



Unisearch Journal

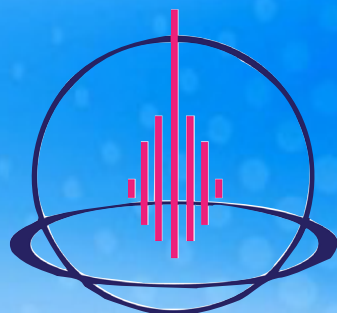
Vol.1 No.2 May-Aug. 2014

The Green Volume : Learn More about the Environment in Various Aspects



- Antarctica and Climate Change from Thailand's First Marine Biologist to Explore the Continent
- Research Clinic: a new service from Unisearch
- Tourism Industry Declined: Time to Reform Tourism Policies
- Evolution of Settlements in Muang Fa Daed Song Yang

- The Special Designated Areas for Sustainable Tourism: a new approach to promote sustainable tourism
- Living in the Salween Basin: The Way of Life in a Marginalized Community
- Electric Cable Car for Phu Kradueng? Is it possible or not?
- Ways to Increase the Wastewater Reuse Ratio in the Map Ta Phut Industrial Estate.
- Can Bangkok become a Green City?



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Tel : 0-2218-2880
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Mrs. Ekjitra Rerkut

Ms. Prapaporn Thapanaphong

Contact Enquiry

Chula Unisearch, Chulalongkorn University

254 Chulalongkorn Research Building,

4th floor, Phayathai Road, Pathumwan,

Bangkok 10330

Tel : 0-2218-2880

Fax : 0-2218-2859

www.unisearch.chula.ac.th

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Our world today faces unprecedented and pervasive environmental challenges. No longer is pollution just a nasty problem that diminishes our quality of life; pollution today is a silent killer, affecting each and every one of us overtly, and sometimes insidiously. Pollution of our land, our rivers and oceans, and the very air we breathe has today reached critical levels, overwhelming the environment's capacity to absorb and adapt. Our complex ecosystems are remarkably resilient, but can no longer cope with the increasing burden of toxic contaminants and other threats to biodiversity.

The challenge is compounded by the impacts of climate change, much of it driven by human activity. Climate change is increasingly recognized as a threat not only to agriculture, low-lying coastal areas and small island states, but also as an existential threat to the whole of humanity.

To prepare for and counter these continuing threats to our environment and our societies, mitigation and alleviation measures are urgently needed. It is only through cooperation among all stakeholders, including governments, the private sector and the international development community that coordinated measures can be launched and sustained at the required scale to mitigate and reverse the environmental degradation from which the world is suffering.

Environmental research has gathered pace around the world to identify cost-effective measures to quantify and counter environmental impacts of human activities, using a plethora of approaches.

To highlight the need to address global environmental threats and find solutions, this volume of Unisearch Journal features an interview from Assoc. Prof. Dr. Voranop Viyakarn, the first Thai marine scientist to set foot in Antarctica. In this interview, Assoc. Prof. Dr. Voranop tells us about his mission to instill an environmental consciousness- and a conscience- in everyone of environment. We hope his research will inspire and stimulate more research to find real, practical solutions to the increasingly severe environmental threats.

The six articles in this issue cover research conducted with the cooperation and support of **Unisearch**. The articles cover a range of disciplines, including a study of the evolution of settlements in Muang Fa Daed Song Yang, the national policy on Specially Designated Areas for Sustainable Tourism, and a study on the feasibility of building an electric cable car for Phu Kradueng National Park in Loei Province. We also feature research into the way of life in a marginalized community in the Salween Basin in Mae Hong Son Province, an area threatened by construction of a dam on the Salween River, a study of waste water in the Map Ta Phut Industrial Estate, and the concept of Bangkok Green City to improve the quality of life in the city.

We hope readers will find the interview and articles in this volume useful and stimulating. The next issue of **Unisearch Journal**, to be published in September, will focus on industrial research.

The Editorial Board

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A Study of the Feasibility of an **Electric Cable Car** for **Phu Kradueng National Park**, Loei Province, Thailand

Assoc. Prof. Dr. Thavivongse Sriburi
Chula Unisearch, Chulalongkorn University



Introduction

Tourism development is important to Thailand's social and economic development and generates hundreds of billions of baht annually in revenues. The tourism industry comprises 3 main elements; tourism resources, services, and the market. The first of these is the most fundamental.

Sustainable tourism development aims to highlight the strengths of the tourist attraction whilst minimizing or mitigating risks of adverse social and environmental impacts. This approach is necessary both to preserve the resource and also to enhance competitiveness with other countries. Appropriate and sensitive development of new tourist attractions will also help create new tourism connections to nearby areas. In addition, coordination with related parties including central and local government agencies, private sector entrepreneurs, and local people will strengthen and maintain a balanced development path.

Objectives of the Study

1. The study evaluated the feasibility of an electric cable car for tourism project in Phu Kradueng National Park, Loei Province, Thailand. The scope included technology and engineering, economics, investment needs and social/ environmental impacts relevant to the present condition of the National Park. The study reviewed development alternatives and studied four proposed routes: (1) the National Park Headquarters and Si Than-Lang Pae Tourist Center; (2) the western part of Phu Kradueng-Thung Dok Moei; (3) Ban I Loet National Park Protection Unit; and (4) Ban Na Noi National Park Protection Unit. The study also surveyed and analyzed additional data and the current status in order to consider additional options aside from the four originally-proposed routes.



2. To investigate the ecosystem within Phu Kradueng National Park and produce an environmental impact assessment report under the framework set by the Department of Natural Resources and Office of Environmental Policy and Planning in order to determine appropriate preventive and mitigating measures.

3. To analyze the project's investment model and legal issues raised by construction within the National Park area.

4. To study the National Park's administration, tourism characteristics both inside and outside Phu Kradueng, and tourism connections under the Master Plan for the designated area for sustainable tourism in Loei, in order to accommodate tourists all year round within the carrying capacity to the top of Phu Kradueng mountains, whilst minimizing the risks of environmental impacts.

5. To develop a conceptual design for the entire electric cable car project.

6. To perform participatory activities and collect feedback on the proposed project from affected communities, whilst ensuring that information is adequately and properly shared with all stakeholders.

Framework for Implementation

Hidden in the mountain complex and clouds, Loei is also known for the richness of its flora and fauna, especially in its renowned national parks such as Phu Kradueng, Phu Luang, and Phu Ruea. The weather is bitterly cold during winter and cool nearly throughout the rest of the year. The landscapes of the province are picturesque and the cultures are unique. With these features combined, Loei is an ideal tourism destination with continually increasing visitor numbers and strong potential for development in many parts of the province. The proposed cable car project aims to promote this development by

connecting some of these locations.

Loei has seen many types of tourism development to accommodate a constantly increasing influx of tourists. However, there is a need for long-term planning to ensure controlled development of this fragile resource in a sustainable way, and especially to ensure equitable distribution of tourism income to local communities. This approach will help preserve the tourism value of Phu Kradueng long into the future. At present, tourists tend to include only Phu Kradueng in their visits and are less likely to visit less well-known or less accessible attractions. Development of the province's tourism industry therefore hinges on enhancing connectivity and providing more alternatives for tourists, in order to prolong their stay in the province.

The feasibility study considered all key dimensions, especially environmental impact and issues relating to public acceptance. Regarding public participation, it is planned to emphasize the planned project's potential to elevate quality of life for local communities as a result of facilities development outside the National Park near the cable car entrance.

The design of the electric cable car prioritizes convenience, safety, economy, and minimization of environmental impact such as appropriate coloring, height of poles, etc. In addition, the design would need to serve many purposes; not only for transporting tourists but also for transport of waste from the top of the mountain and for emergency cases.

Study area

The study covers the entire area of Phu Kradueng National Park (348.12 km²), an adjacent area in Amphoe Phu Kradueng, and the surrounding tourist attractions in Phu Kradueng-Nong Hin-Phu Luang tourism connection scheme in Loei Province, as shown in Figure 1.



