง เป็นสัตว์เลี้ยงลูกด้วยนมขนาดใหญ่ในพื้นที่ศึกษา

พื้นที่ศึกษามีความเหมาะสมสำหรับการพัฒนาการท่องเที่ยวเชิงนิเวศ นกและสัตว์เลี้ยงลูกด้วยนมน่าจะเป็นส่วนที่ได้รับผลกระทบจากการท่องเที่ยวมากที่สุด แต่เนื่องจากนักท่องเที่ยวยังมีปริมาณน้อย ผลกระทบดังกล่าวจึงยังไม่ปรากฏอย่างชัดเจน แต่หากจำนวนนักท่องเที่ยวเพิ่มขึ้นโดยไม่มีการวางแผนการจัดการ ผลกระทบเหล่านี้จะมากขึ้นเช่นกัน ดังนั้นเพื่อเป็นการลดผลกระทบต่อสิ่งแวดล้อม และชุมชน จึงควรมีการวางแผนการจัด

การ การท่องเที่ยว โดยรูปแบบของแผนจะประกอบด้วย การพัฒนาสิ่งอำนวยความสะดวก การตั้งคณะกรรมการดูแลการท่องเที่ยว การแบ่งเขตพื้นที่กิจกรรม ขีดจำกัดและการจัดการ

การดูนกเป็นกิจกรรมหลักในพื้นที่ ที่ควรได้รับการส่งเสริมและประชาสัมพันธ์ โดยเฉพาะกับนักท่องเที่ยวชาวไทย การท่องเที่ยวเชิงนิเวศจะสามารถสร้างแรงจูงใจในการอนุรักษ์ทรัพยากรธรรมชาติแก่ชาวบ้าน รวมถึงการใช้ทรัพยากรอย่างยั่งยืนเพื่อ ชดเชยความต้องการที่ดินทำกินเนื่องจากการขยายตัวของชาวบ้านในอนาคต

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INTRODUCTION

Tourism is a growing worldwide industry, producing approximately 12 percent of the world's economy (Rubin and Dietz, 1995). In Thailand, tourism has been promoted as the biggest segment of national income since 1982. At the same time with its positive economic impacts, tourism can also result in many negative environmental and social impacts such as deterioration of tourist destinations, pollution, encroachment of public land, over-development of infrastructure, degradation of culture, *etc.* (TAT, 1993). Therefore, it is necessary to assess risks and benefits to the natural resources and villagers before the development of ecotourism, a kind of tourism that has fewer impacts than other traditional tourist activities. This was done in the study area by an environmental survey, *i.e.* a mini–EIA to determine what resources are present, their conditions, susceptibility to tourism, *etc.*

This research was done in Huai Nam Pong Village, a small area in Sunpundan Wildlife Sanctuary in Mae Hong Son Province, northern Thailand, during a period of six months from November 1998 to April 1999. In general, the wildlife sanctuary is not aimed at tourism, since only research and education are allowed (Suwan *et al.*, 1997), but there are many sanctuaries that promote ecotourism in their areas, such as Um Pang and Phu Laung Wildlife Sanctuaries. In fact, no laws stipulate that tourism in wildlife sanctuaries is illegal. It is possible, if tourism is aimed to educate people (TDD, 1999). Therefore, ecotourism can be established in wildlife sanctuaries since education is a component of it (TAT, 1996).

In addition, from my observations at a meeting of the Biodiversity Research Project arranged by Mae Hong Son Province in August 1998, this project includes

many subjects, such as birds, orchids, salt licks, and wild animals. The purpose of this project is to promote ecotourism through these subjects in many villages in Mae Hong Son Province, and some of which are in wildlife sanctuaries. This indicates that ecotourism development in the study area is possible and may be supported by the province.

NECESSITY OF THIS PROJECT

There are three main reasons why this project is important.

1. Study about the suitability of ecotourism in this area should be done to offer viable alternatives to use the resources in sustainable and conservative ways and to substitute for lost of income as a result of the government's desire to put most of the land around the village under wildlife sanctuary status.

2. The study area has been affected by small groups of tourists, therefore it is necessary to make an ecotourism plan before the number of tourist increases. Since the area includes natural resources, such as a small hot spring, a marsh with flocks of birds, a stream, *etc.*, unplanned tourism could result in negative impacts on these resources and loss of educational opportunities.

3. It is easier to establish proper ecotourism there than at other areas which are already opened and managed commercially.

PURPOSES OF THE STUDY

The research goal is to answer the question of how suitable is this area is for ecotourism development. This includes the assessment of risks and benefits to the ecology and the villagers in the area.

THEORY

The theory is that ecotourism income can provide economic gain to local people for conservation activities (Dearden, 1997).

An environmental impact assessment (EIA) can be used to determine suitability for ecotourism development of an area. It consists of three aspects, *viz.* physical resources, ecological resources, and human use and quality of life values (TEAM, 1982).

LITERATURE REVIEW

TOURISM AND ECOTOURISM

Tourism contributes significantly to the global economy. It generated almost $159 billion (U.S.) in 1987 and 25% of this amount went to Africa, Central and South America, the Caribbean, East and Southern Asia (Rubin and Dietz, 1995). It is the second largest industry in the world and will be the largest industry by the year 2000 (WTO, 1989). In Thailand, tourism has been the largest foreign exchange earner since 1982 (EIU, 1995).

Large-scale tourism or mass-tourism generally concentrates on economic benefits only. It usually involves luxury hotels, casinos, golf courses, and shopping centers (Laarman and Durst, 1993). Mass tourism activities tend to use external resources rather than local ones (Rodenberg, 1980). Over the last three decades, problems generated by mass tourism in developing countries have been identified and discussed. These problems are about the impacts on local communities and the environment (Pleumarom, 1997). To solve the problems resulting from large-scale tourism development in Thailand, such as increases in prostitution, erosion of cultural and spiritual values, and extensive environmental degradation; several alternative kinds of tourism, which have low impact, have been studied, *i.e.* "soft" tourism (Pleumarom, 1990). By the late 1980's, under pressure to consider environmental conservation and sustainable development, the tourism industry had to promote a new and environmentally friendly product (Pleumarom, 1994).

Eber (1992) cites a report by the National Institute for Development and Administration that 60% of tourism income flows out of Thailand. Pleumarom (1994)

states that the foreign exchange leakage from the tourism industry flows out through foreign-owned tour operators, airlines, hotels, and payments for imported foods and drinks. Only a little money goes to local people through employment sometimes with low and disrespectful salaries. This can lead to negative attitudes at local levels (Pizam, 1978).

Ecotourism is considered to be the fastest growing segment of tourism. Tour operators and national tourist agencies are promoting ecotourism because they believe that it has fewer impacts than other traditional tourist activities (Rubin and Dietz, 1995). There are two main reasons supporting the rapid development of ecotourism. First, tourists have become more interested in natural environments before they disappear and want to have more participation in conservation. Second, ecotourism has been promoted by several concerned sectors such as governments, non-government organizations, and tour agencies (Hvenegaard, 1994).

Ecotourism is promoted as an alternative to mass tourism which is blamed as a cause of negative impacts on the environment and cultures. It is considered to be a means to distribute benefits to local regions, to solve revenue leakage, to give more education to tourists and local people, and to encourage local people to conserve their natural resources (Sheldon, 1998).

Definition of ecotourism

Ecotourism was coined in 1983 by Hector Ceballos-Lascurain. He defined it as "tourism that involves traveling to relatively undisturbed areas with the objective of admiring, studying, and enjoying the scenery and its wild plants and animals, as well as

any cultural features found there" (Thongtham, 1994). This definition emphasizes undisturbed areas while Lash (1997) argues that ecotourism should be operated within properly planned areas.

Sheldon (1998) modified Ceballos-Lascurain's original definition of ecotourism from by changing undisturbed areas to natural areas and adding improvement of the welfare of local people.

In 1991, The Ecotourism Society defined ecotourism as "the responsible travel to natural areas that conserves the environment and sustains the well being of local people" (Epler, 1996). Definitions of ecotourism are still developing, but generally include references of travel to natural areas and local conservation benefits (Hvenegaard, 1994).

Dearden (1997) states that tourism can be managed to be sustainable, but it should not be considered as ecotourism if development results in benefit to only one aspect. Local benefits distinguish ecotourism from adventure tourism (Emphandhu and Chettamart, 1997).

In Thailand, TAT (1996) has included cultural activities as a part of ecotourism and gave a definition as " a visit to any particular tourist area with the purpose to study, enjoy, and appreciate the scenery, natural and social, as well as the life style of local people, based on knowledge about responsibility for the ecological systems in the area". TAT states that the degree of ecotourism depends on the involvement of four key elements, *viz.* nature-based tourism, sustainable management, learning processes, and local participation.

The basic principles of ecotourism are that it should avoid negative impacts on nature and culture. It should educate tourists about the importance of conservation,

bring benefits to local regions, and should be planned under the consideration of the carrying capacity of the area (Lash, 1997).

Pleumarom (1997) states that ecotourism is an approach, rather than a strategy or model, because there are so many arguments about the meanings of participation, carrying capacity, and sustainability.

COSTS AND BENEFITS OF ECOTOURISM

Hvenegaard (1994) states that ecotourism is sustainable development because it has fewer negative impacts on natural resources than mass tourism and can support conservation in four ways. First, ecotourism can offer higher value for natural resources than it's plunder. Second, ecotourism may improve the local economy and culture. Third, ecotourism can produce benefits for a protected area. Finally, it has a high potential to educate tourists and local people about the environment that will lead to more conservation awareness.

In northern Thailand, the forests and wildlife have been severely reduced over the past few decades. Local people have been blamed for this reduction. The main reason behind this reduction is the poverty of local people. Ecotourism can solve this problem by generating income to designated destinations. This income can decrease the poverty of local people and help in conservation approaches (Dearden, 1995).

Kusler (1990) suggests that one benefit of nature tourism is development of an appreciation and pride in natural and cultural resources by local communities.

The benefits of ecotourism defined by Dearden (1997) are very simple as well as easy to understand and implement. He divided these benefits into three categories. First, ecotourism provides economic gains for local people for conservation activities.

Second, ecotourism encourages conservation awareness of visitors and locals. Third ecotourism supports biodiversity knowledge and conservation activities.

Ecotourism can generate both negative and positive impacts. Laarman and Durst (1993) explained these benefits and constraints as follows:

BENEFITS	CONSTRAINTS
Contribution to national income	Risk of environmental degradation
Tourism as a growth sector	Limited carrying capacity
Dispersion of benefits	Economic leakage
Community development	Low earning capacity
Contribution to environmental conservation	Limited infrastructure and facilities
Environmental awareness and activism	Continued disrespect for nature

The costs of tourism are environmental degradation, economic imbalance, unstable benefits, and negative cultural changes (Boo, 1993). McNeely *et al.* (1992) indicate that environmental degradation is a more serious problem in ecotourism than general tourism because ecotourism activities are usually concerned with the natural environment and include ecologically sensitive areas.

It is recognized that local communities are involved in ecotourism activities (Lash, 1997). The benefits to local people have usually been mentioned in terms of education and employment. In many areas, only a small number of local people can receive benefits. This might lead to deterioration or over exploitation of tourism resources (Pleumarom, 1990).

There are many social issues that are caused by mass-tourism which can also be problems of ecotourism. In many meetings about ecotourism development, discussion

about these problems has often been avoided. Loss of cultural and social identity, the changes of behavior and values, prostitution and AIDs, and the changes of land ownership and occupation, have continued from mass tourism to ecotourism (Pleumarom, 1990: Boonchote and Dearden, 1994).

Concept tourism developed by Bulter (1980) starts by making a new area an ecotourist attraction. This attraction focuses on authentic culture and environment then many developments follow with business involvement. After that ecotourism development takes place by large-scale development. Finally, everything declines, the area loses its attractiveness, and social and environmental impacts become visible. Once impacts occur, they cannot be recovered (Pleumarom, 1997).

One important cause of negative impacts, suggested by McNeely *et al.* (1992) is the attitude of area managers to benefits. They state that the potential of negative impacts will be higher when managers attempt to seek maximum economic benefits through inappropriate development.

THE SITUATION OF ECOTOURISM IN THAILAND

The first recognized effect of tourism on nature was TAT's construction of a resort and golf club in Khao Yai National Park in the late 1980's. The impacts on wildlife started by a deer, which ate golf balls and died. After that, there was an accident of elephants dying by falling off a steep cliff because a new road obstructed its normal feeding routes (Gill and Satyanarayan, 1995).

In 1987, Dixon and Sherman (1990) state that fees from concessions, accommodations, and entrance at Khao Yai National Park were 3.18 million baht. This income went to the National Park Division while the budget allocated to the park was

3.38 million Baht. The Tourism Authority of Thailand received more than 10 million baht from the hotel, restaurants, golf course, and souvenir shop in 1987 and all profits went to the TAT (Dobias *et al.* 1988).

Lakdee and Suwansriprisarn (1999) explained that there were three sectors concerned with tourism programs in Khao Yai National Park, *viz.* the park, villages, and the province. Programs managed by the park and the villages allowed tourists to apply for sites all times, while the program managed by the province was advertised in certain periods and tourists have to apply 7 days before. All programs employ local people as guides and porters. Elliott (1993) states that this will improve the standard of living of villagers and also reduce encroachment.

Tourism in Ban Sob Ruak Village in Chiang Rai Province, northern Thailand, started in 1987 after a new road to the village was built. Boonchote and Dearden (1994) state that the village changed from a quiet rural place to a fast-growing tourist destination within a few years. Over two-thirds of the villagers prefer to work in the tourism industry instead of agriculture. Their jobs are absolutely dependent on tourism. The land use pattern was changed from agricultural to resorts, hotels, and tourist services. Land ownership changed to people outside the village.

Khiriwong village is a small village in Nakhon Sri Thammarat, southern Thailand. It is an agricultural village in a valley. Most villagers are fruit farmers. It is interesting for ecotourists because the fruit farms involve agroforestry and are grown among native trees in an ecologically balanced manner. Tourists are invited to live and eat with the villagers. The other focal point of ecotourism is trekking to the highest mountain above the village, Khao Luang (c. 1800 m). Now, there are some problems about the environment and social structure because of increases in the number of

tourists. The carrying capacity has not been defined, but excessive garbage has been produced and more toilets and rest areas are needed. Some new guest houses were made. The villagers do not have enough time to take care of their fruit farms. Most seriously, attitudes about ecotourism have changed, since the younger generation tends to consider ecotourism as a permanent and main source of income (Sukphisit, 1999).

The focal point of tourism at Lod Cave Forest Park in Mae Hong Son Province, northern Thailand, is a cave with a river running through it. Rafting through the cave is unique and very interesting. According to Sheldon (1998), there are 70 local guides and 2,000 visitors a month. The guides are villagers near the park who guide tourists through the cave by kerosene lamps that generate smoke and intensive light, which pollutes the air and disturbs swifts and bats in the cave. They inform tourists only about the shape of rocks that look like animals. Most guides can not speak English. There is no information about wildlife in the park. Tourists do not know about times and places for watching the swifts and bats. There are too many tourists in the cool season - November to February. This kind of tourism is uncontrolled and will lead to destruction of the cave environment.

Sheldon (1998) concludes from his investigation that tourism in northern Thailand has focused in Chiang Mai and only a few destinations have been promoted by tour agencies and by the Tourism Authority of Thailand. Moreover, only a few key attractions have been selected in this area. Only a few tour agencies supply information about wildlife and flora. Most only provide trekking, rafting, and elephant rides.

ENVIRONMENTAL IMPACT ASSESSMENT

Proper planning for ecotourism is required to ensure that it does not exceed the carrying capacity of the environment. The most important component of planning is an environmental impact assessment which includes three functions: environmental status, prediction of the impacts of tourism, and evaluation of the ecotourism project. The meaning of evaluation is the measurement of the consequences of people who will be influenced by ecotourism and assessment of remedial measures (Rubin and Dietz, 1995).

According to Usher (1986), several criteria are used in wildlife conservation evaluation which can be adapted for ecotourism assessment such as: species and habitat diversity, rarity, ecological fragility, educational value, and threat of human interference. Aside from wildlife and vegetation, soils, water resources, mineral resources, and scenery in protected areas also require management (Moor, 1984).

Theobald (1994) suggests that three questions be considered for assessing the economic, social, and ecological impacts of tourism:

First, how many and what type of tourists does the resident population of an area wish to attract?

Second, what is the optimum number of tourists that the area can support in terms of its physical, environmental, and social carrying capacity?

Third, how can these tourists contribute to the enhancement of the life styles of the residents?

The matrix method of environmental impact assessment provided by Gilpin (1995) assesses potential impacts by the relationship between horizontal and vertical axes. The vertical axis consists of four categories: physical and chemical, biological,

cultural, and ecological. The horizontal axis consists of project activities that might cause positive or negative environmental impacts.

During the consideration of ecotourism development, environmental indicators should be selected and developed for use in cost-benefit analysis and sustainable management (Theobald, 1994). According to Westman (1985), a good indicator for habitat monitoring is the animal at or near the top of the food web.

ECOTOURISM POTENTIALS

Resources and activities

Successful tourism areas usually have several interests such as wildlife, local customs, historical sites, and, most of all, water. Seas, lakes, rivers, and waterfalls have high recreation values for tourism (McNeely *et al.* 1992). The most popular activities for ecotourists are trekking, bird watching, nature photography, wildlife safaris, camping, mountain climbing, fishing, river rafting, and botanical study (Ingram and Drust, 1987).

Shackley (1996) concludes that interesting wildlife usually depends on its status, *viz.* common, rare, or endangered; while dangerous and unpopular species such as snakes and rats often have low interest for tourists, even though they may be endangered. Large mammals and birds are more popular and colorful animals are more attractive.

Nairobi National Park in Kenya is very popular for tourists. It receives the most tourists of any park in Kenya. The most important factor of the popularity is that it is the closest park to the capital and easiest for tourists to go (McNeely *et al.* 1992).

Emphandhu and Chettamart (1997) evaluated 17 potential sites for ecotourism in southern Thailand by a weighted scoring method of several criteria such as the opportunity for wildlife viewing, flora diversity, ecosystem uniqueness, *etc.* Top of the list is Khao Sok National Park in Surat Thani Province because of its ecosystems, biodiversity, and especially its location near the major tourism areas such as Samui Island and Phuket. The ecotourism resources of the park are dense forests, caves, waterfalls, 180 species of birds, 48 mammals, and a rare flower called Rafflesia.

Bird watching is the largest single category of wildlife recreation (McNeely *et al.* 1992). Doi Inthanon National Park is one of the most popular sites for bird watching in Thailand because of the 382 bird species found there (Round, 1989). Hvenegaard and Dearden (1998) indicate that the number of birders at Doi Inthanon National Park increased two times from 1989 to 1993.

Ecotourists

There are several types of ecotourists. Hardcore ecotourists have a high interest in species and nature. They are willing to pay for enjoyable experiences with simple infrastructure. Activities for general ecotourists are not focussed on specific species or ecosystems (Dearden, 1997). Ecotourists are likely to watch wildlife, hike on trails, and stay longer in interesting areas. They are older and more educated than most other tourist types (Hvenegaard and Dearden, 1998).

Brockelman and Dearden (1990) state that the promotion of ecotourism should be directed at special interest groups and not general groups.

Local participation

At Doi Inthanon National Park, the local people at Ban Pha Mon were selected as a place for promoting ecotourism for several reasons. One reason was to replace an income generated by flower plantations using toxic chemicals. Another was the potential of villagers to service ecotourists with accommodation, food, and guides (Emphandhu and Chettamart, 1997). The villagers at Ban Pha Mon have an appreciation and understanding of nature around them. Their social characteristics are charming and peaceful. This creates an opportunity of local people to support ecotourism.

ECOTOURISM PLANNING

Successful ecotourism can be considered in two simple themes: benefits to local regions and preserving natural resources. The keys to successful ecotourism are proper planning, slow growth, and sustainability. Fast increases of tourist numbers will lead to difficulties in the preservation of resources (Lash, 1997).

Laws

There are three main measures involved with tourism in the Reservation and Protection of Wild Animal Law 1992, *viz.* measures 37, 38, and 46 (Chatwiroon, 1999). The measure 37 states that people who want to go to the wildlife sanctuary have to ask for permission from the officials of the sanctuary. The measure 38 states that any activity which could disturb wild animals is forbidden, such as land belonging, construction, land clearing, *etc,* excepted the case for protection of wild animals and providing facilities to educate people, which need a permission from director of forestry department.

The measure 46 indicates that wildlife sanctuaries can charge a fee from service only. This makes tourism in wildlife sanctuaries different from that in national parks since the measure 23 in the National Park Law 1961, indicates that national parks can charge a fee from service, concessions, and accommodations. Chatwiroon (1999) explained that it is different between tourism in wildlife sanctuaries and in national parks because a purpose of wildlife sanctuaries is to avoid any activity that could disturb wild animals, such as staying overnight.

Area zoning

In 1982, the Sri Lanka government wanted to study the growth of tourism facilities on the coast. A committee was established from several sections in order to create a zoning plan. The plan divides the coastal belt into segments. Many beaches connected to the area which were already used by other industries or activities were reserved and no tourism developed (Seneviratne, 1993).

In general, a protected area can be divided into zones of strict protection (where people are excluded), wilderness (where visitors are permitted only on foot), tourism (where visitors are encouraged in various ways), and development (where facilities are concentrated). Tourism zones are sometimes divided into two types: extensive use, where park infrastructure is permitted for low density recreation use; and intensive use, where relatively high concentration of visitors are expected (McNeely *et al.* 1992).

According to Emphandhu and Chettamart (1997), the ecotourism zones at Khao Sok National Park were proposed to accommodate activities such as self-guided nature tours, guided hikes, wildlife/bird watching, nature photography, and spelunking.

Carrying capacity and limits of acceptable change

Dearden (1997) states the visitor impacts are not solely the result of numbers, but also depend on group size and scheduling, season, mode of transport, and the amount of disturbance created by each individual. They suggest that the carrying capacity should be flexible considering the limits of acceptable change (LAC) concept that focuses on three factors, *viz.* the management objective, the amount of change in the conditions of that area that is acceptable, and the indicators.

Educational and interpretation programs

With a good interpretative program, ecotourism can help in raising environmental awareness and education (McNeely *et al.* 1992). The program can be conducted with certain focal species which are easier to introduce tourists to understand ecosystems (Wallace, 1993). In tropical forests, however, it is not easy to see these species (Elliott, 1997), therefore the normal species are available. Skilled interpretative guides and good information are needed (Dearden, 1997).

There are many techniques available to communicate information about protected areas such as brochures and leaflets, specialized guides and check lists, self-guided trails, wilderness trails, and visitor information centers (McNeely *et al.*, 1992).

Since viewing wildlife in tropical forest is difficult because of their behavior and forest conditions, several techniques are needed in order to increase chances to see wildlife such as habituation, hides, clearings, salt licks, platforms or aerial walkways, and baiting (Elliott, 1997). According to Dearden (1997), each way may generate directly or indirectly to other species or habitats. For example the building of a

boardwalk at Angka Luang trail in Doi Inthanon National Park to minimize trampling damage has resulted in more visitors to the summit and surrounding area that may disturb some wildlife species.

Infrastructure and services

Elliott (1997) indicates that providing tourist services in protected areas by the Government or private sectors can have both advantages and disadvantages. The advantages of services operated by government are the complete control of tourism and local benefits while investment is usually minimal.

The most direct way of benefiting local communities is to employ as many local residents as possible in tourism-related services. Use of locally produced goods will also benefit the community (Dixon and Sherman, 1991).

The study of ecotourism in Khao Sok National Park, Surat Thani Province by Emphandhu and Chettamart (1997) shows that 72% of tourists did not agree with more infrastructure development. From questioning of Thai and foreign tourists, Elliott (1993) concludes that it is not necessary to provide more facilities such as roads, and hotels in Doi Inthanon and Doi Suthep-Pui National Parks in northern Thailand. Most tourists want more information and facilities for viewing wildlife rather than comfortable transportation and accommodation. Sheldon (1998) states that only 32% of tourists who visited Doi Inthanon National Park preferred park accommodation while others preferred camping and living in hilltribe villages.

McNeely *et al.* (1992) recommended that hotels, restaurants, and other facilities should be located outside park boundaries to reduce human impact on protected areas. Anderson (1993) suggests that the ecotourism facilities should be planned in low impact

areas which do not obstruct ecological processes. Design of buildings should utilize local construction techniques, materials, and cultural images.

Protected area administration

Dixon and Sherman (1991) suggest that the easiest method of gaining benefits from nature tourism is to charge a fee to use the area. They comment that the National Park Division should consider adopting a two-tier fee system at Khao Yai National Park in northern Thailand, with a lower charge for domestic residents and a higher charge for international visitors.

McNeely *et al.* (1992) suggest that because of the lack of technical, economical, and organizational resources in developing countries, it is more appropriate for protected area managers to rent concessions for specific individuals, firms, or local communities for tourism. By this technique, it can provide a self-financing mechanism for the area. Private development often operates as close as possible to natural resources, therefore zoning and others rules should be planned.

Local participation

Brandon (1993) describes four levels of intensity in local participation, *viz.* information sharing, consultation, decision-making, and initiating action. Drake (1991) notes three advantages of incorporating local participation in an ecotourism project, (i) local participation functions as an early warning system, (ii) local involvement fosters better planning and decision-making, and (iii) ensuring local input legitimizes the decision-making process. According to Sukphisit (1999), a disadvantage of absolute management by local communities is that sometimes they can not control development

by themselves, especially the younger generation. They need suggestions from specialists.

STUDY SITE

LOCATION

Sunpundan Wildlife Sanctuary is located between Muang and Pang Mapha Districts, Mae Hong Son Province, northern Thailand (Figure 1). It is about 40 kilometers northeast of Mae Hong Son City. It covers an area of 175,425 rai. The sanctuary is in the process of being officially gazetted, but control and law enforcement began few years ago. Some parts of the proposed wildlife sanctuary lie along the Burmese border (Figure 2). Huai Nam Pong Village is an agricultural village in the study area.

CLIMATE

From 1951 to 1980, the average rainfall of Mae Hong Son Province varied from 2.2 to 262.9 mm. per month with the minimum in February and maximum in August. The temperature ranges from 14.0 ^{o}C minimum in January to 37.7^{o}C maximum in April (Figure 3). The climate in the study area is seasonal with three distinct seasons, *viz.* cool (November – February), hot (March – May), and rainy (June - October). Temperature and rainfall vary inversely with elevation, *i.e.* it is cooler and wetter in the highland but hotter and drier in the lowlands (Maxwell, 1988).

PRESENT TOURISM IN THE STUDY AREA

In 1997 and 1998, about 9 groups, with 3 to 5 tourists per group, went directly to Sunpundan Wildlife Sanctuary Office and Huai Nam Pong Village during October

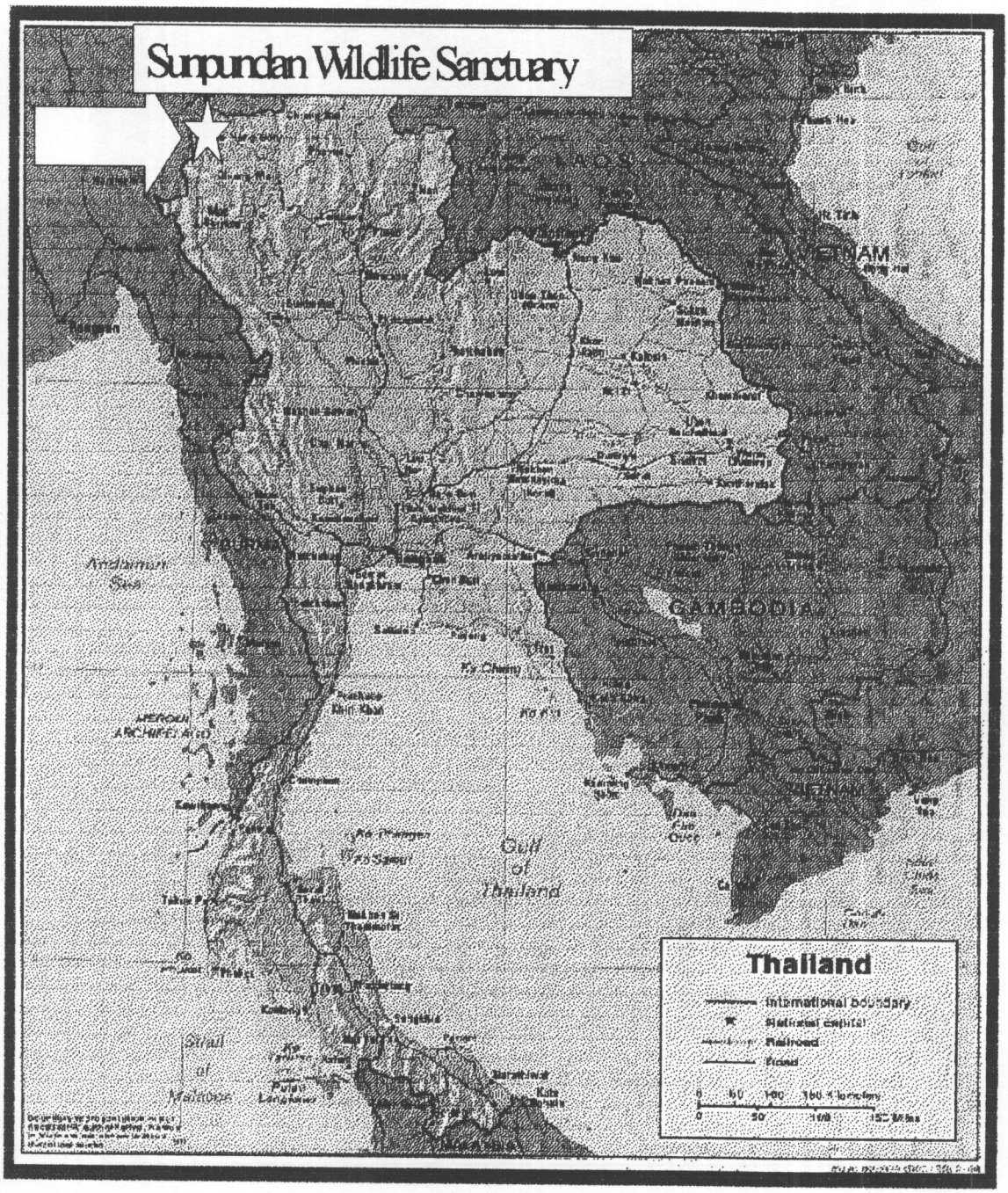


Figure 1. Location of Sunpundan Wildlife Sanctuary. Source: World Atlas (1973), Rand McNally International. Pan Books, London; 114.

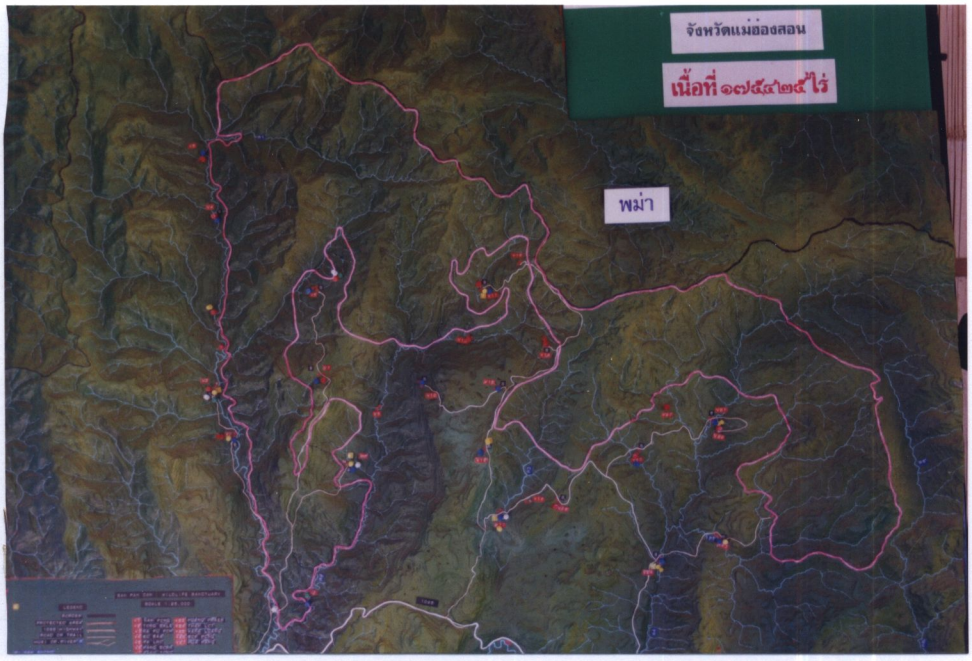


Figure 2. Map of Sunpundan Wildlife Sanctuary (photographed from a display at the headquarters).

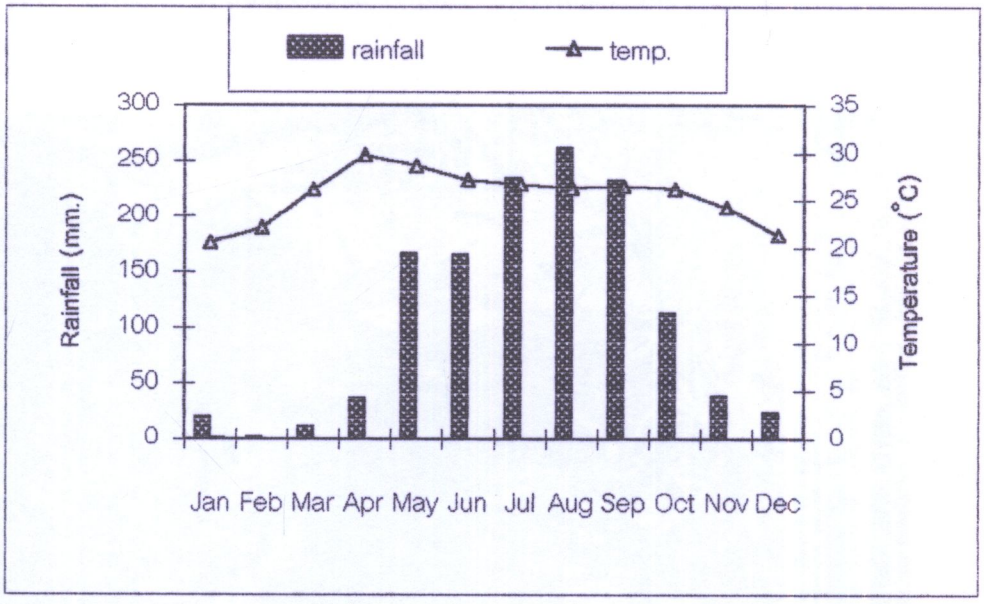


Figure 3. Average monthly rainfall and temperature in Mae Hong Son Province during 1951 – 1980. Source: National Statistical Office, Office of the Prime Minister; Thailand (1994).

Figure 4. Marsh at Sunpundan Wildlife Sanctuary, January 1999.

Figure 5. Small hot spring at Sunpundan Wildlife Sanctuary, January 1999.

to March. They came by personal cars to experience one day sight seeing and sometimes one night camping at the sanctuary office. Only one group with one tourist and a guide stayed over night in Huai Nam Pong Village and paid 30 baht for accommodation. A few groups of tourists with 2 to 3 people per group trekking from another village passed through the area, but their destination and interests were not determined.

The tourists' goals were bird watching at the small marsh (Figure 4) and bathing in the small hot spring (Figure 5). Most of them walked to the marsh without a guide after asking forestry officers or villagers for information about trails and birds likely to be seen. Tourists usually go to the outlet of the hot spring located near Huai Pong Saen Pig Stream for bathing where the villagers have made a bamboo outlet pipe.

Tourists can buy some snacks and drinks at the village, including beer but not whisky. There is an agreement among the villagers to forbid drinking and selling whiskey since they are Christians. There is no restaurant or telephone in the village and the sanctuary. Radio is the only communication system available at the sanctuary. It can link with other nearby stations such as Lum Nam Pai Wildlife Sanctuary and Jik-Jong substation (in Pang Mapha District). It is very difficult for tourists to contact officials at the sanctuary to use the radio.

NATURE TRAIL

The entire nature trail is about 1.5 kilometers long and 60 centimeters wide Most of the trail is along an irrigation canal (Figure 6). The canal is 50 centimeters wide and 50 centimeters deep. The trail is from the sanctuary office to the marsh and

the hot spring. It passes through Huai Nam Pong Village, paddy fields, and across Huai Pong Saen Pig Stream. Most tourists usually use this trail for going to the marsh and hot spring. Villagers also go to their paddy fields by this trail. There are no educational facilities or guides for the trail. To go to the marsh, tourists have to walk across the stream again which often scares the birds, even with small and quiet groups of tourists.

Figure 6. Nature trail to the marsh and hot spring

ACCESS

Highway 1095 from Chiang Mai via Pai and Pang Mapha is the shortest way to the entrances of Sunpundan Wildlife Sanctuary. There are two entrances to Sunpundan Wildlife Sanctuary Office: at kilometers 159.5 and 162.5 on highway 1095. The entrance road at kilometer 159.5 is a steep 4 kilometers long dirt track (about 30^0 slope) and 5 meters wide. It is not suitable for ecotourism since the road surface is rough, dangerous, and narrow with some parts being only one car wide.

The entrance road at kilometer 162.5 is 5 kilometers long. The road condition is similar to that at kilometer 159.5, but the slope is less. This dirt track crosses the Nam Khong River, which is 8 meters wide and 45 centimeters deep with a velocity of 0.46 m/s measured at the end of the rainy season in November. Two-wheeled drive cars and motorcycles can ford the river. In the rainy season only four-wheeled drive cars can make the crossing. This way is uncomfortable in the cool and hot seasons, and dangerous in the rainy season.

TRANSPORTATION

There are 5 daily domestic flights (Thai Airways International) from Chiang Mai to Mae Hong Son airport: 0930, 1135, 1155, 1350, and 1605 hrs. The trip takes about 40 minutes. Five flights from Mae Hong Son to Chiang Mai airport are at 1040, 1245, 1305, 1600, and 1715 hrs. The trip takes about 35 minutes. The flight one way costs 375 baht per person.

Buses traveling from Chiang Mai at Arcade Station to the entrances of Sunpundan Wildlife Sanctuary at kilometers 159.5 and 162.5 leave at 0700, 0900, 1030, and 1230 hrs. The trip takes about 6 hours and costs 73 baht per person. There

are also the same bus routes from Mae Hong Son to the entrances of Sun Pun Dan Wildlife Sanctuary. The trip takes about 1 and half-hours and costs 25 baht per person. There is no public transportation from both entrances to the wildlife sanctuary office.

There are many car rental companies in Mae Hong Son. A four-wheel Suzuki Caribian rents for 1000-1200 baht per day. Some companies will guarantee complete insurance coverage in the event of a claim (1,000 baht deductible), but some will not. Motorbikes rent for 180-350 baht per day according to the volume of the engine.

ACCOMMODATIONS

There is no housing accommodation for tourists in the study area. Aside from the towns in Mae Hong Son and Pang Mapha Districts, the closest accommodation is the Wilderness Lodge. It is located at kilometer 1 on the entrance road (at kilometer 162.5 on highway 1095) of the sanctuary. There are 7 small houses with food and water available.

SITE DESCRIPTION

The study area extends from Sunpundan Wildlife Sanctuary Office to Huai Nam Pong Village, then a marsh and a small hot spring. The boundary of the study area is 0.5 kilometer on each side of a trail, which is about 1.5 kilometers long. Huai Pong Saen Pig Stream is in the study area. The study area consists of bamboo and deciduous hardwood forest which was damaged by logging.

The elevation of the area is about 360 to 560 m (Figure 7). The main part, which includes the marsh and hot spring, is 360 – 400 m above mean sea level. It is an

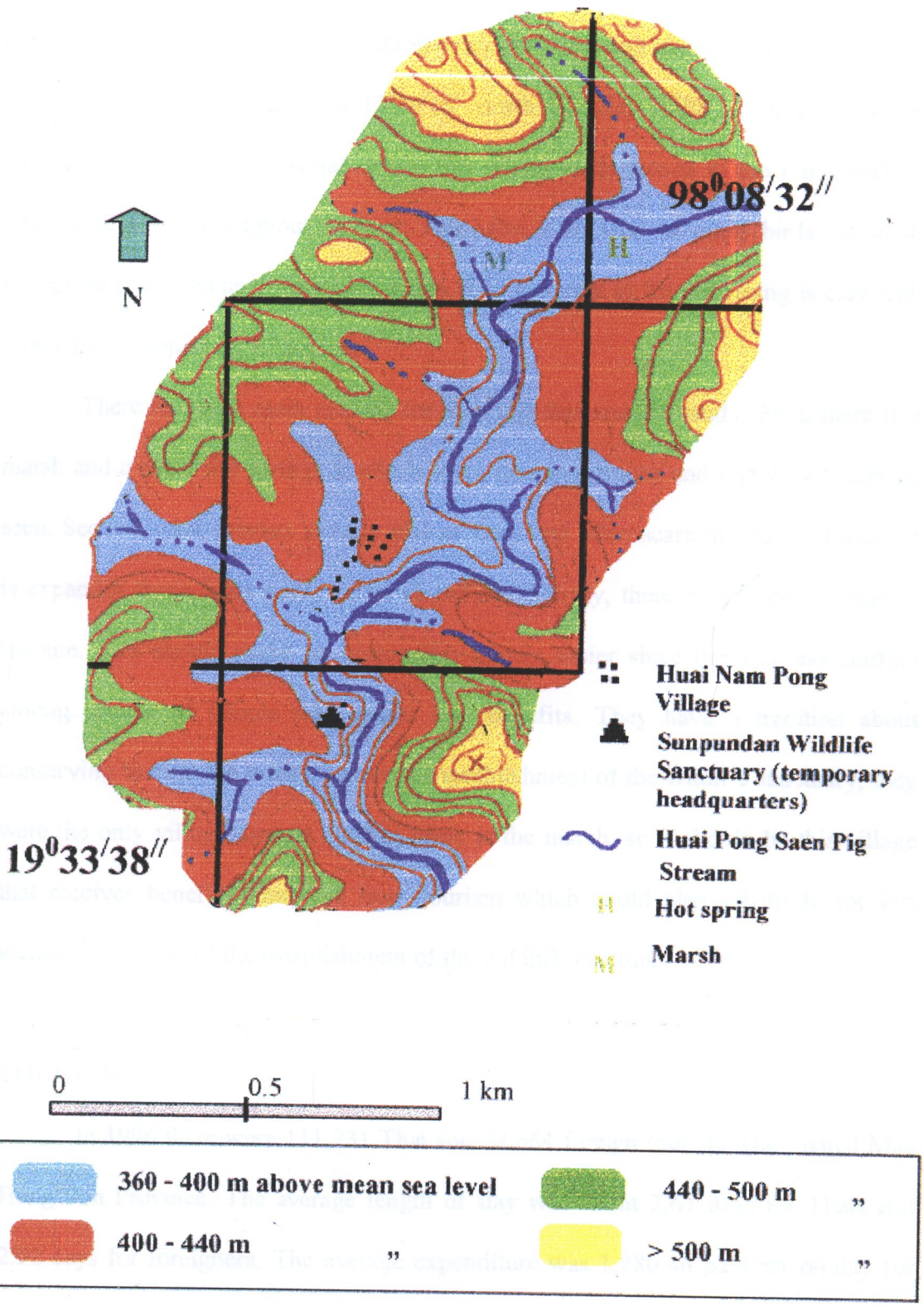


Figure 7. Topographic map of the study area.

associated seasonally riparian area of Huai Pong Saen Pig Stream. The bedrock of the study area is shale, which is 250 million years old (Hess and Koch, 1979).