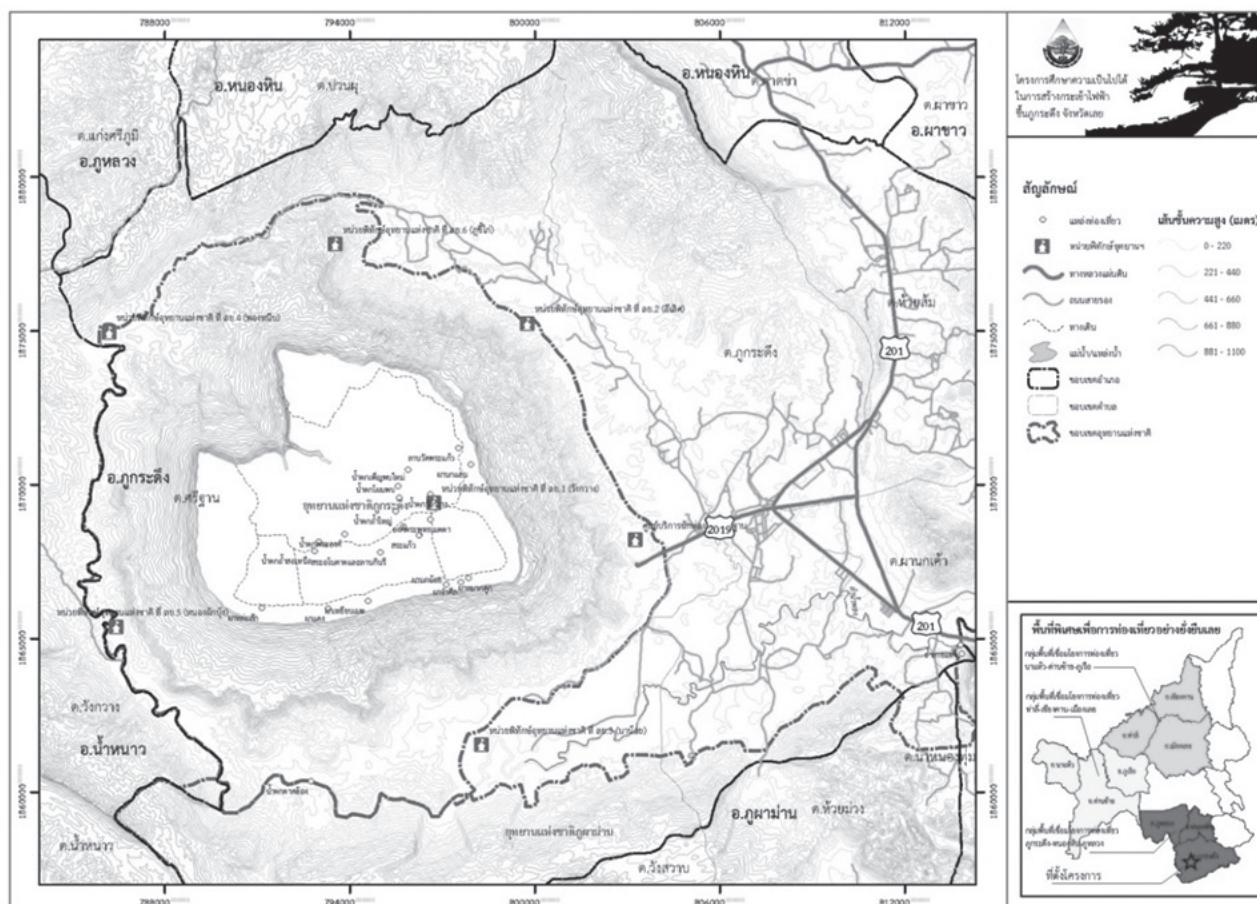


Figure 1: Study area
Source : DASTA (2014)

The study is divided into the following topics. Phu Kradueng National Park.

1. Economic/financial feasibility and investment requirements

Alternative options are compared according to their economic and financial returns, and investment needs. Economic feasibility is used as the main measure of direct and indirect benefits for society. Sensitivity analysis is used to consider future risks to the project's financial viability, and the economic value of natural and environmental resources within the National Park area compared to worthiness of building the electric cable car to Phukradueng is analyzed mainly based on the carrying capacity of

The route, position of stations, the policy to develop the entire electric cable car system and other related systems that suit the current condition are concluded. The means to develop the most suitable project is determined by assessing the benefits to tourism, local economic promotion, and the principles of sustainable tourism development.

2. Route and position of stations

1) Compare at least 3 proposed routes including positions of stations according to clear criteria for determining the most suitable route and model.

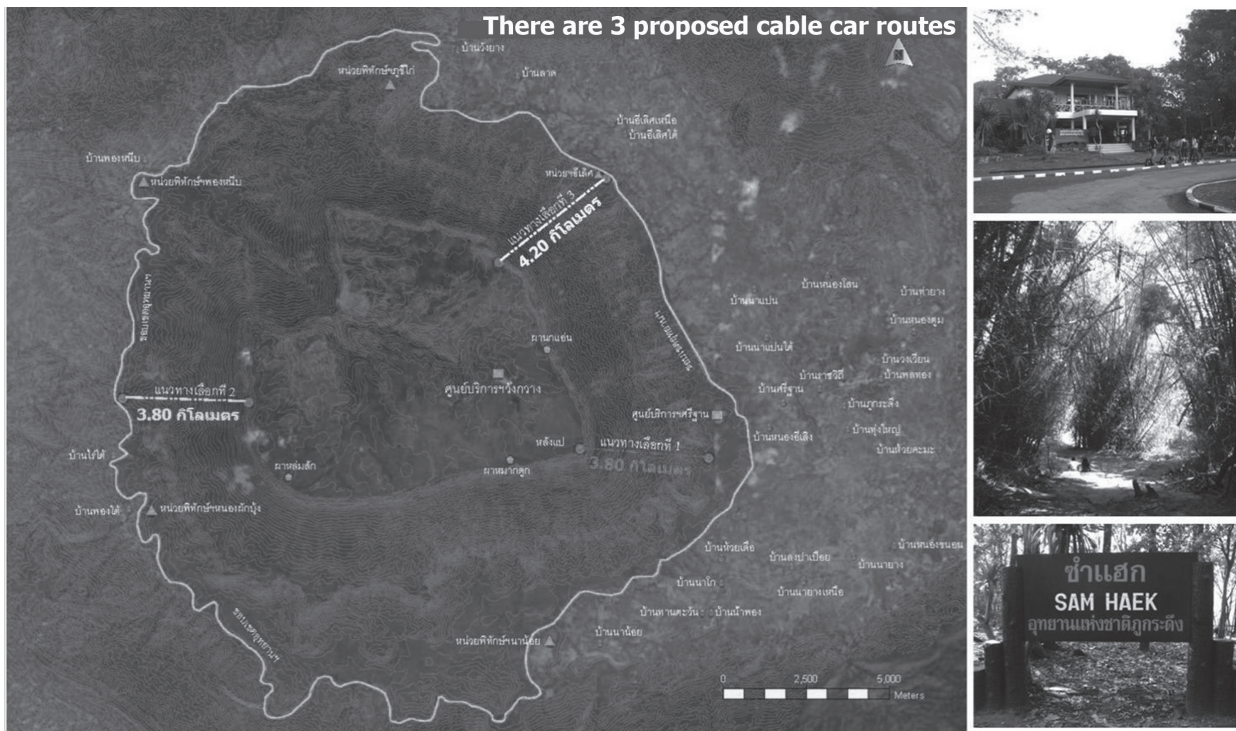


Figure 2 : Proposed cable car route
Source : DASTA (2014)