The marsh is located at $19^{0}34'18''$ north latitude, $98^{0}08'24''$ east longitude. Around the marsh is a seasonal stream that occasionally floods in the rainy season. The marsh is wet throughout the year. This habit is the vital for many birds. A small hot spring is located near the paddy fields. The sediment in the hot spring is clay with a very large proportion of humus.

There are three main reasons for selecting this area for study. First, there is a marsh and a small hot spring, at which some mammal tracks and many birds can be seen. Second, some tourists already visited there and often scare the birds. If tourism is expanded these birds might move elsewhere. Thirdly, there is only one village in the site. This should make an ecotourism project easier since there is less conflict among groups of people who might lose benefits. They have a tradition about conserving birds at the marsh. Before the establishment of the wildlife sanctuary, they were the only village against hunting birds at the marsh, so it should be this village that receives benefits generated from tourism which could also substitute for lost income as a result of the establishment of the wildlife sanctuary.

TOURISTS

In 1996 there were 111,731 Thai and 78,664 foreign tourists who visited Mae Hong Son Province. The average length of stay was about 2.67 days for Thais and 2.92 days for foreigners. The average expenditure was 1,280.46 baht/person/day for Thais and 1,220.77 for foreigners. The number of tourists increased about 7.62 % in 1997 and 0.02 % in 1998. Thai tourists decreased about 9.50 % from 1997 to 1998.

The average length of stay and average expenditure also increased from 1996 to 1998. The average expenditure of foreigners was lower, but their average length of stay was longer (Table 1).

Table 1. Summary of tourists visiting Mae Hong Son Province during 1996 – 1998.

	1996	1997	1998
tourists			
Thai	111,731	115,444	104,475
foreign	78,664	88,985	100,259
average expenditure (baht/person/day)			
Thai	1280.46	1337.90	1469.44
foreign	1220.77	1246.90	1394.81
average length of stay (days)			
Thai	2.67	2.73	2.76
foreign	2.92	3.46	3.50

Source: Tourism Authority of Thailand, Chiang Mai (1999).

MATERIALS AND METHODS

MATERIALS

Soil pH and Moisture Tester, TAKEMURA, Model: DM-15.

Binoculars, 7 x 40

Telescope, 16 x 22-60

Plastic tags, 7 x 10 cm.

50 meter measurement tape

Thermometer, 0 -100 ^{0}C

Base map, topographic map scale 1:50,000, sheet 4648 III, Ban Mae Lana, the Royal Thai Survey Department, 1976.

METHODS

A mini EIA (environmental impact assessment) of the study area consists of three aspects, *viz.* physical features, biological resources, and human use and quality of life values. Physical features consist of the stream, nature trail, the small marsh, and a small hot spring that are being considered as focal points for ecotourism. Biological resources are birds, mammals, and plants. Human use and quality of life values include population, education, public health, infrastructure, collection of forest products, and attitudes of villagers and tourists towards tourism. The attitude of tourists for this area is a factor which can determine its opportunity for ecotourism development of the area and was done by questionnaires. Risks and benefits of each aspect of ecotourism are considered.

PHYSICAL FEATURES

Marsh and hot spring

The physical characteristics of the small marsh and small hot spring were measured, such as soil moisture, pH, temperature, and water flow. Water flow of the small hot spring was calculated by Velocity /Area Method. This depends on measuring the average velocity of flow and the cross-sectional area of the channel and calculating the flow from:

$$Q\ (m^3/s) = A\ (m2) \times V\ (m/s)$$

A = the cross-section area

V = 0.8 x surface velocity

The velocity is not the same at all places in the stream, since it is slower at the sides and bottom, and faster on the surface. Taking 0.8 of the surface velocity as measured by the float gives an approximate value for average velocity (Hudson, 1993). Flow velocity was measured by the time taken for a floating object to travel a five meters distance downstream.

Water flow of the marsh was estimated by use of plastic bags to collect the water at inlets and outlets of the marsh within one minute. Result is an average of these measurements

Nature trail

The nature trail that tourists and local people usually use to go to the marsh and hot spring was ascertained from asking villagers and forestry officers. The condition and highlight points for tourists were observed and mapped.

Stream

Huai Pong Saen Pig was identified as the stream most likely to be affected by tourism and it is also the main source of water for Huai Nam Pong Village. A cross-section of the stream was made and plotted. The calculation of the flow is similar to the calculation method of water flow of the small hot spring.

BIOLOGICAL RESOURCES

Birds

Inventory surveys were performed in order to determine the best sites for bird watching the area. A transect line was placed along the nature trail. By walking slowly at a constant speed on the line, species, distribution, and abundance of birds seen by binoculars and telescope were recorded. Distribution was determined by habitat. Abundance was the frequency of observation. It was divided into 3 classes, *viz.* common, uncommon, and rare or few records. The observations were done in the morning from 0730 to 1000 hrs and in the evening from 1600 to 1830 hrs. The frequency of recording was 2 days each month from November to April.

Plants

Two sampling plots were laid out around the marsh and the hot spring. Each plot was 30 x 10 m. Within each plot, species, girth at breast height (gbh), and height were determined for all trees with gbh > 10 cm. These trees were tagged with plastic tags, 7 x 10 cm. Species diversity, richness, and evenness of tree communities and rarefraction data in each plot were calculated by using the program SPDIVERS.BAS of

the ECOSTAT software (Ludwig and Reynolds, 1988). The ground flora and under storey trees were also identified in each plot.

Mammals

By walking along the trail, around the marsh, hot spring, and paddy fields, mammal tracks and signs were observed. Squirrels and rats are not included. The observations were done once a month in the morning, from November to April. The forestry officers and villagers were questioned regarding the presence mammals in this area.

HUMAN USE AND QUALITY OF LIFE VALUES

Since only Huai Nam Pong Village would be affected by tourism, all information about the local community such as population, education, and public health were collected from the village. Mr. Sange Pipaksa, the religious leader, was asked about land and chemical use. Observations about an infrastructure consist of water consumption and garbage management. Collecting of forest products such as fuelwood, edible plants, fish, and insects, by the villagers were observed.

Attitudes of villagers towards tourism

Interviews were conducted with the Huai Nam Pong Village committee. The comments of the committee should represent the comments of the village. The questions were about the kind of tourism that they wish to attract to their area. Some answer choices were made into categories and the answers of interviewees were put in those categories. This helped eliminate unclear items which they have not seen such as

undesirable activities of tourists. The questions asked are:

1. What type of tourists do you want to avoid attracting?
2. What are the undesirable activities of tourists?
3. What is the optimum number of tourists that the area can support at the same time (in terms of physical, environmental, and social carrying capacity)?
4. What festivals or activities that tourists are / are not welcome?
5. How can you contribute to tourism in this area?

Attitudes of tourists towards potential ecotourism

Using questionnaires, 50 tourists were asked about their attitudes towards destination areas and activities of ecotourism related to the study area (Appendix 1). The answers given ranged from 1 to 5 and analyzed by the Statistical Package for Social Science (SPSS). Questionnaires were distributed at specific locations near the study area, at Tham Lod Forest Park, and in Pai town.

RESULTS AND DISCUSSION

PHYSICAL FEATURES

Marsh and hot spring

In January 1999 less than 500 cm^3 of water per minute flowed through the marsh. It is wet throughout the year. The small amount of water present is a key habitat for many birds. The marsh is a part of a natural waterway and is surrounded by seasonal streams. The water temperature of the hot spring is 65^0 C and flow was about 0.025 m^3/second in January 1999.

The properties of the soil shown in Table 2 were the average of two measurements during 0900 to 1000 hrs. The soil pH of the hot spring is relatively low compared to the other sites while the moisture is highest. The soil of the hot spring is acidic and saturated. The soil pH of the marsh is similar to the forest near the sanctuary office and the rice fields. The soil moisture of the marsh and rice fields are moderate, while the moisture of the forest soil is lowest. The soil moisture measurement is an arbitrary scale for plantation ranged from 1 to 8, for example, the suitable soil moisture for potato crops is 3 to 5.

Table 2. Soil pH and moisture in 4 areas within the study site, January 1999.

	marsh	hot spring	rice field	forest
pH	5.8	4.5	6.2	5.5
moisture	4.5	> 8.0 undetectable	4.0	2.1

Stream

The fine sediment in Huai Pong Saen Pig Stream is sand and clay also with gravel and boulders. The water is clear in the dry season, but turbid in the rainy season. The surface velocity was 0.3 meters per second and the cross-sectional area was about 2.82 m^2. According to the Velocity /Area Method (Hudson, 1993), the flow of Huai Pong Saen Pig was about 0.677 m^3/s in November 1998.

Nature trail

On the nature trail there are two crossing points across Huai Pong Saen Pig Stream. Each part has a fallen tree trunk across it as a natural bridge where the average diameter is about 65 centimeters (Figure 8).

Figure 8. Tree trunk across Huai Pong Saen Pig Stream.

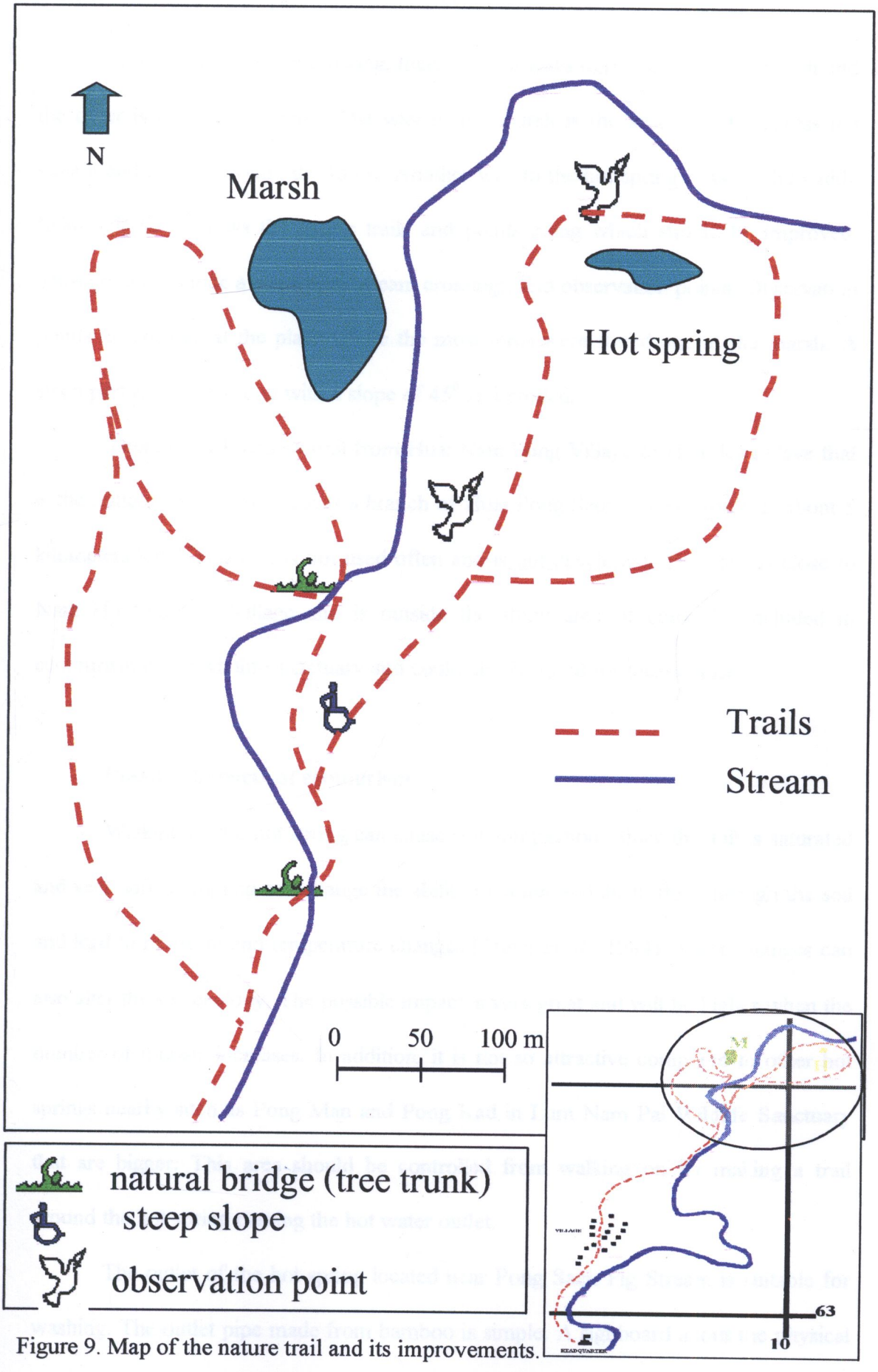


Figure 9. Map of the nature trail and its improvements.

After the first stream crossing, there are two ways to go, one is to the marsh and the other is to the hot spring. The way to the marsh is the second point across the stream and passes through the forest. Another way to the hot spring is along the paddy fields. Figure 9 shows the nature trails and points along which should be improved. Those points include a steep part, stream crossings, and observation points. Observation points are located at the place where the most birds were found and at the marsh. A steep part is 7 meters long with a slope of 45^0 and eroded.

There is a wilderness trail from Huai Nam Pong Village to Huai Kan Cave that is the outlet of a stream which is a branch of Huai Pong Saen Pig Stream. It is about 5 kilometers long. This trail is not used often and is not developed. The cave is close to Nam Hu Pha Sua Village and is outside the study area. It could be included in ecotourism in the wildlife sanctuary and could also be good for local guides.

Possible impacts of ecotourism

Walking by the hot spring can cause soil compaction. Since the soil is saturated and very soft, trampling can change the ability of water and air to flow through the soil and lead to moisture and temperature changes (Tuner *et al.*, 1984). These changes can also alter the soil ecology. The possible impact is very great and will be higher when the number of tourists increases. In addition, it is not so attractive compared to other hot springs nearby such as Pong Man and Pong Kad in Lum Nam Pai Wildlife Sanctuary that are bigger. This area should be controlled from walking on by making a trail around the hot spring passing the hot water outlet.

The outlet of the hot spring located near Pong Saen Pig Stream is suitable for washing. The outlet pipe made from bamboo is simple. A signboard about the physical

conditions of the hot spring could be set up at the outlet pipe and include soil moisture, pH, water temperature, and flow. The wildlife at the hot spring should be include on the board, *e.g.* signs of civets and a flock of Thick-billed Pigeons perching above in the evening. Trail markers and signboards should be made from plywood.

Trampling can cause increased soil erosion on the trail, especially when the number of tourist increases. Steep parts of the trail are easily eroded. Trail steps with adequate drainage are needed (Appendix B).

The two fallen trees, which are used as natural bridges, are interesting and enjoyable, but they are not safe for tourists. They could shift due to flooding in the rainy season and eventually rot. Each log should be fixed at the ends in order to prevent shifting. The surface should be made flat and also painted to prevent rot.

The most suitable entrance to the sanctuary should be at kilometer 162.5 because the road slope is less than at kilometer 159.5. Both roads are in poor condition and not safe. The roads should have concrete or metal fencing. Some parts which are narrower than 5 meters should be widened. The road could be surfaced with gravel or even concrete, depending on the budget. Making drains along the road in order to provide adequate drainage in the rainy season could help prevent soil erosion. Fording the Nam Khong River is difficult, and can cause water pollution by oil and fuel leakage. A bridge should be constructed.

BIOLOGICAL RESOURCES

Birds

A total of 76 bird species were observed during a period of six months (Appendix C). Since the survey was done on only two days per month, it can not

represent the seasonal status of all birds. The distribution and seasonal status of these birds in northern Thailand is from Lekagul and Round (1991) (Table 3). There were 69 residents and 7 winter visitors seen in the study area with 9 uncommon species and 5 fairly common species. The remaining species are common and very common species. There are no rare or endangered bird species in the area. Some common species such as the Red Junglefowl and Mountain Imperial Pigeon have been locally reduced in numbers due to hunting. Most winter visitors were found in January. The Red-throated Flycatcher is a winter visitor that was found throughout the study period (Appendix E).

From my observations, the abundance of birds found in the study area can be divided into 3 classes due to frequency of recording, *viz.* common or seen frequently, uncommon or seen infrequently, and rare or few records. There were 36 commonly seen species, 23 uncommon species, and 17 rare species (Table 4). There were no rare species seen in November and December. Since observation was done only along the trail, it does not cover all habitats and some rare species might be common residents elsewhere in the wildlife sanctuary.

The bird community can be divided into 3 categories according to the position they occupy in the forest canopy, *viz.* tops of trees, middle of trees or shrubs, and near or at ground level (Appendix C.). The percentages of birds found at these levels are shown in Table 5. They are approximate calculations because some species were seen in more than one level. The birds which perch at the tops of trees include less than half of the bird fauna in this area. This might be due to easier visibility.

Table 3. Distribution and seasonal status in northern Thailand of birds found during a six month period in Sunpundan wildlife Sanctuary, according to Lekagul and Round (1991).

	month						
	November	December	January	February	March	April	number of species
distribution							
very common & common	36	39	42	38	44	34	62
fairly common	2	2	4	3	2	1	5
uncommon	3	4	5	5	6	5	9
total	41	45	51	46	52	40	76
seasonal status							
residents	38	40	45	42	49	39	69
winter visitors	3	5	6	4	3	1	7
total	41	45	51	46	52	40	76

Table 4. Abundance of birds found during a six month period in Sunpundan Wildlife Sanctuary.

	month						
	November	December	January	February	March	April	number of species
common	33	34	35	31	35	31	36
uncommon	8	11	12	13	9	6	23
rare	0	0	4	2	8	3	17
total	41	45	51	46	52	40	76

Table 5. Percentages of birds found at different levels in the forest.

	level		
	tree canopy	middle level	near or at ground level
percentage	43.42	36.84	19.74

The area with the highest species richness of birds was in paddy fields between the marsh and the hot spring. Thirty-six species were recorded by binoculars, from 0730 to 1030 hrs., which is the best time to observe birds in the study area in February 1999 (Appendix D). Some birds around the marsh were also observed from this point.

The four most common species at the marsh were Mountain Imperial Pigeon, Grey-headed Parakeet, Thick-billed Pigeon, and Vernal Hanging Parrot. The Thick-billed Pigeon was the most common, while the Grey-headed Parakeet was the least common (Figure 10.). The maximum number of birds seen was in January 1999, with about 510 individuals and decreased during the hot season (Table 6). They usually visit the marsh in the morning from 0730 to 1030 hrs. and in the evening around 1700 to 1830 hrs. At midday some of them were still at the marsh, but the number was less than at other times.

In December and January (Appendix E), Red-rumped Swallow and Asian Palm-Swift were seen feeding overhead along with two bird species that I could not identify. The point with the highest number of individuals of these species is in the paddy fields located between the marsh and the hot spring, which is the same point with the highest species richness. A total of about 100 individuals of these bird species was seen above the paddy fields in the morning, around 0730 to 1030 hrs. The feeding level of the Red-rumped Swallow is the lowest, sometimes only one meter above the paddy

fields, while the Asian Palm-Swift often feeds at the highest levels. Only the Red-rumped Swallow was found perching on trees.

Six species of woodpeckers were observed in the study area while 4 species were found in inundation zone at Mae Yom National Park, Phrae Province (CCB, 1991). Four species of woodpeckers were also found at Tung Gik, an open grassland area covering 3 km^2 in Mae Ping National Park, Lamphun Province (Groom, 1998). Common Flameback was the most frequently encountered species in Sunpundan Wildlife Sanctuary.

A number of birds of prey were recorded in the sanctuary including, Shikra, Collared Falconet, Black Baza, and Crested Serpent-Eagle.

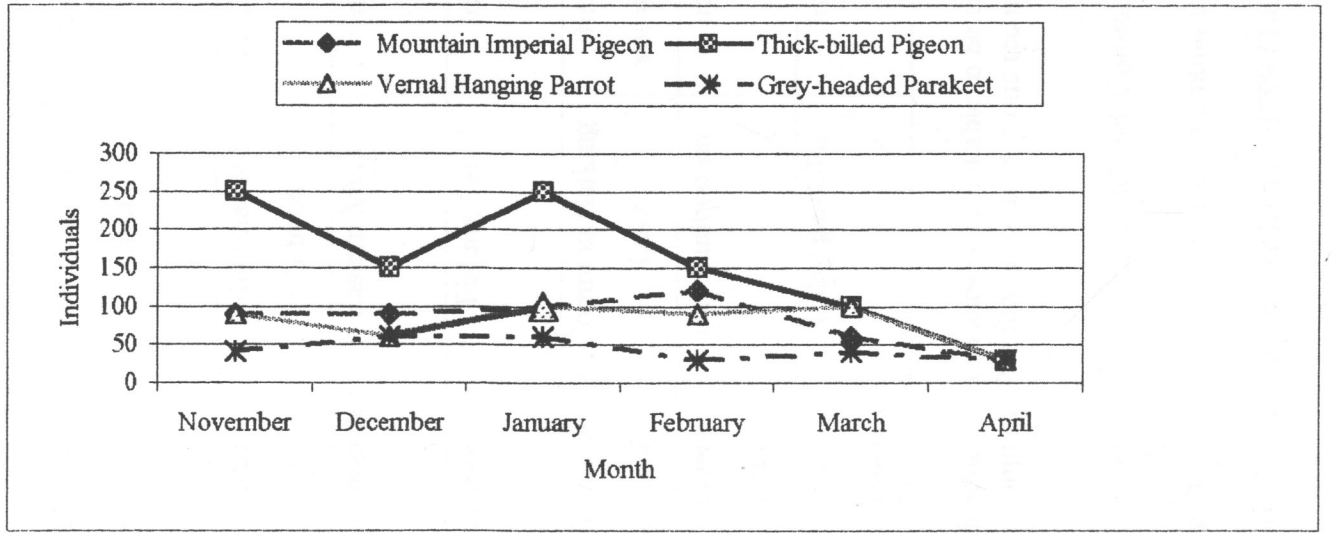
According to Lekagul and Round (1991), there are seven Drongos in Thailand, of which six are residents and another is a passing migrant species. The diversity of Drongos in the study area appeared to be high, since all six resident species were observed.

Several smaller bird species were observed in dense vegetation along the course of seasonal streams around the marsh, but observing was very difficult. At such locations, White-crested and Greater Necklaced Laughingthrushs were easily recognized because of their voices. The long tail of the Asian Paradise-flycatcher is also readily recognized in dense vegetation around the marsh.

Table 6. Numbers of 4 dominant bird species seen at the marsh from November 1998 to April 1999.

Common name	November	December	January	February	March	April
Mountain Imperial Pigeon	90	90	100	120	60	30
Thick-billed Pigeon	250	150	250	150	100	30
Vernal Hanging Parrot	90	60	100	90	100	30
Grey-headed Parakeet	40	60	60	30	40	30
Total	470	360	510	390	300	120

Figure 10. Numbers of 4 dominant bird species seen at the marsh from November 1998 to April 1999.



Mammals

Table 7. Mammal species observed during November 1998 to April 1999.

scientific name	common name	evidence	abundance[2]	area
Viverridae [1]	Civet	tracks / tree scratches	2	hot spring
Hylobates lar	White-handed Gibbon	vocalization	2	outside the study area
Talpa micrura	Eastern Mole	signs	1	around the marsh
Felis viverrina	Fishing Cat	tracks	3	around the marsh
Muntiacus muntjak	Common Barking Deer	tracks / vocalization	1	around the marsh
Cannomys badius	Bay bamboo rat	tracks	2	bamboo clump along the trail
Manis javanica	Malay pangolin	tracks	1	near paddy fields

[1] Individual civet species were not able to be clearly distinguished.
[2] 1 = common; 2 = few records; 3 = one record.

Tracks of Eastern Mole and Common Barking Deer were commonly found along the course of seasonal streams around the marsh while tracks of Fishing Cat were observed only one time on January 1999 (Table 7). According to Nakasathienr (1975), Fishing Cat is a threatened species.

The vocalizations of White-handed Gibbon were heard in November, December, February, and August, northeast of study area in the morning around 0600

to 0900 hrs. It is an endangered species (Nakasathienr, 1975). From asking villagers in Huai Nam Pong Village and officers in the wildlife sanctuary, sometimes it comes close to the study area.

Overall, the mammal community appears to be depauperate in this area. Of significance is that a carnivore (Fishing Cat), herbivores (Common Barking Deers), and omnivores (Civets) still exist around the marsh and the hot spring.

Plants

The vegetation type in this area is a deciduous hardwood + bamboo forest (bb/df). The bedrock is shale. All plants were identified by Mr. James F. Maxwell on 6 August 1999. This bb/df forest has been severely damaged by logging for *Tectona grandis* L. f. (Verbenaceae, teak) and other valuable hardwood trees. It has also been degraded due to annual fires. Much secondary growth has become established. The forest is regenerating itself and will possibly be able to overcome the damage. Since annual fires destroy this regeneration, it should be controlled.

A total of 25 species of 46 trees (gbh>10 cm) belonging to 16 families were recorded at the marsh and hot spring (Table 8). The marsh has a total of 13 species of 21 trees, belonging to 11 families. The hot spring has a total of 12 species of 25 trees, belonging to 8 families. Table 8 shows that tree species compositions were completely different between two sites. *Xylia xylocarpa* (Roxb.) Taub. var. *kerrii* (Craib & Hutch.) Niels. (Leguminosae, Mimosoideae) and *Schleichera oleosa* (Lour.) Oken (Sapindaceae) were the most abundance tree species in the marsh, both having percentages of 14.3 %. The hot spring was dominated by *Albizia lucidor* (Steud.)

Niels. (Leguminosae, Mimosoideae) (21.7 %) and *Ficus hispida* L.f. var. *hispida* (Moraceae) (17.4 %).

The ground flora and understorey tree species are shown in Tables 9 & 10. Deciduous herbs at the marsh were found in more abundance than at the hot spring, at which only *Dendrocalamus membranaceus* Munro (Gramineae, Bambusoideae) was found. The ground flora includes *Globba schomburgkii* Hk. f. (Zingiberaceae) and *Geodorum* sp. (Orchidaceae) which is also found at the marsh. Evergreen herbs were found only at the hot spring. Understorey trees at the marsh are mostly deciduous while both evergreen and deciduous trees were found at the hot spring, but in less abundance.

Deciduous woody climbers include *Dalbergia discolor* Bl. *ex* Miq. (Leguminosae, Papilionoideae), *Pueraria mirifica* A.S. & Suvat. (Leguminosae, Papilionoideae), *Uraria cordata* (Dun.) Alst. (Annonaceae), and *Ziziphus oenoplia* (L.) Mill. var. *oenoplia* (Rhamnaceae) were found at the marsh, while *Phyllanthus reticulatus* Poir. (Euphorbiaceae), *Acacia megaladena* Desv. var. *indo-chinensis* Niels. (Leguminosae, Mimosoideae), *Congea tomentosa* Roxb. var. *tomentosa* (Verbenaceae), and *Combretum latifolium* Bl. (Combretaceae) were found at the hot spring. Shrubs and treelets found at the marsh are deciduous, while those found at the hot spring are evergreen.

Some deciduous herbs were also found along the trails, these include: *Aeginetia indica* Roxb. (Orobanchaceae), *Globba kerrii* Craib (Zingiberaceae), *Begonia integrifolia* Dalz. (Begoniaceae), *Uraria cordifolia* Wall. (Leguminosae, Papilionoideae), and *Costus speciosus* (Koen.) J.E. Sm. (Zingiberaceae).

Table 8. Number of individuals of tree species (gbh>10 cm) at the marsh and hot spring area.*

family	species	site	
		marsh	hot spring
Leguminosae, Mimosoideae	*Xylia xylocarpa* (Roxb.) Taub. var. *kerrii* (Craib & Hutch.) Niels.	3 (14.3)	0
	Albizia lucidor (Steud.) Niels.	0	5 (21.7)
Bombacaceae	*Bombax anceps* Pierre var. *anceps*	2 (9.5)	0
Lecythidaceae	*Careya arborea* Roxb.	1 (4.3)	0
Euphorbiaceae	*Antidesma montanum* Bl.	1 (4.3)	0
	Antidesma acidum Retz.	1 (4.3)	0
	Aporusa villosa (Lindl.) Baill.	2 (9.5)	0
	Bischofia javanica Bl.	0	1 (4.3)
	Phyllanthus emblica L.	0	1 (4.3)
	Phyllanthus columnaris M. - A.	0	1 (4.3)
Leguminosae, Caesalpinioideae	*Cassia fistula* L.	1 (4.3)	0
Tiliaceae	*Grewia eriocarpa* Juss.	2 (9.5)	0
Sapindaceae	*Schleichera oleosa* (Lour.) Oken	3 (14.3)	0
Annonaceae	*Miliusa velutina* (Dun.) Hk. f. & Thoms.	1 (4.3)	0
Lythraceae	*Lagerstroemia venusta* Wall. *ex* Cl.	1 (4.3)	0
Loganiaceae	*Strychnos nux-vomica* L.	2 (9.5)	0

* values in brackets indicate relative abundance of species within sites

Table 8. (continued)

family	species	site	
		marsh	hot spring
Rubiaceae	*Vangueria* (*Meynia*) *pubescens* Kurz	1 (4.3)	0
	Hymenodictyon orixense (Roxb.) Mabb.	0	1 (4.3)
Moraceae	*Broussonetia papyrifera* (L.) Vent.	0	3 (13.0)
	Ficus racemosa L. var. *racemosa*	0	1 (4.3)
	Ficus hispida L.f. var. *hispida*	0	4 (17.4)
Salicaceae	*Salix tetrasperma* Roxb.	0	3 (13.0)
Verbenaceae	*Vitex quinata* (Lour.) Will.	0	1 (4.3)
Bignoniaceae	*Fernandoa adenophylla* (Wall. *ex* G. Don) Steen.	0	1 (4.3)
Leguminosae, Papilionoideae	*Millettia pubinervis* Kurz	0	3 (13.0)
Total		21 (100)	25 (100)

* values in brackets indicate relative abundance of species within sites

Table 9. Habits of ground flora and understorey tree species at the marsh (6 August 1999).

habit	botanical name (family)
evergreen vine	*Rhaphidophora peepla* (Roxb.) Schott (Araceae) vine-creeper
deciduous vines	*Ampelocissus martini Pl.* (Vitaceae) *Dioscorea alata* L. (Dioscoreaceae) *Dioscorea hispida* Denn. var. *hispida* (Dioscoreaceae) *Lygodium flexuosum* (L.) Sw. (Schizaeaceae)
deciduous herbs	*Adiantum philippense* L. (Parkeriaceae) *Amorphophallus paeoniifolius* (Denn.) Nichol. (Araceae) *Curculigo latifolia* Dry. *ex* W.T. Ait. var. *latifolia* (Amaryllidaceae) *Cyanotis cristata* (L.) D. Don (Commelinaceae) *Dendrocalamus membranaceus* Munro (Gramineae, Bambusoideae) *Geodorum* sp.* (Orchidaceae) *Globba schomburgkii* Hk. f. (Zingiberaceae) *Panicum notatum* Retz. (Gramineae) *Peristrophe lanceolaria* (Roxb.) Nees (Acanthaceae) *Scleria levis* Retz. (Cyperaceae)
deciduous trees	*Aegle marmelos* (L.) Corr. (Rutaceae) *Afzelia xylocarpa* (Kurz) Craib (Leguminosae, Caesalpinioideae) *Aporusa dioica* (Roxb.) M.-A. (Euphorbiaceae) *Bombax anceps Pierre* var. *anceps* (Bombacaceae) *Diospyros mollis* Griff. (Ebenaceae) *Falconeria insignis* Roy. (Euphorbiaceae) *Garuga pinnata* Roxb. (Burseraceae)

* Only leaves seen, species identification requires flowers.

Table 9. (continued)

habit	botanical name (family)
deciduous trees	*Holarrhena pubescens* (B.-H.) Wall. *ex* G. Don (Apocynaceae) *Hymenodictyon orixense* (Denn.) Mabb. (Rubiaceae) *Lagerstroemia cochinchinensis* Pierre var. *ovalifolia* Furt. & Mont. (Lythraceae) *Markhamia stipulata* (Wall.) Seem. *ex* K. Sch. var. *stipulata* (Bignoniaceae) *Millettia pubinervis* Kurz (Leguminosae, Papilionoideae) *Oroxylum indicum* (L.) Kurz (Bignoniaceae) *Phyllanthus emblica* L. (Euphorbiaceae) *Protium serratum* (Wall. *ex* Colebr.) Engl. (Burseraceae) *Strychnos nux-vomica* L. (Loganiaceae) *Tectona grandis* L. f. (Verbenaceae) *Terminalia bellirica* (Gaertn.) Roxb. (Combretaceae)
deciduous shrubs / treelets	*Bauhinia viridescens* Desv. var. *viridescens* (Leguminosae, Caesalpinioideae) *Helicteres elongata* Wall. *ex* Boj. (Sterculiaceae) *Thespesia lampas* (Cav.) Dalz. & Gibs. var. *lampas* (Malvaceae)
deciduous woody climbers	*Dalbergia discolor* Bl. *ex* Miq. (Leguminosae, Papilionoideae) *Pueraria mirifica* A.S. & Suvat. (Leguminosae, Papilionoideae) *Uraria cordata* (Dun.) Alst. (Annonaceae) *Ziziphus oenoplia* (L.) Mill. var. *oenoplia* (Rhamnaceae)
annual vine	*Myriopteron extensum* (Wight) K. Sch. (Asclepiadaceae)
annual herb	*Biophytum sensitivum* (L.) DC. (Oxalidaceae)

Table 10. Habits of ground flora and understorey tree species at the hot spring (6 August 1999).

habit	botanical name (family)
evergreen vine	*Thunbergia laurifolia* Lindl. (Acanthaceae)
evergreen herbs	*Colocosia esculenta* (L.) Schott (Araceae) *Commelina diffusa* Burm. f. (Commelinaceae) *Cyrtococcum oxyphyllum* (Steud.) Stapf (Gramineae) *Diplazium esculentum* (Retz.) Sw. (Athyriaceae) *Ficus heterophylla* L. f. var. *heterophylla* (Moraceae) *Justicia quadrifaria* (Nees) T. And. (Acanthaceae) *Musa acuminata* Colla (Musaceae) *Pellionia repens* (Lour.) Merr. (Urticaceae) *Piper sylvaticum* Roxb. (Piperaceae) *Setaria palmifolia* (Koen.) Stapf var. *palmifolia* (Gramineae) *Tectaria impressa* (Fee) Holtt. (Dryopteridaceae)
evergreen trees	*Garcinia cowa* Roxb. (Guttiferae) *Streblus asper* Lour. var. *asper* (Moraceae)
evergreen shrubs / treelets	*Boehmeria zollingeriana* Wedd. (Urticaceae) *Strobilanthes* sp.* (Acanthaceae)
deciduous vine	*Dioscorea bulbifera* L. (Dioscoreaceae)
deciduous herb	*Dendrocalamus membranaceus* Munro (Gramineae, Bambusoideae)
deciduous trees	*Bischofia javanica* Bl. (Euphorbiaceae) *Mallotus philippensis* (Lmk.) M.-A. (Euphorbiaceae) *Broussonetia papyrifera* (L.) Vent. (Moraceae)
deciduous woody climbers	*Phyllanthus reticulatus* Poir. (Euphorbiaceae) *Acacia megaladena* Desv. var. *indo-chinensis* Niels. (Leguminosae, Mimosoideae) *Congea tomentosa* Roxb. var. *tomentosa* (Verbenaceae) *Combretum latifolium* Bl. (Combretaceae)
annual vine	*Pueraria alopecuroides* Craib (Leguminosae, Papilionoideae)
annual herb	*Phaulopsis dorsiflora* (Retz.) Sant. (Acanthaceae)

* Flowers and fruits lacking, required for identification.

Table 11. Species richness, diversity, and evenness of tree communities (gbh > 10 cm) at the marsh and hot spring.

indices	parameters	marsh	hot spring
richness	No	13	12
	R1	3.9415	3.4173
	R2	2.8368	2.4000
diversity	lamda	4.76E-02	8.33E-02
	H'	2.4666	2.2797
	N1	11.7821	9.7736
	N2	21	12
evenness	E1	0.9616	0.9174
	E2	0.9063	0.8145
	E3	0.8985	0.7976
	E4	1.7824	1.2278
	E5	1.8549	1.2538

Table 12. Rarefraction data of the marsh and hot spring.

Rarefraction of the marsh for community of 13 species and 21 individuals.		Rarefraction of the hot Spring for community of 12 species and 25 individuals.	
Sample size (N)	At the hot spring	Sample size (N)	At the marsh
0	0	0	0
5	5	5	4
10	8	10	7
15	11	15	9
17	12	17	10

Species richness, diversity, and evenness of tree communities (gbh > 10 cm) at the marsh and hot spring are shown in Table 11. All indices are higher at the marsh. A similar figure is also performed by rarefraction calculation in Table 12. It means that if the sample sizes are equal, the expected number of species at the marsh is higher.

Possible impacts of ecotourism

Birds

Tourists going to the marsh will have a strong effect on the bird communities there. The degree of disturbance depends on the behavior of tourists and time of visiting. When tourists make loud noises or go into the marsh, the birds fly away and the time before they return will be longer, sometimes being about 2 hours. The Mountain Imperial Pigeon is shyer than the other species. Visiting the marsh in the morning around 0730 to 1030 hrs. and in the evening around 1700 to 1830 hrs. has more adverse effect than at other times. At these times, the number of birds at the marsh is highest, especially the dominant species. Sometimes they leave earlier if there are visitors there in the evening.

The area at which tourists can disturb the birds at the marsh should be absolutely protected from any ecotourism activities. Although trails may be built to bring visitors close to animals, they should avoid sensitive areas (Mcneely *et al.* 1992). The trail that passes through this area should be abandoned. It could be remade along the course of a seasonal stream south of the marsh. Building a hide tower near the marsh is probably the best choice for bird watching. Bird checklists and physical parameters of the marsh could be provided at the tower. This hide tower could be built on a large tree, *Ficus altissima* Bl. (Moraceae), which is 22 meters high near the marsh

(Figure 11). The tower's position and style are shown in Figures 12, 13, & 14. It should be made from hardwood. A civil engineer should be involved in the design and construction of the tower.

Figure 11. *Ficus altissima* Bl. (Moraceae), the largest tree in the study area. This tree would be a suitable site for the construction of a hide tower.

Groups of about 30 Thick-billed Pigeon roost in the trees above the hot spring in the evening. If there are noisy visitors walking through, these birds will fly away. Camping entertainment will also disturb these birds. The hot spring and surrounding area should be absolutely protected at nighttime.