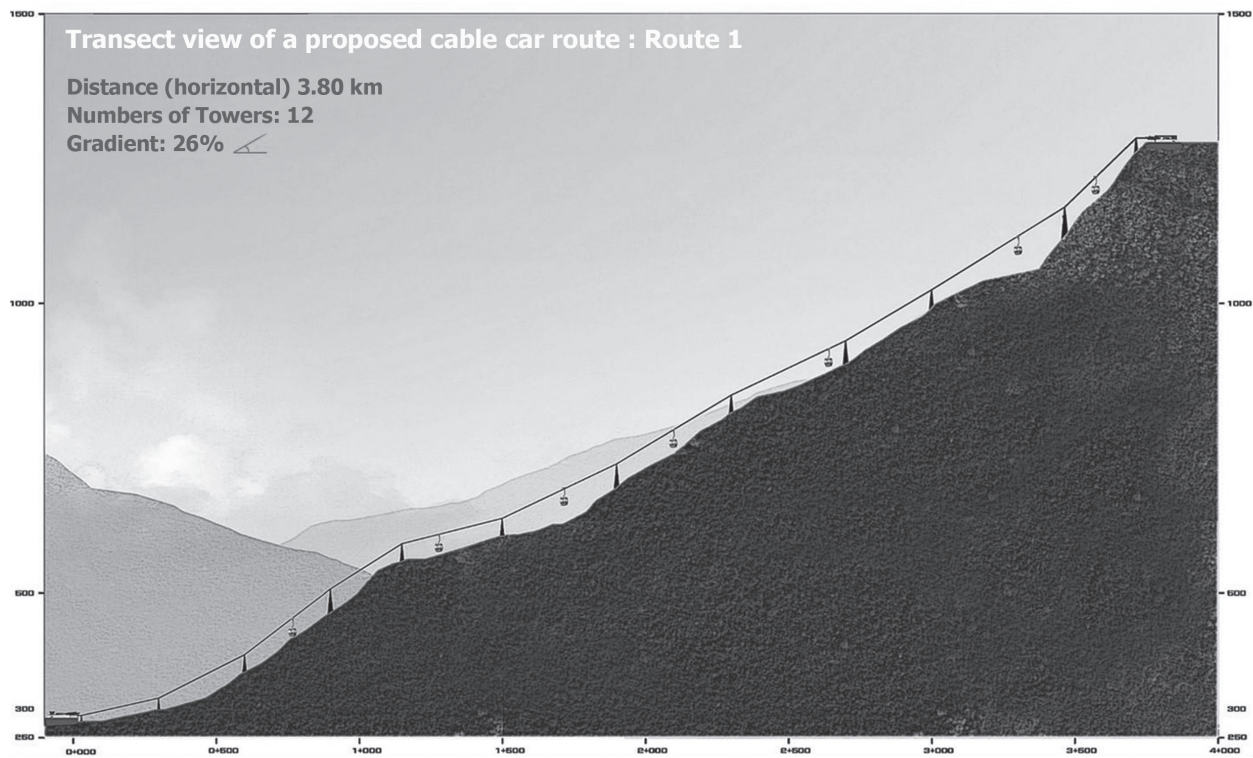


Figure 3 : Transect view of proposed cable car route
Source : DASTA (2014)





2) Determine the most suitable route and station positions by comparing the advantages and disadvantages of each alternative in all aspects including conservation of nature, engineering, and investment worthiness, and especially considering the criteria related to nature conservation. Anticipated environmental impacts according to the environmental checklist for each route model are taken into account in order to propose the most appropriate route.

3. Environmental impact assessment

The environmental assessment includes a study of the literature, ground survey and information gathering to evaluate the area's natural and environmental status in four respects: its physical resources, biological resources, human use values, and current quality of life values. The study also assesses potential impacts caused by the preferred development model, covering all project phases including mobilization, construction, and operation. The assessment will compare scenarios with and without the project, direct and indirect impacts, short-term and long-term impacts; together this understanding will allow development of recommendations for preventive and mitigation measures to minimize and scale of potential impacts. Among the recommendations will be the establishment of mitigation measures to restore the environment and enhance environmental quality, implementation of monitoring procedures, and an environmental operation plan that incorporates public participation in order to ensure their needs and concerns are fairly addressed.

4. Project investment models

Legal complexities related to any proposed development in forest or National Park area necessitate a study of relevant legislation, regulation, and requirements of national parks and other parties. This understanding will allow development of an effective legal strategy to implement the project in compliance with all legal requirements. Proposed solutions to the obstacles of the project investment, project investment model, and conformance between the benefit that

the government is trying to promote and the investment model, conformance with laws, regulations, and requirements of national parks and those related to the project will also be studied.

5. National Park administration, tourism characteristics inside and outside Phu Kradueng, and tourism connections under the DASTA Master Plan

In order to attract tourists throughout the year within the determined carrying capacity of Phu Kradueng National Park, an area utilization management plan has been established to provide infrastructure, services and recreational facilities at the peak of Phu Kradueng National Park, focusing on an environmental management system (wastewater and waste management) to support sustainable tourism. The study also includes development of tour routes and activities by setting Phu Kradueng as the primary tourism node for Loei Province and the surrounding region. Activities and facilities are to be selected to accommodate Phu Kradueng as the tourism node. The administration model is to be determined by creating networks to integrate the tourism industry both inside and outside Loei Province. A special plan for administering Phu Kradueng National Park and connected tourist attractions in Loei designated area will be developed.

6. Determining the conceptual design

The conceptual design for the proposed project establishes principles and guidelines covering operational, aesthetic and environmental considerations. These will ensure that project designs are fit for purpose, comply with international safety standards and have minimal impact on natural and environmental resources.

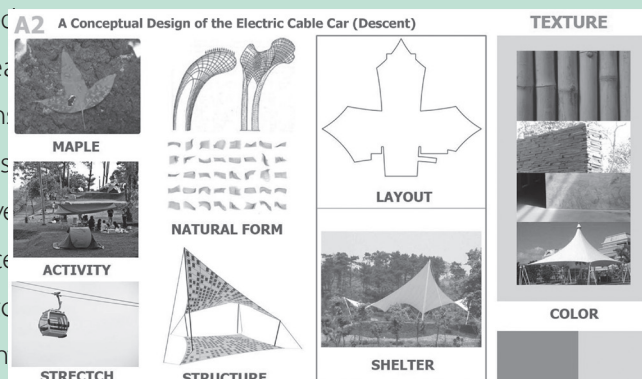


Figure 4 : Conceptual design

Source : DASTA (2014)





7. Public participation

The researcher proposes a public participation plan that covers the study term. The report would specify activities to be implemented, personnel responsible for each activity, target groups, approaches and methodologies, duration, expected outcomes, and how to use suggestions from public meetings. The technique and means of using must have complete details that cover related activities including data gathering, information dissemination, target group identification, and hearing opinion/suggestion.

Acknowledgments

This article is part of the research project “A study of possibility to build an electric cable car for Phu Kradueng National Park in Loei province” funded by the Administration of Designated Areas for Sustainable Tourism (Public Organization).

Reference

DASTA (2014) *Designated Areas for Sustainable Tourism Administration (Public Organization). Inception Report Edition. A Study of Possibility to Build an Electric Cable Car for Phu Kradueng National Park in Loei Province.* 2014.

The project administration study and establishment includes 1) setting up the system and system maintenance plan which can be implemented following completion of construction in order that system operation and maintenance is carried out effectively and sustainably; 2) system operation and maintenance budget plan, income and expense estimation for operation and maintenance throughout the project term; 3) plan for setting up an appropriate organizational structure and human resource plan; 4) public participation plan for public relations before and during construction and during the operational phase, in order to ensure full public understanding of the project; and 5) plan for monitoring and evaluation of the project both in terms of its operation and financial management, and also to set a direction for project evaluation during and after the project term.

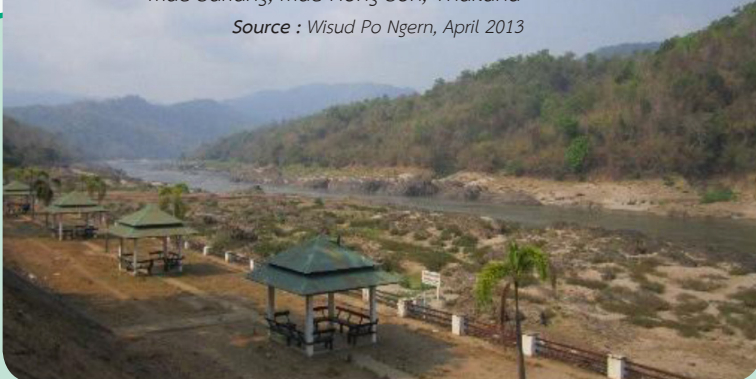


Way of Life in a Marginalized Community in the Salween Basin, Mae Hong Son Province, Thailand

Dr. Wisud Po Ngern

Instructor, Department of Curriculum and Instruction, Faculty of Education, Silpakorn University

Figure 1: View over the Salween River, Ban Mae Sam Laeb, Mae Sariang, Mae Hong Son, Thailand
Source : Wisud Po Ngern, April 2013



Marginalized communities are typically (though not always) remotely located and far from the nearest geographical and socio-cultural centre. Frequently, their members have been forced to relocate from their hometowns or other urban centres, driven by natural, economic, political or socio-cultural factors.