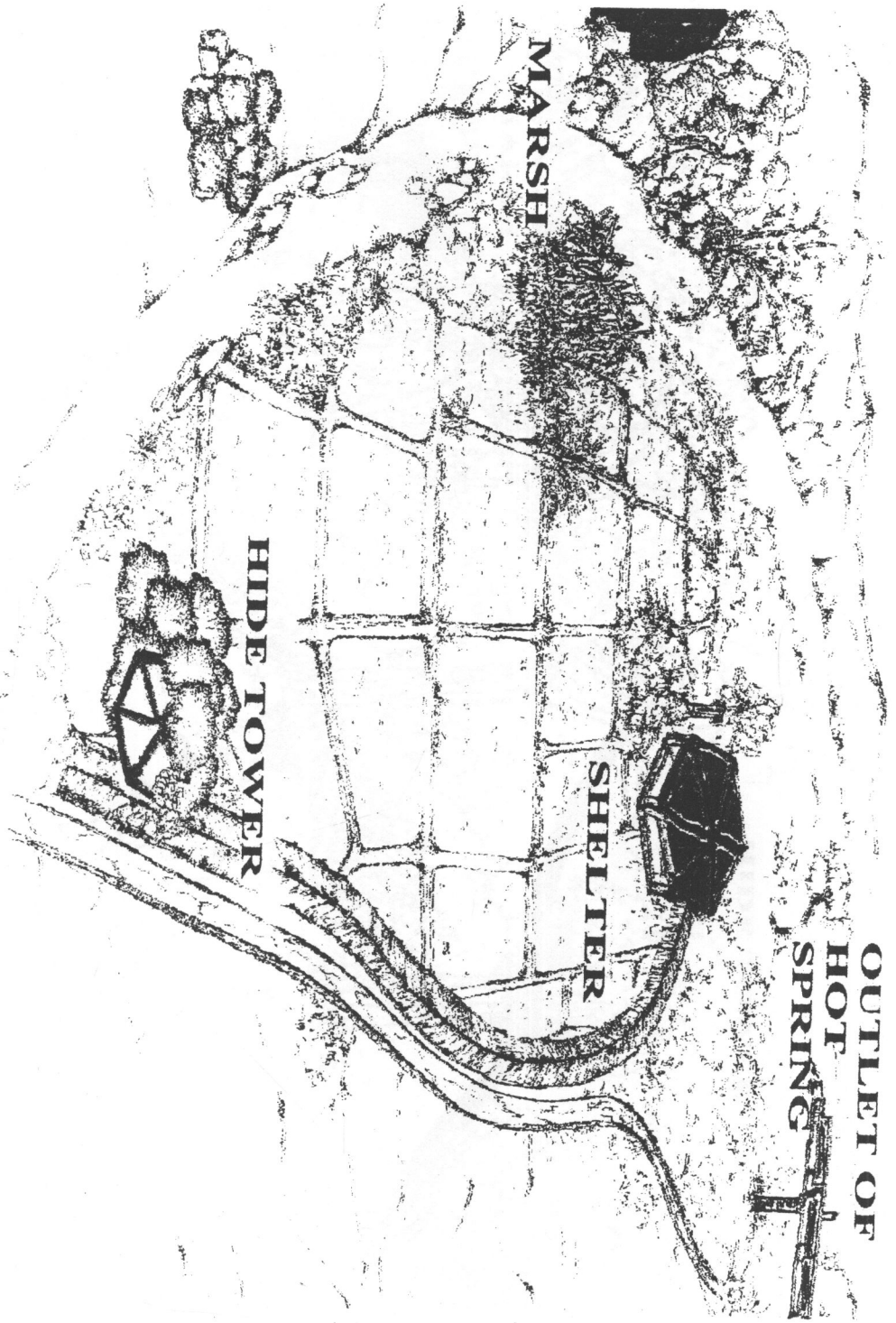


Figure 12. Location of a proposed shelter and a hide tower.

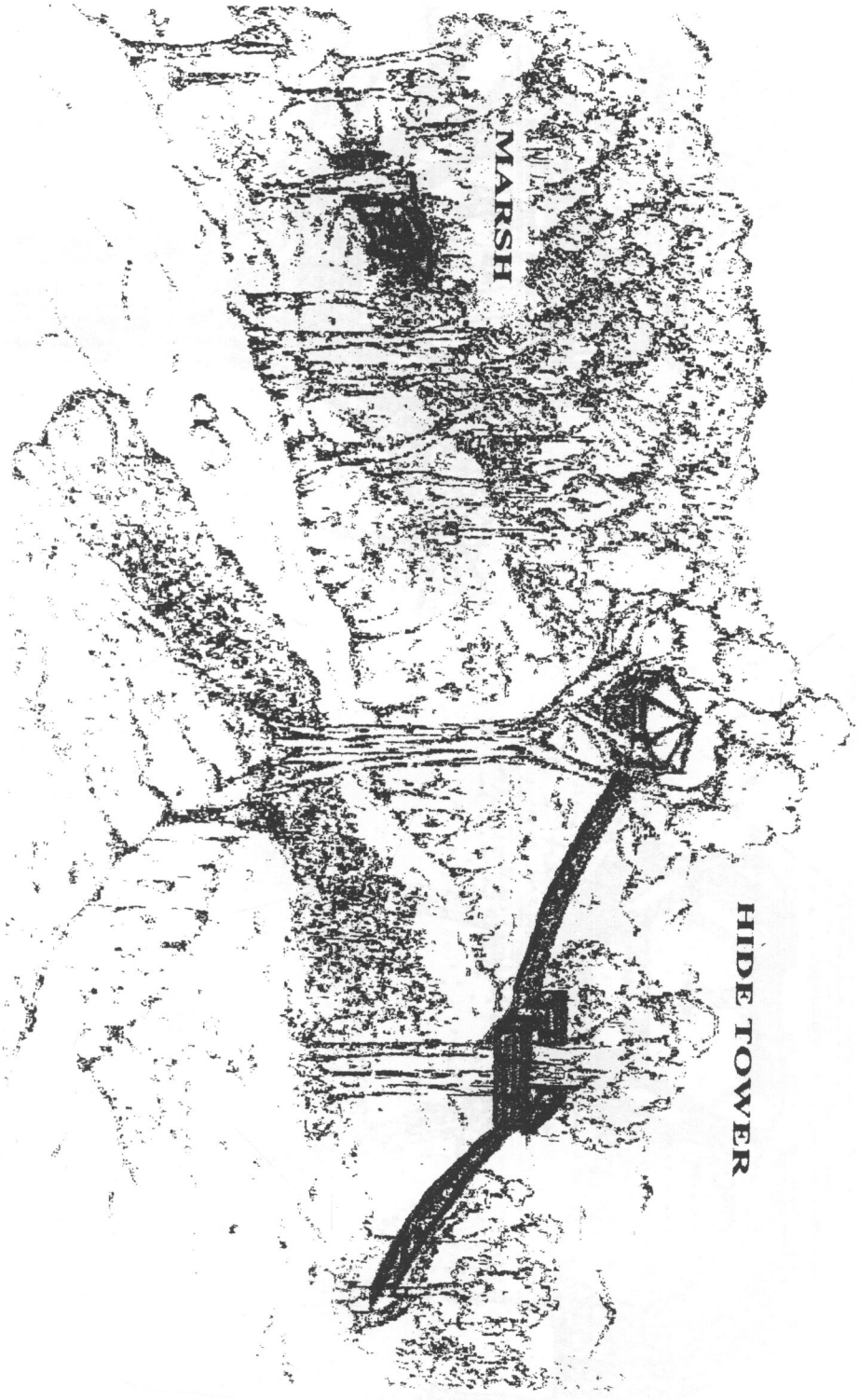


Figure 13. Location of a proposed hide tower at the marsh.

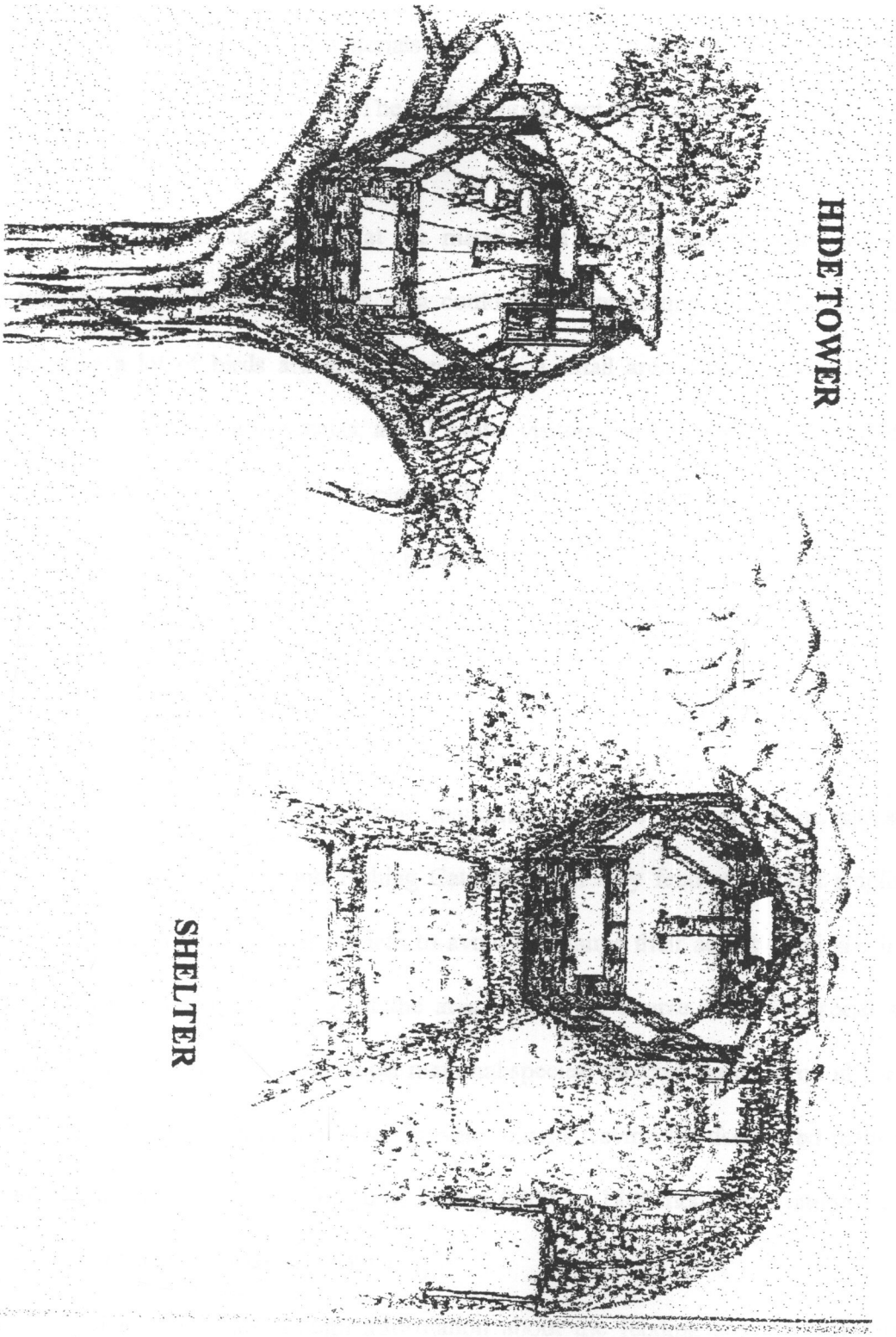


Figure 14. Suggested designs of a shelter and a hide tower.

Shelters should be built at points with the highest species richness of birds. It should be made from local materials such as bamboo. It's position and suggested style are shown in Figures 12 & 14. The shelter should not have a capacity for more than 10 people.

A large flock of birds at the marsh with high species diversity could attract tourists, especially birders. This area could be an interesting site for school children because a lot of birds are easily seen within a small area. Six of seven Drongos in Thailand, 9 uncommon species, and 7 winter visitors can be instructive for children. In turn, ecotourism can help these birds. They can introduce people to further conservation (Groom, 1997). The economic benefits to Huai Nam Pong Village could make the villagers aware of the necessity of protecting bird communities.

Mammals

Tourists could disturb some mammals observed around the marsh, such as Common Barking Deer and Fishing Cat. Although they feed at night, trampling and smells from visitors can cause them to avoid or change their activity periods. If this is too often they will move out of the area. Since the course of the seasonal streams around the marsh is crucial to most mammal species, the trail system around the marsh should be led by a guide in order to prevent tourists leaving the designated paths and be limited to only three tours per day, during 0800 to 1800 hrs. The number of tourist should not be more than 5 per time.

There was not enough information about the feeding area of White-Handed Gibbon and only voices were heard during my study, so more research is needed. Even if it is an endangered species, it should be a high potential species for ecotourism. In

Tham Lod Forest Park, a recreation area in Mae Hong Son Province, there are two gibbons around the headquarters that became habituated to humans and tourists are interested in them.

During an observation in August, two traps were found near the hot spring. Ecotourism can help eliminate this problem. As with the birds, ecotourism should create an incentive for conserving mammals and result in a decrease or discontinuation in traditional hunting.

Plants

The deciduous hardwood + bamboo forest is commonly seen in Mae Hong Son and in northern regions. Impacts will come from trampling, especially when tourists leaving the designated paths at the marsh and hot spring. Ground flora and understorey trees could be destroyed, resulting in disruption of natural process.

Flower collection by tourists will deplete natural attractions and also disturb natural process. Flowers along the trail such as *Globba kerrii* Craib (Zingiberaceae) and *Begonia integrifolia* Dalz. (Begoniaceae) have a high risk from collection because they are colorful and easy to collect.

Another impact is the introduction of exotic plants. Exotic species may compete with indigenous species and can change species composition. Some species can obstruct germination of climax species such as *Tectona grandis* L. f. (Verbenaceae) and *Xylia xylocarpa* (Roxb.) Taub. var. *kerrii* (Craib & Hutch.) Niels. (Leguminosae, Mimosoideae), which results in obstruction of forest regeneration. Tourists should be informed of these impacts by slides together with the information about the plants during registration at the headquarters.

HUMAN USE AND QUALITY OF LIFE VALUES

Population and education

There are 16 Christian families in Huai Nam Pong village and 69 people. They are ethnically Lahu, Thai-Yai, and Lua. There is no school in the village. Some children are learning in Mae Hong Son town and are supported by Christian organizations. At least 8 villagers can read and write Thai and one can speak Chinese. Nine villagers are learning Thai with a teacher who comes from Pang Ma Pha District every Sunday. This should indicate that some of them are active and interested in learning. An English language training program for ecotourism is possible there.

Land and chemicals use

The agricultural area of Huai Nam Pong Village is about 0.5 km^2, which is 0.031 km^2 per family. Expansion of the agricultural area is the responsibility of the village committee and forestry officers. There are forest plantation areas near the village. Before declaration of the plantation areas in 1985, the agricultural area of the village was larger. The area was divided into 2 parts: one for planting, while the other was kept follow for recovery of soil fertility and future use without the need of chemical fertilizers. Plantation areas are to be on fallow areas. The results are the present planting pattern and greater usage of agricultural chemicals.

Rice planting starts in August. Most villagers use the herbicide "Glyphosate" before planting. One month after planting, they use "Edifenphos", an organophosphorus ester fungicide. After harvesting in December, garlic and soybean are planted. The quantities of garlic and soybean depend on the budget of each family for chemical fertilizers and insecticides. Garlic needs more chemicals than soybean, but

its price is higher. If they have enough money, villagers will plant garlic. Both rice and garlic need "Methomyl", a carbamoyloxime insecticide. The use of "Methomyl" depends on the degree of plant damage by insects. These chemicals can cause negative impacts on humans, wild animals, and plants. Humans can absorb these chemicals from direct contact, water, edible plants, and fish. It can be transferred to wildlife through food chains. Residual chemicals in insects have a strong detrimental effect on birds, especially insectivores such as Drongos and Swallows. Swallows appear in this area around November, which is close to the time for insecticide spraying. These chemicals can accumulate in these birds and might change their reproductivity rates. Since, residual chemicals in rice affects rats, Fishing cat can also absorb these poisons by the food chain.

Collecting forest products

Fuel: Fuel wood is collected from the forest around the agriculture area for cooking. Villagers usually collect fuel wood before going back from the paddy fields. *Xylia xylocarpa* (Roxb.) Taub. var. *kerrii* (Craib & Hutch.) Niels. (Leguminosae, Mimosoideae) and *Lagerstroemia venusta* Wall. *ex* Cl. (Lythraceae) are usually collected. The consumption of fuel wood is about 6 kilograms / family / day.

Insects: In April there are a lot of cicadas (*Homoptera)* which appear along the stream, canals, and other moist areas, and will disappear after the first rain at the end of April. The villagers collect cicadas for food. The study area has more of these insects than at other areas nearby. The villagers will set bamboo poles along the river and paint

these poles with a sticky rice powder solution. Cicadas will perch on these poles and their wings will get stuck (Figure 15).

Figure 15. Villagers collecting cicadas along the stream, April 1999.

Fish: Huai Pong Saen Pig Stream is the main supply of fish for Huai Nam Pong and nearby villages. Villagers use normal fishing equipment, such as rods and nets. Most of the fish caught are cooked for family consumption. No one engages in fishing activities as a main source of income. The fish generally caught are listed in Table 13.

Table 13. Fish species collected Huai Pong Saen Pig River.

local name	Thai name	English name	scientific name
pla pok	pla kaem cham	Red-cheek Barb	*Puntius orphoides*
pla kaew	pla kra ting	Armed Spiny eel	*Mastacembelus armatus armatus*
pla mood	pla kang	Red-tailed Snakehead	*Channa gachua*
pla fire	pla ta pien trai	Golden Little Barb	*Puntius stolickae*
pla hake	pla siew kwai	none	*Rasbora lateristriata lateristriata*
pla moong	pla jaad	none	*Tor stracheyi*

Note: All fish were identified by Mr. Satit Somboonchai and Ms. Tippawan Wachasast from the Fresh Water Fisheries Development Center, Mae Joe, Chiang Mai.

Edible plants: There are some edible plants which are usually collected around the village and the paddy fields, in the forest, and along the stream as shown in Table 14. The edible plants are use for family consumption and to feed pigs. All plants were collected by Mr. Sange and Mrs. Jeng Pipagsa and identified by Mr. James f. Maxwell (scientific names), and Mrs. Saijai F. Maxwell and Mr. Jakr Kineesee (Thai names) on 6 August 1999.

Infrastructure

Water consumption: There is an irrigation canal that brings water from Huai Pong Saen Pig River to the rice fields. There is enough water for all rice fields in the rainy season. In the dry season there is not enough water for all fields with soybean and

garlic at the same time, therefore only one family is allowed to open the canal to bring water into fields at each time. This takes about two or three days per family.

A PVC pipeline about 500 meters long with a diameter 3.2 centimeters supplies drinking water for the village. It is connected to a natural reservoir with a 6 meters high waterfall. The reservoir is about 6 x 6 meters wide and 20 centimeters deep. The water is clear and the villagers usually boil it before drinking. There is enough water even in the dry season, but this water could not support large groups of visitors. If the reservoir in the village, which is leaky, is repaired then it could supply enough water for tourists.

Garbage management: Garbage is burnt in a hole in the middle of the village. The villagers may burn or bury the garbage where they like. Some cans, bottles, and plastic bags also appear around the village. The villagers never separate garbage such as cans and bottles since they have no means to get reusable items to the market.

Public health

During the study period, one villager and one forestry official contracted malaria. Talks with the local people show that a few local people are sick with malaria every year, especially in the hot and rainy seasons (around April to August). Malaria might have a serious impact on tourists by keeping them away and preventing the development of ecotourism. Mosquito vectors need urgent control. The officers of the Malaria Protection Center of Pang Ma Pha District usually come to the village to check and give some medicines to the villagers who have contracted malaria. They could also help to control the disease and suggest protection measures for tourists.

Table 14. Edible plants around Huai Nam Pong Village, observed on 6 August 1999.

No	botanical name (family)	Thai name (local name)
1	*Acacia megaladena* Desv. var. *indo-chinensis* I. Neils. (Leguminosae, Mimosoideae)	cha ohm, pak la
2	*Adenia viridiflora* Craib (Passifloraceae)	pak khao (o-la)
3	*Amaranthus spinosus* L. (Amaranthaceae)	pak khom nam (pak kom)
4	*Bidens pilosa* L. var. *minor* (Bl.) Sherff (Compositae)	pak kim
5	*Colocasia esculenta* (L.) Schott (Araceae)	bawn
6	*Commelina diffusa* Burm. f. (Commelinaceae)	pak prab (pak kab)
7	*Conyza sumatrensis* (Retz.) Walk. (Compositae)	pian wo
8	*Crassocephalum crepidioides* (Bth.) S. Moore (Compositae)	pak mhu tui (pak ya ngok)
9	*Dioscorea alata* L. (Dioscoreaceae)	mun liam(mun cruai)
10	*Diplazium esculentum* (Retz.) Sw. (Athyriaceae)	pak goot
11	*Diplocyclos palmatus* (L.) C. Jeff. (Cucurbitaceae)	teang pa (pak buap)
12	*Ficus racemosa* L. var. *racemosa* (Moraceae)	ma duai pong (pak huaid)
13	*Ipomoea aquatica* Forsk. (Convolvulaceae)	pak bung
14	*Marsilea crenata* Presl (Marsileaceae)	pak wahn
15	*Momordica charantia* L. (Cucurbitaceae)	ma ra pa
16	*Operculina turpethum* (L.) S. Manso (Convolvulaceae)	pak bung liam (mun help)
17	*Oroxylum indicum* (L.) Kurz (Bignoniaceae)	lin pha, pe-ga (lin chang)
18	*Parabaena sagittata* Miers *ex* Hk. f. & Th. (Menispermaceae)	pak nang
19	*Piper sylvaticum* Roxb. (Piperaceae)	pak pu ling pa
20	*Solanum nigrum* L. (Solanaceae)	pak pi
21	*Spilanthes paniculata* Wall. *ex* DC. (Compositae)	pak pade laung (pak pade)
22	*Thladiantha cordifolia* (Bl.) Cogn. (Cucurbitaceae)	buap bah (pang yang)

Attitude of villagers towards tourism

After discussions with the Huai Nam Pong village committee about their attitudes to tourism, the answers to some questions were clear while some were not. This is due to two reasons. First, these discussions about tourism were only general. I could not force them to answer the questions that they seemed difficult to make a decision on. Second, they are not familiar with tourism, therefore they did not understand the problems. In turn, they did not think that the questions I asked were problems for them.