By definition, marginalized people lack education, land, resources and often even the bare necessities of life; and they are excluded from the systems of bargaining power, resource allocation, power and stability in society. Marginalized groups may often be distinguished from majority populations in terms of their race, ethnicity, religion, ideology, education, economic or socio-economic status (Seymour Smith, 1986: 177).

This article discusses marginalized inhabitants living along the banks of the Salween River, part of which forms the natural border between western Thailand and the Union of Myanmar. It originates in the Himalayan Plateau in Tibet, flowing through the southern part of the People's Republic of China into the northeastern Myanmar, then along the border with western Thailand into Karen State in Myanmar at Baan Sop Moei, Mae Sariang District in Mae Hong Son Province. Communities are sporadically situated along both banks of the river; this paper focuses on three communities on the Thai side: 1) Baan Thata Fang community in Mae Sariang district 2) Baan Mae Sam Laeb community, Sop Moei district 3) Baan Sop Moei in Sop Moei District, Mae Hong Son Province.

The majority of the residents of the three villages are Skor Karen (Pakayo), or white Karen (Yang Khao) (Sangkett Janthanapothi, 1999: 17). The lifestyle is generally rural and mainly dependent on agriculture and forest products; they tend to be rooted to their localities. However, the village of Baan Mae Sam Laeb is more

business-oriented, and more villagers are employed in fishery, trading, service provision, or are employed by local businesses. This business community has emerged as the village serves as a hub for river travel to other villages, and also provides tourism services further afield along the Salween River and adjacent areas.



Figure 2 : Households along the Salween River: Ban Mae Sam Laeb, Mae Sariang, Mae Hong Son Province

Source : Wisud Po Ngern, April 2013

Additionally, Baan Mae Sam Laeb village is home to a diverse ethnic and religious mix, including Buddhist and Christian Karens, and Muslims. Karen homes are constructed on higher land away from the river, using contemporary styles combined with traditional Karen and lowland Thai building styles. However, some houses built in the original style still remain. Groups of houses were built in communities with outside toilets; bedrooms, living rooms and separate kitchens. Most dwellings are raised, with the roomy areas below used as a living space during daytime. Houses built in original Karen style were constructed using natural locally-available materials, including roofs thatched with certain kinds of banana leaves, Pluang leaves, or split bamboo laid up and down alternately. This construction style is cheap and keeps the dwelling cool down in summer; the dwellings can also be easily dismantled for transportation.

However, some dwellings in the business areas such as Baan Mae Sam Laeb (a tourist attraction and landing for river travel) have been built in more modern styles with more distinctive features. The most densely populated areas are along the road to the landing, down very steep banks. An outstanding feature of these houses is, when viewed from the road, these dwellings appear as ordinary wooden houses interspersed with brick and cement houses. However, when viewed from the river, the extremely long poles supporting single-storey dwellings become visible, alongside the steeply sloped road leading down to the river landing.

The communities of Baan Thata Fang and Baan Sob Moei can be accessed by both land or water. However, access by land is rather difficult on the unpaved gravel road, taking about 3 hours to traverse the 25 kilometres of steeply winding road from Baan Sam Laeb to Baan Sop Moei in the dry season; in the wet season travel takes even longer and some parts of the road are impassable. In contrast,

boat travel is possible throughout the year, although the river current is usually strong, especially in the rainy season. Due to the river's many gullies and rapids, only skillful and experienced boat drivers are needed; each year these dangerous river conditions result in boat accidents and casualties. Nevertheless, the river remains the most important lifeline and means of communication Karen State in Myanmar and Thailand. There are roads since many villages are located in forest conservation areas, where construction of buildings and roads is prohibited.

Villagers also must deal with power shortages, with insufficient supplies to meet daily needs of the communities. Some dwellings are equipped with solar cells, but still the electricity generated is often insufficient to meet household needs.

Most Karen communities living along the Thai side of the Salween river are composed of Thai and Myanmar Karen who took refuge from wars in Myanmar and crossed the border to settle in Thailand. Villagers use the Karen language to communicate in daily life; although they can listen and understand the Thai language well, most, and particularly the older generation and those not educated in Thai schools, are generally illiterate. Most villagers dress in contemporary styles, except for important religious ceremonies and special occasions, when traditional costume is preferred. Girls and young single women wear a plain white dress with red thread embroidery; once married, the embroidery colour is changed to black, red, or blue, according to ethnic group. Turbans are also worn in various colours. Men, single and married, wear red clothes with beautiful embroidered patterns, and blue or red loose pants or civil trousers for special occasions. Most of these clothes are woven from ready-made cotton; however, a few villagers still grow cotton and make their own cotton





thread. Cloth is woven using a type of loom known as the *kee aew nok*. Home-sewn clothes are today rarely seen, although some families weave traditional cloth for sale to villagers and tourists.

Karen people living in the communities along the banks of the Salween River include Buddhists, Protestant Christians, Muslims as well as Karen who worship ghosts after their traditional beliefs. Religious rituals are conducted in religious places in villages or outdoors in forest areas around the villages. Generally, the religious beliefs and rituals of local Karen people are similar to those found on the plain. Some important religious and traditional rituals still practiced in the Karen community are described in brief below.

1. *The Poi Sang Long* tradition, or ordaining novice monks following the Thai Yai tradition, is practiced at Baan Mae Sam Laeb.

2. A 'Wrist-tying' (hand binding) ritual is held annually in January or February. The village elders bless wrist-bound supplicants and celebrations continue throughout the day and night. One interesting interpretation of this tradition is that it celebrates the importance of *"the family's village"*; when finishing the ritual, a drink and all food are offered first to housewives, since the mother is recognized as the one who feeds the ancestors' ghosts. Following the death of a mother, the house is dismantled and then rebuilt (this is the reason why Karen houses are constructed of bamboo). Any daughter or married women living in the house will follow the ritual of feeding the ancestors' ghosts.

3. The ritual of binding the hands with white thread is done to bless the family. When done in April, the ritual is known as *"Khichuehitoku,"* but in August, it is known differently as *"Khichuekualkala"*.

4. *"Por"* is a ritual for paying respect to large trees in the village on the 15th lunar day in any month, once every 7 years.

5. *"Buesorku"* is a ritual at which a meal of new rice is eaten to celebrate the new rice harvest. It is held at the end of December, and ends with a request for God's blessing by Christian Karen.

6. *"Lueche"* is a ceremony for offering food and other goods in homage to the gods of the rice field. Based on the villagers' belief in ghosts, the ceremony takes place



Figure 3 : Weaving household Karen

Source : Wisud Po Ngern, April 2013

during August to September.

The rich tradition of rituals and religious ceremonies has been practiced for generations, although undoubtedly some have changed and have been lost over time and changing social dynamics. Nevertheless, new rituals have also emerged, focusing on the river; for example the *"Succeeding the Salween River's Life"* which melds traditional beliefs with the concepts of water conservation. The ritual is held annually to raise awareness of the river's critical importance to all aspects of community life and the environment, in Baan Sop Moei at the confluence of Moei and Salween rivers.

The diet of Karen villagers comprises mostly of locally-grown fruit and vegetables, some collected from the forest, and others purchased (such as flavour additives, beef, pork, chicken and fish). Generally, most villagers cook for themselves, with local dishes such as *"Khao Bur"* (a rice gruel containing different ingredients) eaten in all households. Other dishes include roasted rice and *Som Poy* curry. A typical local dessert is boiled sticky rice, which is wrapped in 2 kinds of packets. The 'female' sticky rice *"Mei Tor Moe"* is wrapped in a cone packet, whereas the 'male' version (*Mei Tor Pa*) is wrapped in a larger triangular packet. Both are symbols of prosperity, eaten on their own or with added sugar, sugar cane juice or nuts. Roasted rice (*Meto Pijuay*) is also a popular dessert (Suriya Rattanakul, 1986: 46). Villagers espouse a number of beliefs surrounding food; for example, they will not eat black rattan because they believe it may make them sick. Also, some kinds of food (e.g. duck, shellfish, soft-shell turtle, lemur, hunted wild animals, and non-laying hens) are not eaten in the presence of guests as they are believed to trigger brawls. Other long-held superstitions include cocks that crow at night, and pigs that give birth to dead





Figure 4 : The life of the community Salween basin.

Source : Wisud Po Ngern, May 2013

piglets are believed to bring misfortune to family members.

The social structure of Karen families has changed significantly in recent years. Thirty years ago most Karens lived as single nuclear families, including parents, children and including the mother's parents. After marriage, the groom traditionally moved into the bride's family home and would respect the woman's relatives. The new couple would live in the house for a year or so, before building their own house nearby when the bride's younger sister got married. However, the youngest daughter traditionally would continue to live in the parental house after marriage in order to take care of her parents. As a result of these arrangements, the youngest daughter inherited more rice fields and other properties than her brothers or sisters. In families without a daughter, a son would take over these duties (Prawit Pothart, 1984 cited in Suriya Rattanakul, 1988: 25). Today, this social structure can still be seen, but increasingly, young Karen can choose their own spouses, even those from other clans. Many teenagers and young adults have left their home villages to search for work or further their education in the nearest urban centres, leaving mostly the old and young children remaining in the villages along the Salween river banks. Educated Karen tend increasingly to migrate to the towns or the plain, visiting their hometowns only occasionally, particularly to celebrate traditional festivals.

Karen communities along the Salween River, as in other rural areas, depend on upland agriculture. They may be distinguished by the higher proportion of adults of working age than is seen elsewhere. The influx of Karen refugees crossing the border over many years has resulted in offspring born in Thailand. Such people live in a state of limbo; while they wait to be granted Thai citizenship, they cannot move out of the

settlement and have no rights to education or healthcare services conferred by citizenship. Marginalized by poverty, their refugee status and an often uncertain legal status, many residents of the Salween communities are disempowered, without bargaining power, economic rights, social stability or the basic rights and protections conferred by Thai citizenship.

Acknowledgement

This article is part of "the findings of the Additional Study of Environment Impact of the Hutgyi Hydropower Project, Union of Myanmar", funded by EGAT International.

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Evolution of Settlement in

Muang Fa Daed Song Yang:

Aerial Photograph Uncovered and Archaeological Excavations

Asst. Prof. Dr. Chaichana Saengsawang

Department of Urban and Regional Planning, Faculty of Architecture, Chulalongkorn University

Introduction

Muang Fa Daed Song Yang is situated in Ampoe Kamalasai of Kalasin Province, Thailand. Since 1918, the town has been attracted many researchers in fields ranging from the history of art, archaeology and restoration of historic sites. According to excavations in the town's vicinity, most archaeological finds are Dvaravati art. Prathat Ya Khu is the most important construction and has survived in excellent condition. The hexagonal pagoda is constructed of brick from three different eras. The square-based stupa with indented corners with stairs in four directions, and decorated with Dvaravati stuccos. The upper base is hexagonal, similar in appearance to an Ayudhaya-style pagoda, built over the existing lower base. The top of the pagoda was restored during the Rattanakosin era (BE 2500).

Archaeologists have also discovered sandstone Bai Sema, or battlements, with bas-relief carving featuring the biography of the Lord Buddha. The battlements at Muang Fa Daed Song Yang have attracted much academic attention due to their splendour and intricate carvings of Buddhist epics derived from the biography of the Lord Buddha and Jataka such as Mahajanaka Jataka and Mahosot Jataka. These reliefs reflect beliefs and values, clothing, culture and architectural fashions prevalent during those times. It is estimated that the battlements at Muang Fa Daed Song Yang may date as far back as 14-15 BE. Thus, Muang Fa Daed Song Yang is regarded as northeast Thailand's most important sandstone battlement.

The many historic sites and archaeological finds discovered in Muang Fa Daed Song Yang signifies that the ancient communities in the vicinity had flourished for a sustained period of time. Evidence for this includes the planning of the town and irrigation system, proofs of beliefs in a religion, and inventions of tools and pottery. Therefore, it is important to study the development of settlements at Muang Fa Daed Song Yang, since it helps not only to reflect a clearer history in Dvaravati, but also offers insights to the modern generation to understand the ways of life, thoughts and beliefs of their ancestors.

Location and topography of Muang Fa Daed Song Yang

Muang Fa Daed Song Yang is situated in the area of Ban Sema (formerly called Ban Kom), Tambon Nong Paen, Amphoe Kamalasai, Kalasin Province, northeastern Thailand, between latitudes $16^{\circ}18'15''$ - $16^{\circ}19'23''$ and longitude $100^{\circ}30'55''$ - $100^{\circ}31'33''$ or grid coordinates UTM Zone 48 N between 340820 – 342210 E and 1803280 – 1805380 N (Royal Thai Survey Department's Topographic Map, a series of L7018 sheet 5741 IV scale of 1:50,000).

Muang Fa Daed Song Yang is situated in the lower basin of Kalasin at the confluence of Lam Nam Pha and Lam Nam Pao rivers. Low-laying lands and mounds are common in this area. When the two landscapes combine, they form natural swamps, which remain filled all year round and some are relatively large. Important natural resources include rock salt, hard woods such as *Shoceabotusa*, *shoceasiamensis*, *Lagerstroemia calyculata* and *Dipterocarpus* spp. Today these woods have disappeared due to deforestation, leaving only clues in the names of villages, such as Ban Song Pueai (meaning high *Lagerstroemia calyculata* tree), or Ban Song Yang (High *Dipterocarpus* tree).

The aforementioned prove that this ancient town was located in a fertile land caused by river sediments, with a year-round water supply, ample agricultural land and waterways that facilitated transportation and contact with other communities. All these are factors that enabled the long-term survival of this town over many generations.

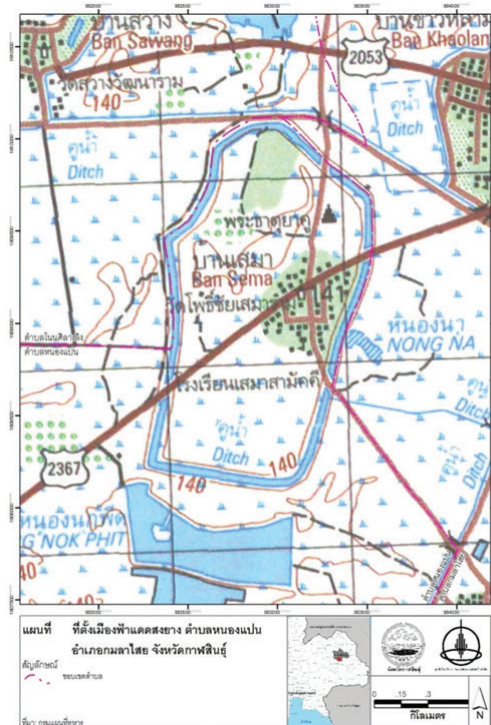
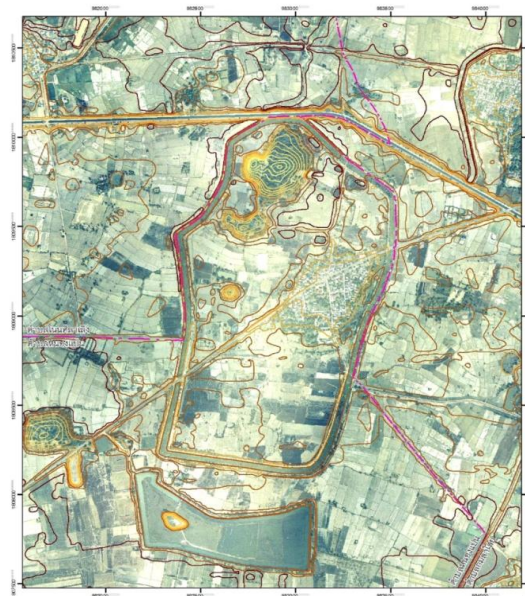