The first topic discussed on tourism at an informal meeting was about their opinions about ecotourism development in the area. All of them agreed that this was good. The villagers are interested in welcoming new, alternative sources of income, and have expressed an interest in ecotourism. They know that tourism could generate income, but how is not clear to them. Nowadays tourism generates only small profits on snacks and drinks there. They have pride in showing visitors the natural resources in the area, especially the bird communities at the marsh. They said that they have conserved these resources before the sanctuary was declared and they were the only village that favoured the sanctuary. This indicates that they are ready to join with conservation activities such as ecotourism.

Some questions were about the way to manage tourism in order to reduce any possible impact on natural resources. They said that tourists should not be allowed to go into the marsh. Tourists should come to the village before going to the marsh and hot spring. The villagers only want to know about the visitor's purposes and can easily guide Thai visitors. They have a problem about communication with foreigners. I suggested to them about information written in English and they agreed with me. I also

asked them about learning English, but they just laughed. They were not confident that they could learn.

There was no conclusion about the carrying capacity of the area. They only know that the number of visitor should be limited. They didn't think that large groups of tourist could make any problems for them, but may effect the trails, birds, and other wild animals there.

Since the numbers of tourists visiting the area is low, the villagers could not discuss about the undesirable activities of tourists. I had to give them examples of these problems. Displaying some western culture, such as wearing no shirt, especially for women, and kissing in public areas are unsuitable activities. Whenever tourists display these habits, they have to be informed. Drinking in the village is acceptable, but arguing is forbidden. Going to private areas without asking permission and leaving garbage are not serious problems for them. They are happy when visitors come. Music playing and camping with entertainment are welcome.

Since all villagers are Christian, most festivals revolve around church activities. Festivals concerned with their living, at which guests are welcome, include the new rice festival and rice seed praying. They don't think that the number of tourists visiting the festivals should be limited. The new rice festival is in November when the first paddy fields are harvested. Before detrimental Christian influences, all villagers believed in ghosts. Before harvesting, some new rice had to be sent to the ghosts in the celebration. Nowadays the purpose of this celebration has been changed to be a part of their religion. Prayers for rice seed are in July, before planting. Likewise, at the new rice festival, they believed that there was a ghost who could yield plentiful paddy yields. They had to appease that ghost before planting rice.

They have little experience of providing accommodation or food for tourists. They have no agreed price for staying overnight. Some of them said that it depends on the tourists' generosity.

Women are interested in cooking and washing clothes, while only men showed their availability to be guides. When I asked for guides, only men responded. They said that they would guide tourists, if they had enough time. In fact, they are not sure that they can guide and what should be seen. In my opinion, they never thought that it could generate money.

Attitude of tourists towards potential ecotourism

Answer choices in questionnaire for each topic (natural resources, activities, and facilities), which consist of five degrees of interest (Appendix E), can be grouped into 3 categories *viz.* interested, no opinion, and no interest (Wongratana, 1984). After significance testing by the SPSS program, the results indicated that for questions on natural resources and activities there was significant difference between interest and no interest (Table 15). This means that the percentage of occurrences between interest and no interest was statistically distinct. More than 80 % of respondents were interested in wild flowers, the trail to Huai Kan Cave, tracks and signs of wildlife, birds, hot spring, and river, while only 68.63 % and 58.83 % of respondents were interested in the difficult trail and rice fields. From talking with some respondents, some percentages of no opinion came from not seeing the site. Some of them said that the interest is not only in the resources, but is a combination of several factors such as accessibility and facilities. There were some comments on the question of interest of wild flowers which has no information about species and diversity. This may not indicate the real interest of

respondents. Because of this survey, it can be concluded that all respondents preferred the natural resources there, especially the bird community.

There is a significant difference between interest and no interest for questions on activities. Trekking and visiting local festivals were the most popular responses (more than 90 %) while collecting food products and bird watching are minor (76.47 and 70.59 %, respectively). Camping and staying with the hilltribe people had the least interest with only 58.82 and 62.75 % of respondents preferring these. From these results, it can be concluded that trekking and visiting festivals are the main activities that should be managed and promoted. This is true from the perspective that most respondents prefer trekking and viewing nature. The overall scenery of the site is commonly seen in Mae Hong Son Province. Like the scenery, local festivals are also common because the present culture there has been degraded by Christianity and has become less authentic. Therefore, if promotion is emphasized on trekking and local festivals, it may lead to a loss of interest. Since the bird community is the most interesting resource, ecotourism in this area should emphasize bird watching with an additional support for promoting some other activities.

There was no significant difference between important and unimportant responses in convenient roads, bus service to the site, lodges, and restaurants (Table 15). The importance of these factors in ecotourism is not clear, because there are two comments about these facilities. Therefore, the improvement of these facilities should be done moderately. The road to the site should be improved for all weather conditions with adequate drainage (to minimize soil erosion), and easy access.

During the study several buildings at the sanctuary headquarters were completed and the old office was abandoned. There are 6 houses, 2 outside toilets, and 1 kitchen.

This could be a solution for providing accommodations. The old office should be repaired by use of local materials such as bamboo and be owned by the villagers. Local people should have a sense of ownership in projects through local investment. This is one of the functions of local participation (Brandon, 1993). Since providing tourist services in protected areas by the government can have many disadvantages (Elliott, 1997), tourists should be serviced by the villagers. These services include cooking, cleaning, accommodation, and clothes washing.

The need for local guides is great since more than 90 % of the people surveyed indicated this, while electricity and souvenir shops are not desired (Table 15). Local guides should be the first priority for ecotourism improvement. In combination with the interesting activities mentioned above, the training of local guides should include bird watching, trekking, visiting local festivals, and collecting food products. The scope of training should cover the information about physical and ecological characteristics as mentioned in the part about ecotourism resources. English could also be included in the training.

As with the statistical test of interest, the significance between Thais and foreigners was also tested (Table 16). The results indicate that there was no significant difference between Thais and foreigners on all natural resource questions.

There is a significant difference in interest in bird watching between Thais and foreigners (Table 16). Most of the Thais prefer bird watching, while only half of the foreigners liked this. This indicates that if ecotourism in this area emphasizes bird watching, it should be mainly to attract Thai tourists. The promotion of ecotourism should be directed to special interest groups and not general groups (Brockelman and Dearden, 1990).

Table 15. Results of the questionnaires and their statistical tests between interest and no interest from 51 respondents.

questions	occurrence (%)			significance[1]
	interest	no opinion	no interest	
natural resources				
seeing 600 birds at a small marsh and 70 bird species along a 1.5 km trail	96.08	3.92	0	**
walking on a difficult trail (high effort needed) to a 6 meters high waterfall which is the drinking water reservoir of a village	68.63 a	15.69	15.68 b	*
walking on a wilderness trail, 5 km, to Haui Kan Cave, the outlet of a river	84.32 a	5.88	9.80 b	*
seeing tracks and signs of wildlife (civet, fishing cat, mole, barking deer, gibbon's voice)	90.20	9.80	0	**
seeing wild flowers	98.04	1.96	0	**
seeing rice fields	58.83 a	27.45	13.72 b	*
visiting a small hot spring	82.36 a	11.76	5.88 b	*
visiting a river	100	0	0	**
activities				
watching birds	70.59 a	17.65	11.76 b	*
tent camping	58.82 a	15.69	25.49 b	*
trekking and viewing nature	94.12 a	1.96	3.92 b	*

Table 15. (continued)

questions	occurrence (%) interest	no opinion	no interest	significance[1]
activities				
home stay with hilltribe people	62.75 a	11.76	25.49 b	*
collecting vegetable/fish/insects with the villagers for food	76.47 a	13.73	9.80 b	*
visiting local festivals	92.16 a	3.92	3.92 b	*
facilities				
comfortable road	56.86 a	7.84	35.30 a	NS
bus service to the site	45.10 a	15.69	39.21 a	NS
local guide	90.20 a	5.88	3.92 b	*
electricity	23.53 a	11.77	64.70 b	*
comfortable lodge	45.10 a	11.77	43.13 a	NS
souvenir shop	21.57 a	11.77	66.66 b	*
restaurant	41.18 a	17.64	41.18 a	NS

[1] * = There is a significant difference between interest and no interest at probability (P) < 0.01

NS = There is no significant difference between interest and no interest.

** = It is absolutely different, test abandoned.

Table 16. Results of the questionnaires and the statistical test of interest answers between Thai and foreigners from 51 respondents.

questions	occurrence (%)						
	foreigners, n = 28 (100 %)			Thai, n = 23 (100%)			
	interest	no opinion	no interest	interest	no opinion	no interest	significance[1]
natural resources							
seeing 600 birds at a small marsh and 70 bird species along a 1.5 km trail	92.86 a	7.14	0	100 a	0	0	NS
walking on a difficult trail (high effort needed) to a 6 meters high waterfall which is the drinking water reservoir of a village	89.29 a	10.71	0	43.47 a	21.74	34.79	NS
walking on a wilderness trail, 5 km, to Haui Kan Cave, the outlet of a river	96.43 a	3.57	0	69.56 a	8.70	21.74	NS
seeing tracks and signs of wildlife	92.86 a	7.14	0	86.96 a	13.04	0.00	NS
seeing wild flowers	96.43 a	3.57	0	100 a	0	0	NS
seeing rice fields	67.86 a	25.00	7.14	47.83 a	30.43	21.74	NS
visiting a small hot spring	78.57 a	17.86	3.57	86.96 a	4.34	8.70	NS
visiting a river	100 a	0	0	100 a	0	0	NS
watching birds	50.00 a	28.57	21.43	95.64 b	4.34	0	*
tent camping	53.57 a	21.43	25.00	65.22 a	8.70	26.08	NS

Table 16. (continued)

questions	occurrence (%)						
	foreigners, n = 28 (100 %)			Thai, n = 23 (100%)			
	interest	no opinion	no interest	Interest	no opinion	no interest	significance[1]
activities							
trekking and viewing nature	89.29 a	3.57	7.14	100 a	0	0	NS
home stay with hilltribe people	82.15 a	10.71	7.14	39.13 a	13.04	47.83	NS
collecting vegetable/fish/insects with the villagers for food	71.43 a	25.00	3.57	82.61 a	0	17.39	NS
visiting local festivals	85.72 a	7.14	7.14	100 a	0	0	NS
facilities							
comfortable road	42.86 a	3.57	53.57	73.92 a	13.04	13.04	NS
bus service to the site	35.71 a	14.29	50.00	56.53 a	17.39	26.08	NS
local guide	92.86 a	3.57	3.57	86.96 a	8.70	4.34	NS
electricity	28.57 a	17.86	53.57	13.04 a	4.34	82.62	NS
comfortable lodge	39.28 a	14.29	46.43	52.17 a	8.70	39.13	NS
souvenir shop	10.71 a	10.71	78.58	34.79 a	13.04	52.17	NS
restaurant	35.72 a	25.00	39.28	47.83 a	8.70	43.47	NS

[1] * = There is a significant difference between Thais and foreigners at probability (P) < 0.01

NS = There is no significant difference between Thais and foreigners.

Two factors which indicate that the study area would be a suitable location for ecotourism. First, all respondents are interested in diverse natural resources there. Second, it would have special groups interested in promoting special activities, especially bird watching.

Possible impacts of ecotourism

Consumption of firewood by tourists could cause depletion of wood resources, especially when ecotourism is expanded. It could result in habitat degradation, vegetation loss, and interference with energy flows. The fundamental mitigation measure in this area is to restrict camping to certain areas and charge user fees.

Litter might be a significant problem in the future. It could make the area become less aesthetic and wild animals might swallow plastic bags. Villagers should provide disposal bins within the village, along with collection services. Recycling of some garbage such as cans and bottles should be done and sold in Pang Ma Pha District, while plastic bags could be buried. Landfill for garbage disposal could produce habitats favourable to some species such as rats. This might lead to a change in wildlife communities. The villagers should observe this change and report to the committee in order to control any changes. The number of rats and the amount of acceptable change in the condition of the area should be done by scientists (Dearden, 1997).

Since the trail passes through the village, tourists should contact the villagers before going to the area. Fees charged could be collected and returned to a community fund to improve facilities, such as repairing the trails, observation points, markers, and signboards. Along with the fees charged, tourists should be provided with trail maps and information about birds, mammals, and plants. This information could be provided

by posters, booklets, and checklists. A small visitor center (or large, according to budget and number of visitors) could be constructed at the village by use of local materials. A toilet should be installed there.

Ecotourism could generate additional income through providing services, *viz.* cooking, providing accommodations, and washing clothes. The cost of each service should be fixed. The benefits should be rotated among the villagers who want to join this activity. Some money should go to a community fund for further improvements. The villagers are not ready to be guides since they have no confidence. They need training about interpretive skills and in English. This should be done slowly until some of them can guide visitors. The Tourism Authority of Thailand should design and set up these training courses. Non-government organizations should help the villagers to manage benefits and a community fund.

The additional income could substitute the loss of income as a result of the government's decision to put most of the land around the village under wildlife sanctuary status. This could prevent expansion of agriculture areas. Ecotourism could help demonstrate to the villagers the economic importance of protecting nature that would conserve habitats (Dearden, 1997), which are the objectives of the wildlife sanctuary. Another benefit of ecotourism is development of an appreciation and pride in natural resources by the villagers (Kusler, 1990). This benefit might prevent land ownership changes.

While ecotourism can generate income, it can cause occupational changes. These changes are negative impacts and could lead to further changes in the lives of local people. Since tourism is unpredictable, money generated from ecotourism would be a minor source of income. At least they should have enough time for planting rice.

Building of guest houses within the village should not be permitted because it would lead to over investment by individuals or the community.

It is all right to make use of culture or festivals to attract tourists, but the original meaning of the festivals should be maintained. Too mush emphasis placed on commercial benefits might lead to loss of interest in culture (TAT, 1993). The committee should monitor this. Members of the committee have to assess possible changes of the festival purposes and if necessity the number of tourists visiting the festivals should be limited.

SUMMARY OF IMPORTANT IMPACTS AND THEIR MANAGEMENT

Since ecotourism is to promote responsible travel that conserves the natural environment and sustains the well being of local people, all possible impacts mentioned above should be told to tourists during their registration at the headquarters.

In practice, the carrying capacity of the area is not so easy to determine because the local people do not have the power to control the number of tourists. It should be controlled by the wildlife sanctuary. The carrying capacity of the area should be flexible considering by the limits of acceptable change (Dearden, 1997). For example, the carrying capacity of the trail around the marsh that was suggested at three groups of 5 tourists per day could be changed if unacceptable limits of negative impact are reached. The limits of acceptable change of the trail could be done in two main steps (Wallace, 1993). The first step is to select indicators that should be directly related to the activities of visitors. Since walking on the trails around the marsh could disturb four dominant bird species, these birds should be indicators. The second step is to establish standards for each indicator and set limits of acceptable change. The number of the four

dominant bird species could be used for setting the acceptable limit. It might be acceptable if their numbers decrease no more than 20%.

A summary of the major impacts of this ecotourism project is given in Table 17, together with the recommended mitigation measures. The first major impacts are soil and water quality. Details of the mitigation measures are mentioned in the part about physical resources. The sanctuary should build a bridge across the river in front of the office. The road should be improved by the local government of Na Pu Pom District, because it is the main road (outside the wildlife sanctuary) to the district and Huai Nam Pong Village is in the district.

Birds receive much direct impact from ecotourism since bird watching is the highlighted activity. The shelter and tower could help ecotourists enjoy bird watching with minimum impact. Since mammals avoid heavily traveled areas, uncontrolled tourism can result in the mammals moving out of the area. A zoning system should prevent this.

Since fuel wood is a basic need of the village, collection of firewood by campers might effect that need. Fees charged and restriction of camping to a certain area should limit fuelwood consumption by tourists. Other energy sources such as power lines and solar cells are not recommended now, because the costs of both sources are high and from the results of questionnaires indicate that this demand by tourists is low. In the future when energy demands increase, solar cells are better than power lines. Power lines produce a negative visual impact as well as detrimental impacts associated with vegetation loss where pylons are erected or cables are buried (Roe *et al.*, 1997).

The risk of occupational change is a possible impact which can lead to over investment in tourism-related business, land encroachment, deterioration of the area,

and finally to disrupting the lives of the local people. It should be clear that ecotourism is only an additional or minor source of income. Tourism committees should be active in assignment of ecotourism components such as local guides, services, and construction of new lodges. The villagers should have enough time to plant rice. They should not engage in guiding, tourist services, and providing accommodations as their main source of income because the tourism industry is unpredictable (Sukphisit, 1999). The number of tourists should be limited to prevent the villagers engaging in tourism as their main source of income.

Table 17. Summary of some important impacts of ecotourism and their mitigation measures.

resource	impact	mitigation
physical	soil erosion and water pollution caused by vehicles	repairing the road making a bridge across Nam Khong River
biological	disturbances of birds and mammals	preparation of a zoning plan building a shelter and tower at the bird observation points monitoring of mammal and bird communities
human use and quality of life values	depletion of wood resources	fees charged preparation of zoning
	Occupational changes	tourism committee

CONCLUSIONS AND RECOMMENDATIONS

The suitability of the area for ecotourism development is based on three aspects, *viz.* natural resources, local communities, and tourists. At present, the impact on natural resources from ecotourism development at Sunpundan Wildlife Sanctuary is relatively low. The most important impact is on the birds and mammals. Ecotourism could disturb these animals and may result in their moving out of the area. Because there are no endemic or rare species that need specific protection in the area, ecotourism can be introduced to the area without serious impact on species or habitats as long as it is properly planned and controlled.

With proper planning, ecotourism can encourage conservation awareness of visitors and locals, increase biodiversity knowledge, and support conservation activities. It can generate income for local people and provide incentives for conserving nature, which is an objective of the wildlife sanctuary. It can also stop an illegal hunting in the area. Loss of income due to establishing the sanctuary and land requirements for future generations are significant problems in the area, and could be assisted by ecotourism.

The Huai Nam Pong village is suitable for ecotourism for three reasons:

1. The villagers have a long history of living within the area and are particularly active in conservation. This is evident from the natural resources there that still exist, especially the bird communities.

2. They have a mostly subsistence-based economy and are interested in welcoming alternative sources of income *e.g.* tourism. They are willing to accept tourists.
3. Discussions with the villagers have resulted in approval for the concept of ecotourism.

The results from questionnaires indicate that the area has diverse natural resources, which most tourists come to Mae Hong Son Province are interested in. If bird watching is promoted as a main activity in the area, it could attract some special interest groups, especially Thai tourists. Another activity that could be promoted is trekking on a wilderness trail to Huai Kan Cave. It should be developed for locally guided tours.

Even if ecotourism is not developed, there will still be some tourists visiting the area, so some environmental impacts continue. The magnitude of impacts on natural resources may be low due to a small number of tourists. When the number of tourists increases, there would be no time to prepare proper plans and this will lead to greater threats and disruption of natural resources. Without ecotourism development, local people will not be involved in ecotourism planning, development, and management. Significant opportunities to bring money into the sanctuary and to provide employment for local people would be missed. Another lost opportunity is the education of visitors and also their conservative role, since tourists experiencing nature directly are more apt to become involved in conservation if they are informed about the issues (Boo, 1991).

Zoning

The study area should be divided into 4 zones (Figure 16).

Zone A is a restricted area that should be forbidden to enter. The area is located at the hot spring and marsh. The area surrounding the marsh that could disturb the lives of the four dominant bird species is included.

Zone B is the area that tourists can walk along the pathway to see animal tracks and plants with the local guides during the day. Signboards of tracks and species should be made along the trail. Since baiting would attract wildlife to smell or even eat (Srigosamatr, 1999), a small station should be built along this trail. Tracks of the animals at the station could indicate population fluctuations. This station could be part of ecotourism activities in this zone. Tourists can join monitoring programs by assessing the presence of mammal tracks in comparison with data provided or with previous visits if tourists come back. The number of tourists is limited to three groups with five people per day.

Zone C is a self-guided area. Tourists can walk by themselves to enjoy birds, plants, insects, and to view nature. This area includes the observation points at which tourists can watch the birds at the marsh. The hot water outlet is included in this area. The number of tourists is limited to 20 people per day.

Zone D is an intensive use zone where relatively high concentrations of visitors are expected. This area is at the temporary office of the sanctuary. It includes

campgrounds and accommodations. The number of tourists is limited to 20 people per day.

Tourism committee

To maintain stable biodiversity, the partnerships between the wildlife sanctuary, locals, and the tour industry are important for ecotourism. Since sustainable tourism should rely on management by local people (RECOFT, 1996: Whelan, 1991), a tourism committee, which consists of several sections, has an important role in ecotourism projects. The committee should regulate ecotourism activities, assessment of possible impacts on natural resources and culture, and managing income.

The tourism committee should consist of 40% of villagers in order to encourage local participation and 60% of non-government organizations, tourism agencies, and officials of Mae Hong Son Province and Sunpundan Wildlife Sanctuary.