Figure 1 : The Location of Muang Fa Daed Song Yang, Tambon Nong Paen, Amphoe Kamalasai, Kalasin Province
Source : Royal Thai Survey Department



(a) 1972 CE



(b) 2003 CE

Figure 2 : The Aerial photographs of Muang Fa Daed Song Yang taken in 1972 and 2003 CE
Source : Royal Thai Survey Department

Development of Settlement of Muang Fa Daed Song Yang

This study is based on secondary data emphasizing excavation and restoration by the Fine Arts Department, together with excavation of soil layers by the Department of Archaeology, Faculty of Archaeology, Silpakorn University, and translation of aerial photographs in order to set hypotheses on how lands were used in the past in 3 key topics: 1) era order and history of land usage; 2) activities in the past and traditions or beliefs; and 3) relationships with outsiders or other communities with different cultures. According to the data, the development of Muang Fa Daed Song Yang can be divided into 5 eras as explained below.

1. Muang Fa Daed Song Yang era 1

According to an excavation is 1991 by Prof. Dr. Phasook Indrawooth, it is known that a community existed at this site since before the end of the Prehistoric era, around 3-7 BE in the area of Muang Fa Daed Song Yang before moats were constructed around the old town. Evidence for this was found in burial pits of prehistoric humans, where remains were found lying in a straight position, also known as the primary burial. The burials are commonly found in prehistoric sites. It is known that some prehistoric communities dug moats around the mounds to build reservoirs for water consumption and agriculture or simple irrigation systems. It is assumed that the digging of moats around the ancient town might have taken place before the end of the prehistoric era. According to aerial photographs, it was found that Ban Sema also has large moats around the mounds similar to those in the ancient town. The existence of settlements near such mounds can therefore be assumed.

2. Muang Fa Daed Song Yang era 2

The archeological finds around the ancient town's mounds signify that the community that had lived before the end of the prehistoric era continued to the semi-prehistoric era, between 7 and 8 BE.



(a) The Remains of Prehistoric Humans



(b) Pottery Ware Remnants with Color Stripes

Figure 3 : Evidence of Prehistoric Community in Muang Fah Daed Song Yang

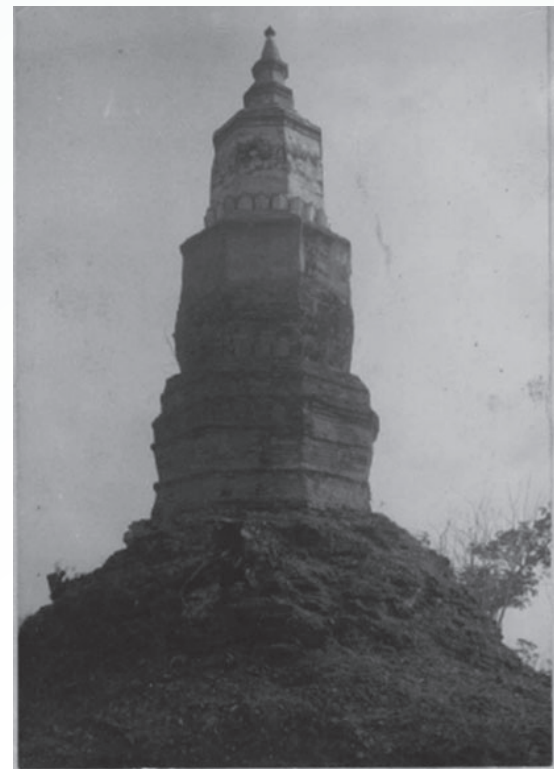
Source : Phasuk Intrawut et al.

However, little proof of activities in this era has been discovered, save some simple pottery finds in the field. The pottery is assumed to have been made in a mortar: a simple bamboo structure covered with soil. Four-legged pottery tables, with short sturdy legs (like pig's legs) have also been found. Near the four-legged table,

a soft-shell turtle shell was found. It is believed to be related to life expansion of patients because the turtle is a symbol of longevity.

3. Muang Fa Daed Song Yang era 3

The period during the 11-16 BE, known as the Dvaravati era, was the most flourishing period for the town. It is believed that the town was systematically developed during this period. The moats were complex, indicative of increased population and expansion of the town. Many religious places were constructed both inside and outside the town. *Prathat Ya Khu* was the largest pagoda and is in the best condition, and remains as a place of worship today. Apart from that, the Dvaravati-style battlements at Muang Fa Daed Song Yang are regarded as the most academically contributive since they are beautiful and rich with detail of Buddhist stories derived directly from the biography



Prathat Ya Khu after restoration



Stucco mouldings



Examples of Archaeological Finds Found near Prathat Ya Khu

Figure 4 : Prathat Ya Khu and Other Archaeological Finds

Source : Phasuk Intrawut et al.

of the Lord Buddha and Jataka tales. In conclusion, Prathat Ya Khu and the sandstone battlements are important to any discussion of Dvaravati stories at Muang Fa Daed Song Yang.

4. Muang Fa Daed Song Yang era 4

During the period 17-18 BE or the Lop Buri era, Khmer culture was prevalent in the area of Muang Fa Daed Song Yang. The way of life and construction of religious sites loosely resembled Khmer culture. Religious places, with roofs made of pottery have been discovered and potter ware was known to be

used as routine tools. Baray was built in addition to the previous era's water management system with only complex moats. A large Baray was found to the northeastern of the town. It is also believed that there were communities outside the town area as there is a reservoir called Nongsarpung. The reservoir is thought to have been built during this era due to the name's close relationship to Khmer names.

5. Muang Fa Daed Song Yang era 5

During the period 19-23 BE, Khmer culture faded and a new culture, the Lan Xang culture, arrived at Muang



Figure 5 : Fragments of native pottery
Source : Phasuk Intrawut et al.

Fa Daed Song Yang, approximately concurrent with the Ayudhaya period. Fragments of native pottery and chinaware have been unearthed and are believed to be from the Ayudhaya period. Following restoration of some historic sites, especially at Phrathat Ya Khu, it was found that some constructions were built over older religious sites. To clarify, the square base of the pagoda with Dvaravati patterns was built over with the hexagonal brick structure as the pagoda body and its top from the age of Ayudhaya. It is therefore believed that the pagoda was once restored during the Ayudhaya period.

In conclusion, the ancient town at Muang Fa Daed Song Yang has enjoyed continuous waves of development since the end of the prehistoric era. Its Golden age was certainly during the Dvaravati era, from 11-16 BE. The period's unique characteristic is the battlement, decorated with Buddhist stories according to Dvaravati art. Muang Fa Daed Song Yang is well-known famous among historians and archaeologists for this reason. When ancient Khmer culture expanded to this area, Barays were constructed to supplement the existing reservoirs. During the Ayudhaya period, the Dvaravati constructions were restored before the settlement of the new generation in this town rich with histories.

Table 1 : Development of Muang Fa Daed Song Yang

Era	B.E.	Discovery area	Past activity	Major historic finds	Cultural relationship
1	3 – 7	Non Muang Kao	Primary burial of human bodies in the position of straight lying	Fragments of containers painted red on cream - colored background	Prehistoric culture in Sakon Nakhon Basin and Korat Basin
2	7 – 8	Non Muang Kao	Invention of pottery	4-legged pottery table	Semi-prehistoric culture in Korat Basin
3	11 – 16	- In the vicinity of Phrathat Ya Khu - Non Muang Kao - Non Wat Sung - Don Ngio	- Construction of religious places - Living activity (in the excavation site) - Primary burial of human bodies in the position of straight lying and the secondary burial (in earthen jar)	- Historic sites - Religious sculpture - Battlement - Dvaravati-style objects excavated	Expansion of Dvaravati culture from the central part of the country
4	17 – 18	- Non Muang Kao - Non Wat Sung - Non Fa Daed	- Living activity (in the excavation site) - Construction of religious places (Non Fa Daed)	- Earthenware - Pottery casket - Brown-green pottery	Ancient khmer culture
5	19 – 23	- Non Muang Kao - Non Wat Sung - Phrathat Ya Khu	Structures constructed over older Dvaravati religious site	- Ayudhaya pottery - Chinaware	Ayudhaya-Lan Xang culture

Source : Phasuk Intrawut et al.