Possible impacts in the future may be monitored by tourists. Tourists could participate in the monitoring by informing the tourism committee about the resources, such as birds seen. They might compare this with the data provided at the information center or from previous visiting. The committee should summarize and discuss these comments. By having a meeting every two years, tourists who visited the area should be invited to join also. This would allow the public to participate.

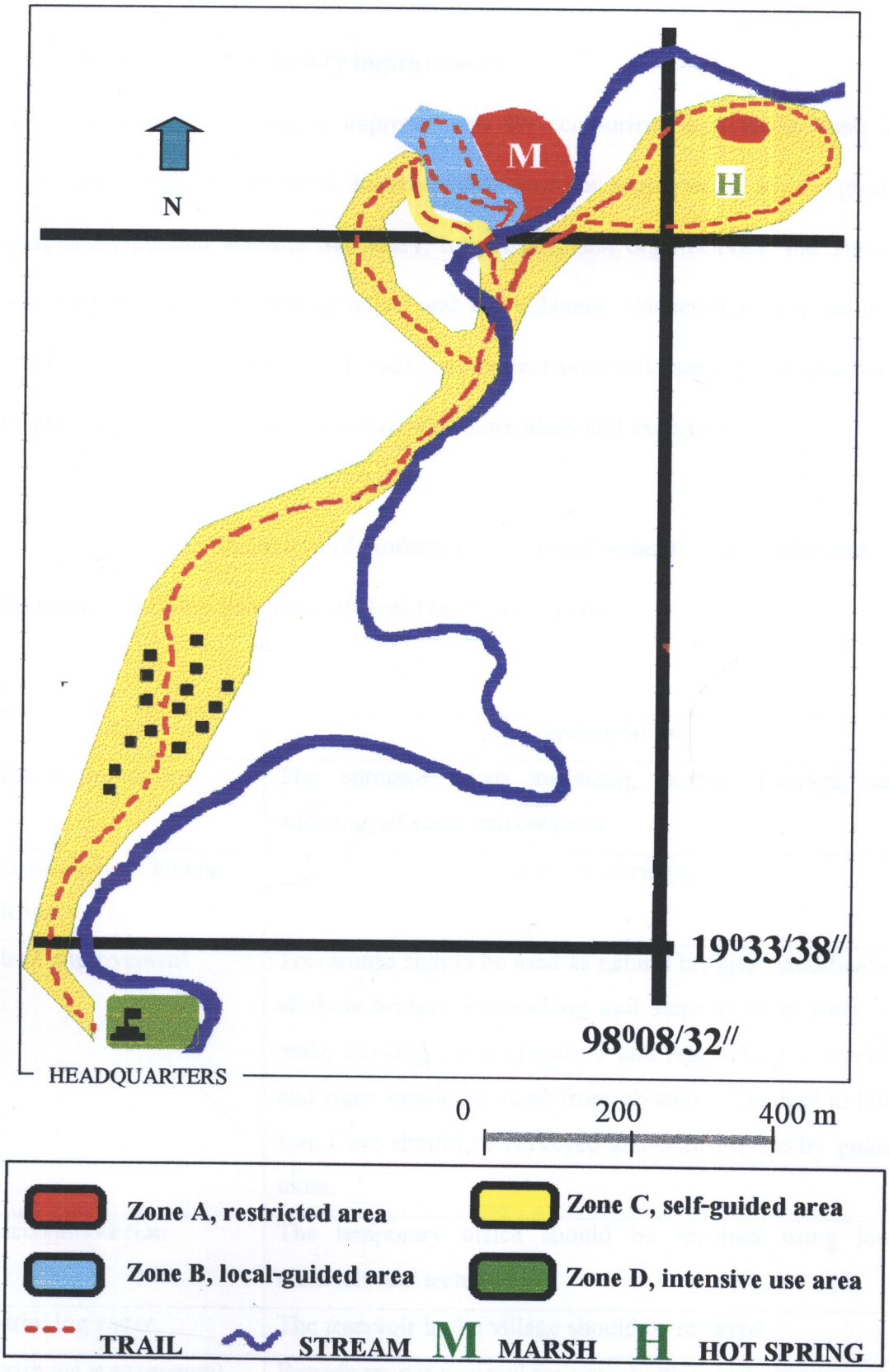


Figure 16. Proposed zoning map of the study area.

Summary of the facility improvements

A summary of facility improvements for ecotourism is given in Table 18, together with recommendations. Improvements could be supported by several groups, such as Sunpundan Wildlife Sanctuary, non-government organizations, the Tourism Authority of Thailand, tour agencies, and the villagers. Cooperation between these groups is probably the best way to make the project successful since development can be planned, monitored, and controlled with more ideas and expertise.

Table 18. Summary of infrastructure improvements for ecotourism in Sunpundan Wildlife Sanctuary at Huai Nam Pong Village.

item	recommendation
road improvement	The entrance needs surfacing, proper drainage, and widening of some narrow parts.
crossing Nam Khong River	Construct a bridge.
trail improvement	Tree trunks should be used as natural bridges. Modification of these bridges and making trail steps at steep parts can make trekking easier (Figure 9 and Appendix B). Markers and signs should be made from plywood. The trail to Huai Kan Cave should be surveyed and used for locally guided tours.
accommodation	The temporary office should be repaired using local materials and techniques.
drinking water	The reservoir in the village should be repaired.
garbage management	Provide proper disposal for cans, bottles, and plastics.

Table 18. (continued)

item	recommendation
observation shelter	Design of buildings should utilize local construction techniques and materials (Figure 14).
hide tower	A civil engineer should be involved in design and construction (Figure 14).
interpretive information	Signboards, booklets, and checklists should be provided, with soil, water, bird, mammal, and vegetation data. Visitor centers could be built at the village and/or the headquarters.
local guides	Training programs for interpretive skills should be provided together with providing self confidence for the villagers.

Recommended plan

The TAT should promote ecotourism in this area by advertising bird watching as the main activity in this area and ask tour companies in Mae Hong Son Province for their cooperation. Tour company is an important component of ecotourism to bring tourists to the site.

Since the best time to watch the birds in this area is in the morning, tourists should stay overnight at the accommodations, or camp at campground areas and enjoy bird watching the next morning. Other activities, such as trekking to Huai Kan Cave, visiting festivals, and collecting food products could be minor attraction to the area. Local guide training is necessary and should be done by the TAT. According to these activities, the carrying capacity of local people to service tourists should be developed by the tourism committee by two concepts. First, it should not distort the original

meaning of the festivals. Second, the villagers should not engage ecotourism as their main source of income. At least, they should have enough time for planting rice.

The villagers should run ecotourism in this area. Since wildlife sanctuaries can not charge fees from accommodation (Chatwiroon, 1999) and to encourage local investment, the villagers should provide accommodation within zone D (Figure 11). They should repair and improve the temporary office, instead of making new lodges. According to measure 38 of the Reservation and Protection of Wild Animal Law 1992, it is possible for villagers to own the accommodation if their purpose is to facilitate people in education or living and there is a permission from the Director of the Forestry Department (Chatwiroon, 1999). The TAT should ask for this permission. They should make a small restaurant in the village or at the campground area (zone D). These local investments should be run by the village, not by individuals.

The accommodation should be not more than 6 houses with 2-3 persons per house and cost about 50 baht / person for sleeping overnight. The villagers should also provide facilities in zone D, such as garbage disposal and cleaning. The opportunity to make income through providing services, such as washing clothes and guiding should be rotated among the villagers.

Income generated by the ecotourism would be distributed in three ways, *viz.* tour companies, villagers, and the Sunpundan Wildlife Sanctuary. First, it should make a profit for tour companies. Therefore, tour companies should return some

profits back to the area by donating 10 % of the tourist fees to a community fund. They could advertise to tourists how they are involved in conservation activities. Second, the villagers should receive benefits by selling things, providing services and accommodation, and fees charged. Fees charged should be 20 baht per person for entering the village (to the marsh or hot spring), 10 baht for camping, and 5 baht for 1 kilogram of fuelwood. Money generated by providing accommodation and fees charged should go to a community fund for conservation activities and facility improvements such as interpretive information, toilets, garbage disposals, and trail improvements, and 20 % of this money should be returned to the sanctuary for conservation activities. The representative of the sanctuary should report to the tourism committee how this money is spent.

The beginning and direct costs of ecotourism development in this area should be 25,000 baht for the constructions of a shelter and hide tower, 20,000 baht for improvement of the accommodations and accessories, 15,000 baht for providing interpretive information, and 10,000 baht for training of local people (Table 18). Total costs of this development should be not more than 70,000 baht.

In 1998, 204,734 tourists visited Mae Hong Son Province (TAT, 1999). If 0.5 % of these tourists came to the study area, income might be about 70,000 baht per year for entering and providing accommodations. So there are no profits from the first year of operation if costs of employment of the villagers to operate accommodations and fees charged are not included in the cost of operation, since the villagers should donate their time for providing these services. The villagers should get profits during

the second year of ecotourism operation. The money generated from entering the village and accommodation plus from selling things, washing clothes, and guides would be a minor source of income that can compensate the need of more land for future generations in this village. It can induce the villagers to conserve and use their natural resources in sustainable and profitable ways.

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APPENDICES

Appendix A. Questionnaires

1. How important are each of these attractions to you?

1- Very important
2- Important
3- No opinion
4- Unimportant
5- Very unimportant

	1	2	3	4	5
seeing 600 birds at a small marsh and 70 bird species on 1.5 km trail					
walking on a difficult trail (high effort needed) to a 6meters height waterfall which is the drinking water reservoir of a village					
walking on wilderness trail, 5 km, to Haui Kan Cave, the outlet of a river					
seeing tracks and signs of wildlife (civet, fishing cat, mole, barking deer, gibbon's voice)					
seeing wild flowers					
seeing rice fields					
visiting a small hot spring					
visiting a river					

2. How interesting are the following activities to you?

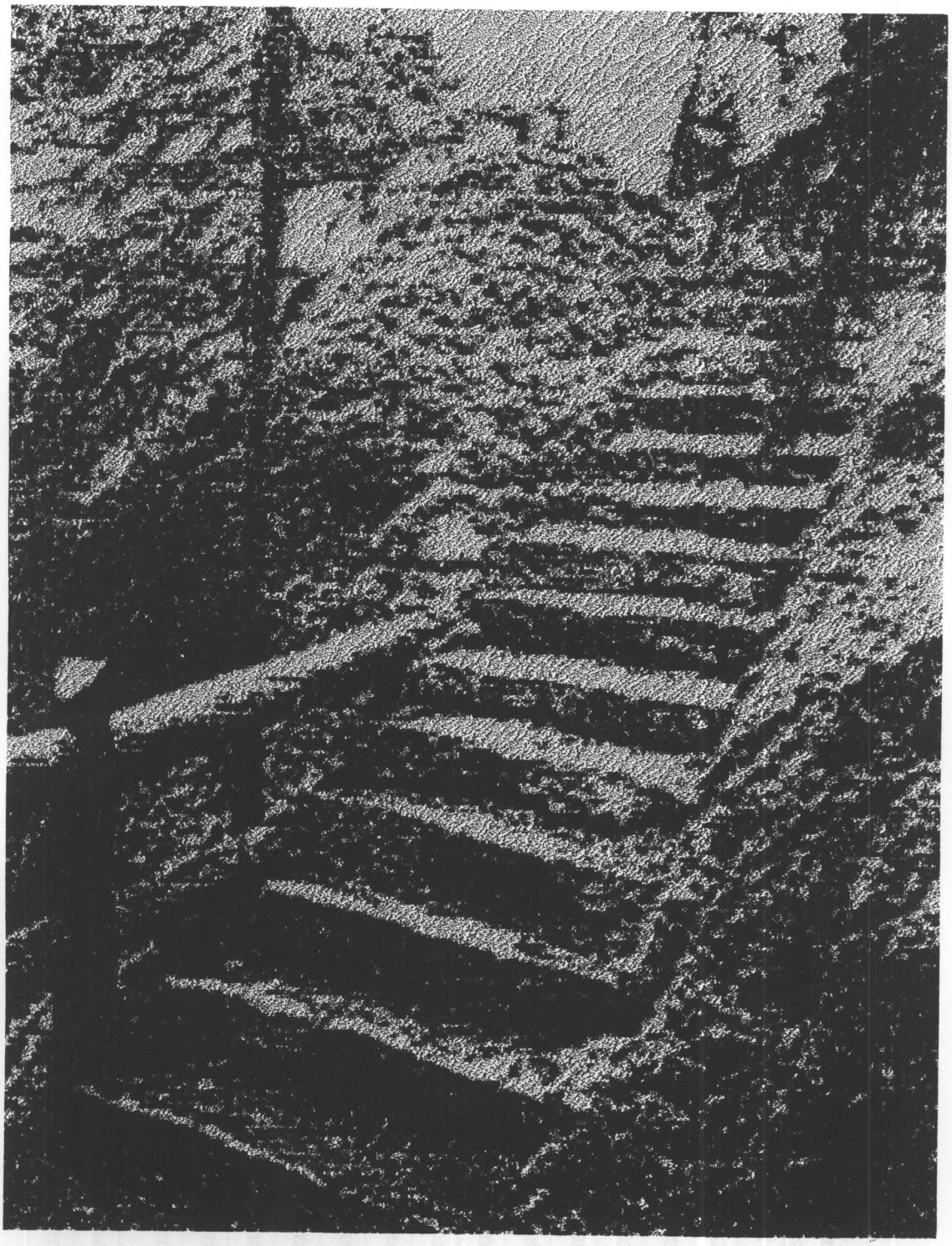
1- Very interesting
2- Interesting
3- No opinion
4- Uninteresting
5- Very uninteresting

	1	2	3	4	5
watching birds					
Tent camping					
Trekking and viewing nature					
Home stay with hilltribe people					
Collecting vegetable/fish/insect with the villagers for food					
Visiting local festivals					

3. How important are the following facilities to you to visit the destination mentioned above?

1- Very important
2- Important
3- No opinion
4- Unimportant
5- Very unimportant

	1	2	3	4	5
Comfortable road					
Bus service to the destination					
Local guide					
Electricity					
Comfortable lodge					
Souvenir shop					
Restaurant					



Appendix B. Example of trail steps and railing (USDI, 1938)

Appendix C. List of birds observed during November 1998 to April 1999.

No.	common name	scientific name	abundance[1] in northern Thailand	abundance[2] in the study area	habitat[3]
1	Ashy Drongo	*Dicrurus leucophaeus*	common	uncommon	T
2	Asian Palm-Swift	*Cypsiurus balasiensis*	very common	uncommon	T
3	Asian Paradise-flycatcher	*Terpsiphone paradisi*	fairy common	rare	M
4	Barred Buttonquail	*Turnix suscitator*	very common	rare	G
5	Black Baza	*Aviceda leuphotes*	uncommon	rare	T
6	Black Drongo	*Dicrurus macrocercus*	common	common	T
7	Black-backed Forktail	*Enicurus immaculatus*	uncommon	uncommon	G
8	Black-crested Bulbul	*Pycnonotus melanicterus*	very common	common	M
9	Black-headed Woodpecker	*Picus erythropygius*	uncommon	rare	T
10	Black-hooded Oriole	*Oriolus xanthornus*	common	common	T
11	Black-naped Monarch	*Hypothymis azurea*	very common	uncommon	M
12	Blue Magpie	*Urocissa erythrorhyncha*	uncommon	common	M
13	Blue Whistling Thrush	*Myiophoneus caeruleus*	common	rare	G
14	Blue-winged Leafbird	*Chloropsis cochinchinensis*	very common	uncommon	M
15	Bronzed Drongo	*Dicrurus aeneus*	common	rare	T
16	Chestnut-headed Bee-eater	*Merops leschenaulti*	common	common	M

Appendix C. (continued)

No.	common name	scientific name	abundance[1] in northern Thailand	abundance[2] in the study area	habitat[3]
17	Chinese Pond-Heron	*Ardeola bacchus*	very common[w]	common	G
18	Collared Falconet	*Microhierax caerulescens*	common	common	T
19	Common Flameback (Common Goldenback)	*Dinopium javanense*	common	common	T
20	Common Iora	*Aegithina Tiphia*	very common	rare	M
21	Common Tailorbird	*Orthotomus sutorius*	very common	common	M
22	Coppersmith Barbet	*Megalaima Haemacephala*	very common	uncommon	T
23	Crested Serpent-Eagle	*Spilornis cheela*	common	rare	T
24	Dark-necked Tailorbird	*Orthotomus atrogularis*	very common	uncommon	M
25	Dollarbird	*Eurystomus orientalis*	fairy common	common	M
26	Eurasian Jay	*Garrulus glandarius*	common	common	T
27	Golden-fronted Leafbird	*Chloropsis aurifrons*	very common	common	M
28	Great Barbet	*Megalaima virens*	common	common	T
29	Greater Coucal	*Centropus sinensis*	very common	common	G
30	Greater Flameback (Greater Goldenback)	*Chrysocolaptes lucidus*	common	uncommon	T
31	Greater Necklaced Laughingthrush	*Garrulax pectoralis*	fairy common	uncommon	G

Appendix C. (continued)

No.	common name	scientific name	abundance[1] in northern Thailand	abundance[2] in the study area	habitat[3]
32	Greater Racket-tailed Drongo	*Dicrurus paradiseus*	common	common	T
33	Greater Yellownape	*Picus flavinucha*	common	uncommon	T
34	Green-billed Malkoha	*Phaenicophaeus tristis*	very common	common	M
35	Grey Wagtail	*Motacilla cinerea*	very common[w]	uncommon	G
36	Grey-headed Parakeet	*Psittacula finschii*	uncommon	common	T
37	Grey-headed Woodpecker	*Picus canus*	uncommon	rare	T
38	Hair-crested Drongo(Spangled Drongo)	*Dicrurus hottentottus*	common	common	T
39	Hill Myna	*Gracula religiosa*	uncommon	common	T
40	Hoopoe	*Upupa epops*	common	uncommon	M
41	Indian Roller	*Coracias benghalensis*	very common	common	M
42	Large Cuckoo-shrike	*Coracina macei*	fairy common	uncommon	M
43	Lesser Racket-tailed Drongo	*Dicrurus remifer*	common	uncommon	T
44	Lesser Yellownape	*Picus chlorolophus*	common	uncommon	T
45	Lineated Barbet	*Megalaima lineata*	common	common	T
46	Little Cuckoo-Dove	*Macropytia ruficeps*	uncommon	rare	T
47	Little Heron	*Butorides striatus*	common[w]	uncommon	G
48	Mountain Imperial Pigeon	*Ducula badia*	common	common	T

Appendix C. (continued)

No.	common name	scientific name	abundance[1] in northern Thailand	abundance[2] in the study area	habitat[3]
49	Olive-backed Sunbird	*Nectarinia jugularis*	very common	uncommon	M
50	Oriental Magpie-Robin (Magpie Robin)	*Copsychus saularis*	very common	common	M
51	Oriental Pied Hornbill (Indian Pied Hornbill)	*Anthracoceros albirosris*	fairy common	rare	T
52	Oriental Turtle-Dove	*Streptopelia orientalis*	uncommon	uncommon	T
53	Pied Bushchat	*Saxicola caprata*	common	rare	G
54	Purple Sunbird	*Nectarinia asiatica*	common	rare	M
55	Red Junglefowl	*Gallus gallus*	common	common	G
56	Red-rumped Swallow	*Hirundo daurica*	common[w]	uncommon	T
57	Red-throated Flycatcher	*Ficedula parva*	very common[w]	common	M
58	Red-whiskered Bulbul	*Pycnonotus jocosus*	very common	common	M
59	Rufous-fronted Babbler	*Stachyris rufifrons*	very common	rare	M
60	Scaly-breasted Munia	*Lonchura punctulata*	very common	rare	G
61	Shikra	*Accipiter badius*	common	common	T
62	Slaty-backed Forktail	*Enicurus schistaceus*	common	rare	G
63	Sooty-headed Bulbul	*Pycnonotus aurigaster*	very common	common	M
64	Spotted Dove	*Streptopelia chinensis*	very common	common	T

Appendix C. (continued)

No.	common name	scientific name	abundance[1] in northern Thailand	abundance[2] in the study area	habitat[3]
65	Streak-eared Bulbul	*Pycnonotus plumosus*	very common	common	M
66	Streaked Spiderhunter	*Arachnothera magna*	common	common	M
67	Striped Tit-Babbler	*Macronous gularis*	very common	rare	M
68	Thick-billed Pigeon	*Treron curvirostra*	common	common	T
69	Thick-billed Warbler	*Acrocephalus aedon*	common[W]	uncommon	M
70	Vernal Hanging Parrot	*Loriculus vernalis*	common	common	T
71	White-breasted Waterhen	*Amaurornis phoenicurus*	very common	common	G
72	White-crested Laughingthrush	*Garrulax leuolophus*	common	common	M
73	White-rumped Munia	*Lonchura striata*	very common	uncommon	G
74	White-rumped Shama	*Copsychus malabaricus*	very common	uncommon	M
75	White-throated Kingfisher	*Halcyon smyrnensis*	very common	common	T
76	Yellow Wagtail	*Motacilla flava*	very common[W]	uncommon	G

[1] = Lekagul and Round (1991)

[2] 1 = rare or few records; 2 = uncommon; 3 = common

[3] T = top of trees; M = middle of trees; G = near or at ground level

[W] = winter visitor, according to Lekagul and Round (1991)

Appendix D. List of bird species at the point with highest species richness in February 1999.

No.	Common name	Species
1	Black-crested Bulbul	Pycnonotus melanicterus
2	Black-hooded Oriole	Oriolus xanthornus
3	Blue Magpie	Urocissa erythrorhyncha
4	Bronzed Drongo	Dicrurus aeneus
5	Chinese Pond-Heron	Ardeola bacchus
6	Collared Falconet	Microhierax caerulescens
7	Common Tailorbird	Orthotomus sutorius
8	Eurasian Jay	Garrulus glandarius
9	Golden-fronted Leafbird	Chloropsis aurifrons
10	Greater Coucal	Centropus sinensis
11	Greater Flameback (Greater Goldenback)	Chrysocolaptes lucidus
12	Greater Racket-tailed Drongo	Dicrurus paradiseus
13	Greater Yellownape	Picus flavinucha
14	Greater Yellownape	Picus flavinucha
15	Green-billed Malkoha	Phaenicophaeus tristis
16	Grey-headed Parakeet	Psittacula finschii
17	Hair-crested Drongo(Spangled Drongo)	Dicrurus hottentottus
18	Hill Myna	Gracula religiosa
19	Hoopoe	Upupa epops
20	Indian Roller	Coracias benghalensis
21	Large Cuckoo-shrike	Coracina macei
22	Lesser Racket-tailed Drongo	Dicrurus remifer
23	Lineated Barbet	Megalaima lineata
24	Mountain Imperial Pigeon	Ducula badia
25	Oriental Magpie-Robin (Magpie Robin)	Copsychus saularis
26	Oriental Pied Hornbill (Indian Pied Hornbill)	Anthracoceros albirosris
27	Red Junglefowl	Gallus gallus
28	Red-throated Flycatcher	Ficedula parva

Appendix D. (continued)

29	Shikra	Accipiter badius
30	Sooty-headed Bulbul	Pycnonotus aurigaster
31	Spotted Dove	Streptopelia chinensis
32	Thick-billed Pigeon	Treron curvirostra
33	Vernal Hanging Parrot	Loriculus vernalis
34	White-breasted Waterhen	Amaurornis phoenicurus
35	White-throated Kingfisher	Halcyon smyrnensis
36	Yellow Wagtail	Motacilla flava

Appendix E. List of birds observed in each month, from November 1998 to April 1999.

month	no.	common name	scientific name
November	1	Asian Palm-Swift	*Cypsiurus balasiensis*
	2	Black Drongo	*Dicrurus macrocercus*
	3	Black-crested Bulbul	*Pycnonotus melanicterus*
	4	Black-hooded Oriole	*Oriolus xanthornus*
	5	Blue Magpie	*Urocissa erythrorhyncha*
	6	Chestnut-headed Bee-eater	*Merops leschenaulti*
	7	Chinese Pond-Heron	*Ardeola bacchus*
	8	Collared Falconet	*Microhierax caerulescens*
	9	Common Flameback (Common Goldenback)	*Dinopium javanense*
	10	Common Tailorbird	*Orthotomus sutorius*
	11	Coppersmith Barbet	*Megalaima Haemacephala*
	12	Dark-necked Tailorbird	*Orthotomus atrogularis*
	13	Golden-fronted Leafbird	*Chloropsis aurifrons*
	14	Great Barbet	*Megalaima virens*
	15	Greater Coucal	*Centropus sinensis*
	16	Greater Flameback (Greater Goldenback)	*Chrysocolaptes lucidus*
	17	Greater Necklaced Laughingthrush	*Garrulax pectoralis*
	18	Greater Racket-tailed Drongo	*Dicrurus paradiseus*
	19	Green-billed Malkoha	*Phaenicophaeus tristis*
	20	Grey-headed Parakeet	*Psittacula finschii*
	21	Hair-crested Drongo(Spangled Drongo)	*Dicrurus hottentottus*
	22	Hill Myna	*Gracula religiosa*
	23	Indian Roller	*Coracias benghalensis*
	24	Lineated Barbet	*Megalaima lineata*
	25	Little Heron	*Butorides striatus*
	26	Mountain Imperial Pigeon	*Ducula badia*
	27	Olive-backed Sunbird	*Nectarinia jugularis*
	28	Red Junglefowl	*Gallus gallus*
	29	Red-throated Flycatcher	*Ficedula parva*
	30	Red-whiskered Bulbul	*Pycnonotus jocosus*
	31	Shikra	*Accipiter badius*
	32	Silver Pheasant	*Lophura nycthemera*
	33	Sooty-headed Bulbul	*Pycnonotus aurigaster*
	34	Spotted Dove	*Streptopelia chinensis*
	35	Streak-eared Bulbul	*Pycnonotus plumosus*
	36	Streaked Spiderhunter	*Arachnothera magna*
	37	Thick-billed Pigeon	*Treron curvirostra*
	38	Vernal Hanging Parrot	*Loriculus vernalis*
	39	White-breasted Waterhen	*Amaurornis phoenicurus*
	40	White-rumped Shama	*Copsychus malabaricus*
	41	White-throated Kingfisher	*Halcyon smyrnensis*

Appendix E. (continued)

month	no.	common name	scientific name
December	1	Asian Palm-Swift	*Cypsiurus balasiensis*
	2	Black Drongo	*Dicrurus macrocercus*
	3	Black-crested Bulbul	*Pycnonotus melanicterus*
	4	Black-hooded Oriole	*Oriolus xanthornus*
	5	Blue Magpie	*Urocissa erythrorhyncha*
	6	Chestnut-headed Bee-eater	*Merops leschenaulti*
	7	Chinese Pond-Heron	*Ardeola bacchus*
	8	Collared Falconet	*Microhierax caerulescens*
	9	Common Flameback (Common Goldenback)	*Dinopium javanense*
	10	Common Tailorbird	*Orthotomus sutorius*
	11	Dark-necked Tailorbird	*Orthotomus atrogularis*
	12	Dollarbird	*Eurystomus orientalis*
	13	Eurasian Jay	*Garrulus glandarius*
	14	Golden-fronted Leafbird	*Chloropsis aurifrons*
	15	Greater Coucal	*Centropus sinensis*
	16	Greater Flameback (Greater Goldenback)	*Chrysocolaptes lucidus*
	17	Greater Racket-tailed Drongo	*Dicrurus paradiseus*
	18	Green-billed Malkoha	*Phaenicophaeus tristis*
	19	Grey Wagtail	*Motacilla cinerea*
	20	Grey-headed Parakeet	*Psittacula finschii*
	21	Hair-crested Drongo(Spangled Drongo)	*Dicrurus hottentottus*
	22	Hill Myna	*Gracula religiosa*
	23	Indian Roller	*Coracias benghalensis*
	24	Large Cuckoo-shrike	*Coracina macei*
	25	Lesser Yellownape	*Picus chlorolophus*
	26	Lineated Barbet	*Megalaima lineata*
	27	Little Heron	*Butorides striatus*
	28	Mountain Imperial Pigeon	*Ducula badia*
	29	Olive-backed Sunbird	*Nectarinia jugularis*
	30	Oriental Magpie-Robin (Magpie Robin)	*Copsychus saularis*
	31	Oriental Turtle-Dove	*Streptopelia orientalis*
	32	Red Junglefowl	*Gallus gallus*
	33	Red-rumped Swallow	*Hirundo daurica*
	34	Red-throated Flycatcher	*Ficedula parva*
	35	Red-whiskered Bulbul	*Pycnonotus jocosus*
	36	Shikra	*Accipiter badius*
	37	Sooty-headed Bulbul	*Pycnonotus aurigaster*
	38	Spotted Dove	*Streptopelia chinensis*
	39	Streak-eared Bulbul	*Pycnonotus plumosus*
	40	Streaked Spiderhunter	*Arachnothera magna*
	41	Thick-billed Pigeon	*Treron curvirostra*
	42	Vernal Hanging Parrot	*Loriculus vernalis*
	43	White-breasted Waterhen	*Amaurornis phoenicurus*
	44	White-rumped Shama	*Copsychus malabaricus*
	45	White-throated Kingfisher	*Halcyon smyrnensis*

Appendix E. (continued)

month	no.	common name	scientific name
January	1	Ashy Drongo	*Dicrurus leucophaeus*
	2	Asian Palm-Swift	*Cypsiurus balasiensis*
	3	Asian Paradise-flycatcher	*Terpsiphone paradisi*
	4	Black-backed Forktail	*Enicurus immaculatus*
	5	Black-crested Bulbul	*Pycnonotus melanicterus*
	6	Black-hooded Oriole	*Oriolus xanthornus*
	7	Blue Magpie	*Urocissa erythrorhyncha*
	8	Blue Whistling Thrush	*Myiophoneus caeruleus*
	9	Bronzed Drongo	*Dicrurus aeneus*
	10	Chestnut-headed Bee-eater	*Merops leschenaulti*
	11	Chinese Pond-Heron	*Ardeola bacchus*
	12	Collared Falconet	*Microhierax caerulescens*
	13	Common Flameback (Common Goldenback)	*Dinopium javanense*
	14	Common Tailorbird	*Orthotomus sutorius*
	15	Dollarbird	*Eurystomus orientalis*
	16	Eurasian Jay	*Garrulus glandarius*
	17	Golden-fronted Leafbird	*Chloropsis aurifrons*
	18	Great Barbet	*Megalaima virens*
	19	Greater Coucal	*Centropus sinensis*
	20	Greater Racket-tailed Drongo	*Dicrurus paradiseus*
	21	Greater Yellownape	*Picus flavinucha*
	22	Green-billed Malkoha	*Phaenicophaeus tristis*
	23	Grey-headed Parakeet	*Psittacula finschii*
	24	Hair-crested Drongo(Spangled Drongo)	*Dicrurus hottentottus*
	25	Hill Myna	*Gracula religiosa*
	26	Indian Roller	*Coracias benghalensis*
	27	Large Cuckoo-shrike	*Coracina macei*
	28	Lesser Yellownape	*Picus chlorolophus*
	29	Lineated Barbet	*Megalaima lineata*
	30	Little Heron	*Butorides striatus*
	31	Mountain Imperial Pigeon	*Ducula badia*
	32	Olive-backed Sunbird	*Nectarinia jugularis*
	33	Oriental Magpie-Robin (Magpie Robin)	*Copsychus saularis*
	34	Oriental Pied Hornbill (Indian Pied Hornbill)	*Anthracoceros albirosris*
	35	Oriental Turtle-Dove	*Streptopelia orientalis*
	36	Red Junglefowl	*Gallus gallus*
	37	Red-rumped Swallow	*Hirundo daurica*
	38	Red-throated Flycatcher	*Ficedula parva*
	39	Red-whiskered Bulbul	*Pycnonotus jocosus*
	40	Shikra	*Accipiter badius*
	41	Sooty-headed Bulbul	*Pycnonotus aurigaster*
	42	Spotted Dove	*Streptopelia chinensis*
	43	Streak-eared Bulbul	*Pycnonotus plumosus*
	44	Streaked Spiderhunter	*Arachnothera magna*
	45	Thick-billed Pigeon	*Treron curvirostra*
	46	Thick-billed Warbler	*Acrocephalus aedon*
	47	Vernal Hanging Parrot	*Loriculus vernalis*
	48	White-breasted Waterhen	*Amaurornis phoenicurus*
	49	White-crested Laughingthrush	*Garrulax leuolophus*
	50	White-throated Kingfisher	*Halcyon smyrnensis*
	51	Yellow Wagtail	*Motacilla flava*

Appendix E. (continued)

month	no.	common name	scientific name
February	1	Black-backed Forktail	*Enicurus immaculatus*
	2	Black-hooded Oriole	*Oriolus xanthornus*
	3	Black-naped Monarch	*Hypothymis azurea*
	4	Blue Magpie	*Urocissa erythrorhyncha*
	5	Chestnut-headed Bee-eater	*Merops leschenaulti*
	6	Chinese Pond-Heron	*Ardeola bacchus*
	7	Collared Falconet	*Microhierax caerulescens*
	8	Common Flameback (Common Goldenback)	*Dinopium javanense*
	9	Common Tailorbird	*Orthotomus sutorius*
	10	Dark-necked Tailorbird	*Orthotomus atrogularis*
	11	Dollarbird	*Eurystomus orientalis*
	12	Eurasian Jay	*Garrulus glandarius*
	13	Golden-fronted Leafbird	*Chloropsis aurifrons*
	14	Greater Coucal	*Centropus sinensis*
	15	Greater Flameback (Greater Goldenback)	*Chrysocolaptes lucidus*
	16	Greater Racket-tailed Drongo	*Dicrurus paradiseus*
	17	Greater Yellownape	*Picus flavinucha*
	18	Green-billed Malkoha	*Phaenicophaeus tristis*
	19	Grey Wagtail	*Motacilla cinerea*
	20	Grey-headed Parakeet	*Psittacula finschii*
	21	Hair-crested Drongo(Spangled Drongo)	*Dicrurus hottentottus*
	22	Hill Myna	*Gracula religiosa*
	23	Hoopoe	*Upupa epops*
	24	Indian Roller	*Coracias benghalensis*
	25	Large Cuckoo-shrike	*Coracina macei*
	26	Lesser Racket-tailed Drongo	*Dicrurus remifer*
	27	Lineated Barbet	*Megalaima lineata*
	28	Mountain Imperial Pigeon	*Ducula badia*
	29	Oriental Magpie-Robin (Magpie Robin)	*Copsychus saularis*
	30	Oriental Pied Hornbill (Indian Pied Hornbill)	*Anthracoceros albirosris*
	31	Oriental Turtle-Dove	*Streptopelia orientalis*
	32	Purple Sunbird	*Nectarinia asiatica*
	33	Red Junglefowl	*Gallus gallus*
	34	Red-throated Flycatcher	*Ficedula parva*
	35	Red-whiskered Bulbul	*Pycnonotus jocosus*
	36	Shikra	*Accipiter badius*
	37	Spotted Dove	*Streptopelia chinensis*
	38	Streaked Spiderhunter	*Arachnothera magna*
	39	Thick-billed Pigeon	*Treron curvirostra*
	40	Thick-billed Warbler	*Acrocephalus aedon*
	41	Vernal Hanging Parrot	*Loriculus vernalis*
	42	White-breasted Waterhen	*Amaurornis phoenicurus*
	43	White-crested Laughingthrush	*Garrulax leuolophus*
	44	White-rumped Munia	*Lonchura striata*
	45	White-throated Kingfisher	*Halcyon smyrnensis*
	46	Yellow Wagtail	*Motacilla flava*

Appendix E. (continued)

month	no.	common name	scientific name
March	1	Black Baza	*Aviceda leuphotes*
	2	Black Drongo	*Dicrurus macrocercus*
	3	Black-crested Bulbul	*Pycnonotus melanicterus*
	4	Black-headed Woodpecker	*Picus erythropygius*
	5	Black-hooded Oriole	*Oriolus xanthornus*
	6	Black-naped Monarch	*Hypothymis azurea*
	7	Blue Magpie	*Urocissa erythrorhyncha*
	8	Blue-winged Leafbird	*Chloropsis cochinchinensis*
	9	Chestnut-headed Bee-eater	*Merops leschenaulti*
	10	Chinese Pond-Heron	*Ardeola bacchus*
	11	Collared Falconet	*Microhierax caerulescens*
	12	Common Flameback (Common Goldenback)	*Dinopium javanense*
	13	Common Tailorbird	*Orthotomus sutorius*
	14	Coppersmith Barbet	*Megalaima Haemacephala*
	15	Dollarbird	*Eurystomus orientalis*
	16	Eurasian Jay	*Garrulus glandarius*
	17	Golden-fronted Leafbird	*Chloropsis aurifrons*
	18	Great Barbet	*Megalaima virens*
	19	Greater Coucal	*Centropus sinensis*
	20	Greater Flameback (Greater Goldenback)	*Chrysocolaptes lucidus*
	21	Greater Necklaced Laughingthrush	*Garrulax pectoralis*
	22	Greater Racket-tailed Drongo	*Dicrurus paradiseus*
	23	Greater Yellownape	*Picus flavinucha*
	24	Green-billed Malkoha	*Phaenicophaeus tristis*
	25	Grey-headed Parakeet	*Psittacula finschii*
	26	Grey-headed Woodpecker	*Picus canus*
	27	Hair-crested Drongo(Spangled Drongo)	*Dicrurus hottentottus*
	28	Hill Myna	*Gracula religiosa*
	29	Indian Roller	*Coracias benghalensis*
	30	Lesser Racket-tailed Drongo	*Dicrurus remifer*
	31	Lineated Barbet	*Megalaima lineata*
	32	Mountain Imperial Pigeon	*Ducula badia*
	33	Oriental Magpie-Robin (Magpie Robin)	*Copsychus saularis*
	34	Pied Bushchat	*Saxicola caprata*
	35	Red Junglefowl	*Gallus gallus*
	36	Red-throated Flycatcher	*Ficedula parva*
	37	Red-whiskered Bulbul	*Pycnonotus jocosus*
	38	Rufous-fronted Babbler	*Stachyris rufifrons*
	39	Scaly-breasted Munia	*Lonchura punctulata*
	40	Shikra	*Accipiter badius*
	41	Slaty-backed Forktail	*Enicurus schistaceus*
	42	Sooty-headed Bulbul	*Pycnonotus aurigaster*
	43	Spotted Dove	*Streptopelia chinensis*
	44	Streak-eared Bulbul	*Pycnonotus plumosus*
	45	Streaked Spiderhunter	*Arachnothera magna*
	46	Striped Tit-Babbler	*Macronous gularis*
	47	Thick-billed Pigeon	*Treron curvirostra*
	48	Thick-billed Warbler	*Acrocephalus aedon*
	49	Vernal Hanging Parrot	*Loriculus vernalis*
	50	White-crested Laughingthrush	*Garrulax leuolophus*
	51	White-rumped Munia	*Lonchura striata*
	52	White-throated Kingfisher	*Halcyon smyrnensis*

Appendix E. (continued)

month	no.	common name	scientific name
April	1	Ashy Drongo	*Dicrurus leucophaeus*
	2	Black Drongo	*Dicrurus macrocercus*
	3	Black-backed Forktail	*Enicurus immaculatus*
	4	Black-crested Bulbul	*Pycnonotus melanicterus*
	5	Black-hooded Oriole	*Oriolus xanthornus*
	6	Blue Magpie	*Urocissa erythrorhyncha*
	7	Blue-winged Leafbird	*Chloropsis cochinchinensis*
	8	Chestnut-headed Bee-eater	*Merops leschenaulti*
	9	Common Flameback (Common Goldenback)	*Dinopium javanense*
	10	Common Iora	*Aegithina Tiphia*
	11	Common Tailorbird	*Orthotomus sutorius*
	12	Coppersmith Barbet	*Megalaima Haemacephala*
	13	Crested Serpent-Eagle	*Spilornis cheela*
	14	Dollarbird	*Eurystomus orientalis*
	15	Eurasian Jay	*Garrulus glandarius*
	16	Golden-fronted Leafbird	*Chloropsis aurifrons*
	17	Great Barbet	*Megalaima virens*
	18	Greater Coucal	*Centropus sinensis*
	19	Greater Racket-tailed Drongo	*Dicrurus paradiseus*
	20	Green-billed Malkoha	*Phaenicophaeus tristis*
	21	Grey-headed Parakeet	*Psittacula finschii*
	22	Hair-crested Drongo(Spangled Drongo)	*Dicrurus hottentottus*
	23	Hill Myna	*Gracula religiosa*
	24	Hoopoe	*Upupa epops*
	25	Indian Roller	*Coracias benghalensis*
	26	Lineated Barbet	*Megalaima lineata*
	27	Little Cuckoo-Dove	*Macropytia ruficeps*
	28	Mountain Imperial Pigeon	*Ducula badia*
	29	Oriental Magpie-Robin (Magpie Robin)	*Copsychus saularis*
	30	Red Junglefowl	*Gallus gallus*
	31	Red-throated Flycatcher	*Ficedula parva*
	32	Red-whiskered Bulbul	*Pycnonotus jocosus*
	33	Sooty-headed Bulbul	*Pycnonotus aurigaster*
	34	Streak-eared Bulbul	*Pycnonotus plumosus*
	35	Streaked Spiderhunter	*Arachnothera magna*
	36	Thick-billed Pigeon	*Treron curvirostra*
	37	Vernal Hanging Parrot	*Loriculus vernalis*
	38	White-crested Laughingthrush	*Garrulax leuolophus*
	39	White-rumped Munia	*Lonchura striata*
	40	White-throated Kingfisher	*Halcyon smyrnensis*

CURRICULUM VITAE

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1985 – 1990:	Bachelor Degree in Electrical Engineering, Chiang Mai University
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