Acknowledgements

This article is part of a research project “*Master plan for development of Muang Fa Daed Song Yang, Amphoe Kamalasai, Kalasin*” funded by Kalasin Provincial Office.

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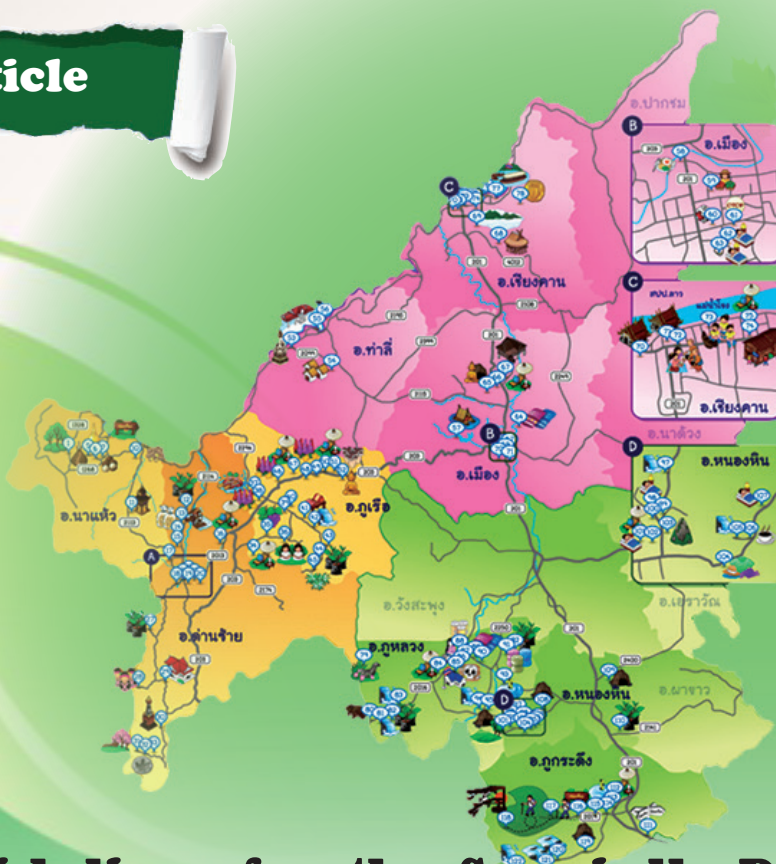
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Preface

Environmental Research Institute, Chulalongkorn University

whilst generating revenues, has also created immense pressure on the local carrying capacity, presenting challenges to local communities as well as to rehabilitating and restoring degraded sites, especially in locations with fragile ecological or environmental characteristics.

The government's policy to establish special designated areas for sustainable tourism is implemented by a public agency – the Designated Areas for Sustainable Tourism Administration (Public Organization), or DASTA. DASTA's goal is to focus resources on these key areas in order to develop and manage them under the principles of sustainable tourism development, in order to achieve a balance between economic, social and environmental goals.



Qualified Areas for Sustainable Tourism

To date, DASTA has declared 6 areas for sustainable tourism, as follows:

- 1) Koh Chang and vicinity (4,280 km²)
- 2) Pattaya City and vicinity (949.47 km²)
- 3) The Historical Park Areas of Sukhothai - Srisachanalai - Kamphaengpet
- 4) Loei Province (7,193.01 km²), comprising 3 areas: Dan Sai – Phu Reuh – Na Haew District; Tha Li - Chiang Khan - Loei City; and Phu Kradeung – Nhong Hin – Phu Luang Districts
- 5) The Old Village of Nan (total area : 139.37 km²)
- 6) The Ancient City of U Thong (total area : 38.16 km²)

DASTA has also conducted feasibility studies for other potential areas of interest, and plans to

announce 10 new designated areas within the coming 5 year period (2012 - 2017), as follows:

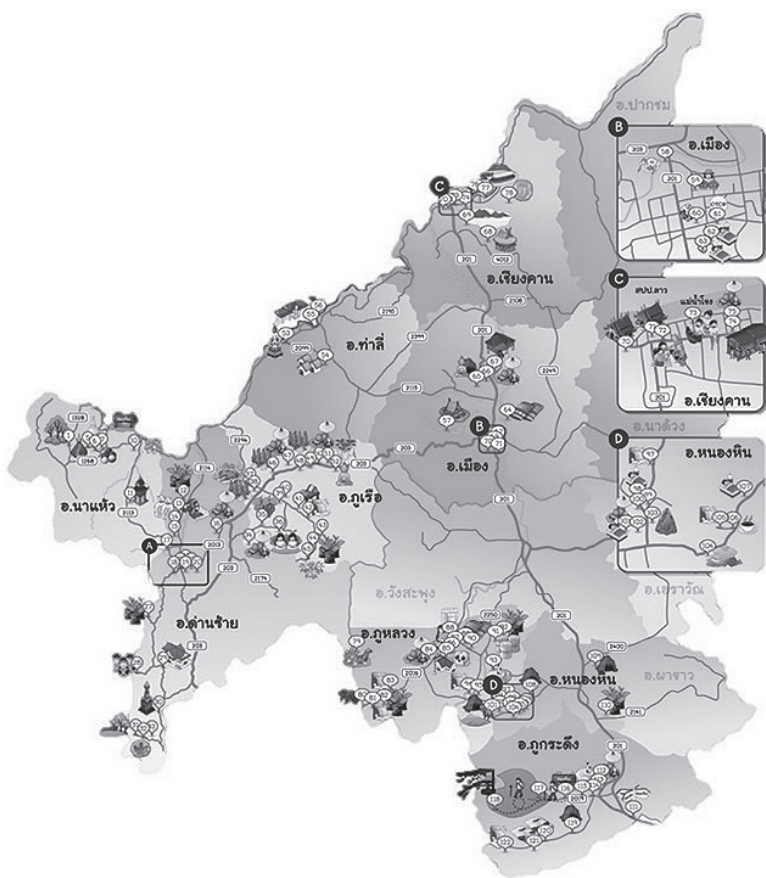
- 1) The Cultural Area of Lanna
- 2) Pai District, Mae Hong Son Province
- 3) Historical Park of Ayutthaya
- 4) Cultural Tourist Site of Mae Klong Watershed
- 5) Historical Areas of Noi - Tha Chin Watershed and surrounding areas
- 6) Phu Kum Khao Dinosaur World Park
- 7) Geological Park Pah Chun-Sampan Bhoke
- 8) Surin Islands National Park
- 9) Samui - Phangan Islands, and
- 10) Songkla Lake area.

Designated Areas for Sustainable Tourism

DASTA is responsible for selecting areas for designation, and for developing strategic development policies and management plans for such areas designated by the Cabinet as areas for sustainable tourism. DASTA also monitors and evaluates management of all designated areas, and has a role in coordinating between local and central government agencies to facilitate cooperation in developing the sustainable tourism sector and to assure an appropriate balance between economic, social and environmental demands.

In considering areas for possible declaration as areas for sustainable tourism, appropriate rules, criteria and measurable standards are required as a framework for analysis. At the same time, such rules must allow room for interpretation, given the need to give appropriate weight to factors such as the beauty of unique natural attractions. These criteria are to be prepared as a handbook for use by DASTA's evaluation committee. The following three eligibility criteria are key considerations for designation:

1. It is a unique space, important for its contributions to nature and the environment.



Picture 1 : Designated Areas for Sustainable Tourism at Loei Province

Source : Adapted from DASTA





2. The area is valuable in terms of its historical and cultural contributions.

3. The area has potential for development as a new tourist attraction.

Criteria for Specially Declared Areas for Sustainable Tourism

In order to improve the standard for evaluating potential areas for designation areas for Sustainable Tourism, a set of criteria was developed as follows:

- 1) The area is important for tourism because of its natural, historical or cultural assets;
- 2) The area has adequate capacity within local communities to support development and management under the principles and parameters of sustainable tourism
- 3) Tourism sites are already present in the area, and are likely to grow, with increased visitor numbers and activities for tourists.

An area may be declared as a specially designated area in one of four types:

- 1) Natural attraction
- 2) Historical attraction
- 3) Cultural attraction
- 4) Mixed attraction

Criteria for Sustainable Tourism Areas

The broad diversity of type and potential of tourism sites must be reflected in DASTA's approaches to management. Criteria have been defined with 3 elements to assess site characteristics (described in the following section).

Element 1 : Value of the Tourism Attraction

The value of natural tourism attraction may derive from many criteria such as environmental diversity, the biodiversity or natural integrity of the site, occurrence of rare or endangered species, or unique geographical or geological features.

The tourism value of a historic site depends upon the site's historical background, unique features, the integrity of any historical arts, any linkages with key historic events and local/international prominence as a historic site.

The value of a cultural-historical tourism site rests upon the uniqueness of local cultural traditions, richness of local wisdom, continuity and integrity of long-held cultural traditions, researchable traditions and the level of commitment to preserve local traditions and identities.

Mixed attractions will be assessed according to the type of the attraction.

Element 2 : Risk of Destruction

Risk of Destruction represents an evaluation of man-made risk and natural risks, which result from degradation of natural resources and the local environment, such as environmental deterioration, the risk of damage from the impact of natural disasters, air and water pollution and ecosystem impacts. Any change from the original state of the attraction can be considered as detrimental to its tourism value.

Element 3 : Management

Sustainable Tourism Management includes:

1. Environmental and Ecosystem Management : facilities management, landscape management, tourism impacts management as well as education of management and staff to enhance awareness of the need to protect towards nature and the local environment.

2. Tourism Management : facilities management for tourists and services and security management.

3. Socio-economic Management & Participation of local people : participation of local organizations, private sector groups and government tourism development sector, also the community that has a partnership in tourism development.

Auditors play a significant role in the Specially Declared Areas for Sustainable Tourism assessment. Auditors must be able to identify the area's tourism type and categorize the area strictly according to the tourism definition. Each tourism area will be evaluated using an area-specific survey form. However, there should be at least five auditors for an assessment to make the assessment results reliable since the evaluation is based on the auditors' judgment.





Management Efficiency	High Value High Management Efficiency High Risk	1	Low Value High Management Efficiency Low Risk	2	High Value High Management Efficiency Low Risk	3	Risk of Destruction
	Low Value High Management Efficiency High Risk	4	High Value Low Management Efficiency Low Risk	5	High Value Low Management Efficiency High Risk	6	
	Tourism Value						

The areas that need to be promoted as Specially Declared Areas for Sustainable Tourism can be categorized in to 3 groups according to the afore mentioned characteristics.

- **Group 1** is the areas that should be to be promoted as Specially Declared Areas for Sustainable Tourism. The areas belong in this group may contain only one criterion: the Risk of Destruction (Element 2). For Group 1, DASTA prepares a proper mitigation measure to prevent the area from destruction and promote sustainable tourism based on community preparedness to the risk of destruction. The areas in Group 1 are those that labeled as High Risk, High Management Efficiency and High Risk (1) and High Risk, High Management Efficiency and Low Risk (3).

- **Group 2** is the areas that need to be promoted as Specially Declared Areas for Sustainable Tourism. DASTA needs to interfere with the local administrators to ensure sustainable tourism. The areas in this group are labeled as High Risk, Low Management Efficiency and Low Risk (5) and High Risk, Low Management Efficiency and High Risk (6).

- **Group 3** in the areas that can be declared as Specially Declared Areas for Sustainable Tourism but not in an emergency to be declared. The areas in this group may require a significant amount of budget and a new, or an additional, set of policies to develop the area as Specially Declared Areas for Sustainable Tourism according to DASTA's standard. The areas in this group are labeled as Low Risk, High Management Efficiency and Low Risk (2) and Low Risk, High Management Efficiency and High Risk (4).

The management and development schemes of the areas declared as Specially Declared Areas for Sustainable Tourism are based on DASTA's policy, including Community-Based Tourism Development and Creative Tourism Development.

Acknowledgements

This article forms part of the research project "Improving and Developing the Evaluation Guide for Specially Declared Areas for Sustainable Tourism", and supported financially by the Designated Areas for Sustainable Tourism Administration (Public Organization), or DASTA.



Bangkok : The State of Becoming Green City

Assoc. Prof. Dr.Vorasun Buranakarn

Department of Architecture, Faculty of Architecture, Chulalongkorn University

Introduction

The framework for Bangkok's Development 2009-2020 and the policy of the Governor of Bangkok (Mom Rajawongse Sukhumbhand Paripatra) both aim to develop Bangkok as a *"Sustainable Metropolis"*. Priority is given to developing the urban environment and providing access to quality public services which will allow all Bangkok's people to enjoy a good quality of life and enhance the potential of the capital at international level. These goals support the National Science Technology and Innovation Strategic Plan and Policy I (2012-2021) which aims at local quality and stable expansion of Thailand's economic system and fair distribution of benefits to the communities. Under the principle of *"Green Innovation for Quality Society and Sustainable Economic Growth"*, the priorities are set to harmonize the three

dimensions of growth; Green Economy, Green Society, and Green Energy and Environment.

A Green Society may be defined as a society where all sectors understand the adjustment of the production, the consumption, and the use of natural resources, which should be efficient and minimize waste released into the environment. The adjustment should follow the 3Rs principle; 1) Reduce the use of non-eco-friendly products, energy, and natural resources, 2) Reuse all products as many times as possible before disposal, and 3) Recycle or remanufacture waste into new products, including the use of recycled packaging. In order to create a green society, all sectors must help create a mutual awareness of the environmental problems and encourage the people of Bangkok to adopt an eco-friendly life style.

Green City Indicators

In Asia, Green City Indicators are grouped into eight categories, as follows.

Category 1- Energy use and CO₂ emission: this category includes 4 indicators: 1) Proportion of CO₂

emission per capita (tons/person); 2) Proportion of energy use per GDP (MJ/US\$); 3) Policies regarding climate change; and 4) Policies regarding clean energy.

Category 2 - Land use and buildings: this category includes 4 indicators: 1) Proportion of green

area per capita (square metre/head of population);
2) Population density (persons/per square metre);
3) Green building policy; and 4) Land use policy

Category 3 - Transportation and traffic: this category includes 3 indicators which are 1) proportion of the total distance of available public transportation per area (kilometre/square kilometre) 2) traffic management solution, and 3) public transportation policy

Category 4 - Waste management: this category includes 4 indicators which are 1) proportion of garbage per person (kilogram/person), 2) proportion of garbage collected per garbage disposed accordingly to sanitary standards, 3) 3Rs policy, and 4) waste collecting and disposal policy

Category 5 - Water management: this category includes 4 indicators: 1) Proportion of water used per person (litre/person); 2) Water loss in the tap water system (%); 3) Surface water and drinking water policy; and 4) Sufficient water resource management policy

Category 6 - Sanitation: this category includes

3 indicators: 1) Proportion of people who can access sanitation system such as sanitary wastewater treatment and excretion management (%); 2) Proportion of wastewater collected and treated; and 3) Urban sanitation policy

Category 7 - Air quality: this category includes 3 indicators: 1) Nitrogen Oxide (NO_x) atmospheric concentration (microgram/cubic metre); 2) Sulfur oxide (SO_x) concentrations in air (microgram/cubic metre); and 3) PM₁₀ concentration in air (microgram/cubic metre)

Category 8 - Environmental governance: this category includes 3 indicators: 1) Environment management policy and method; 2) Environment watch method; and 3) People's participation in environment management

Bangkok Green City Status according to Green City Indicators

Using the Green City Indicators, Bangkok's Green City Status can be evaluated as follows (figure 1);

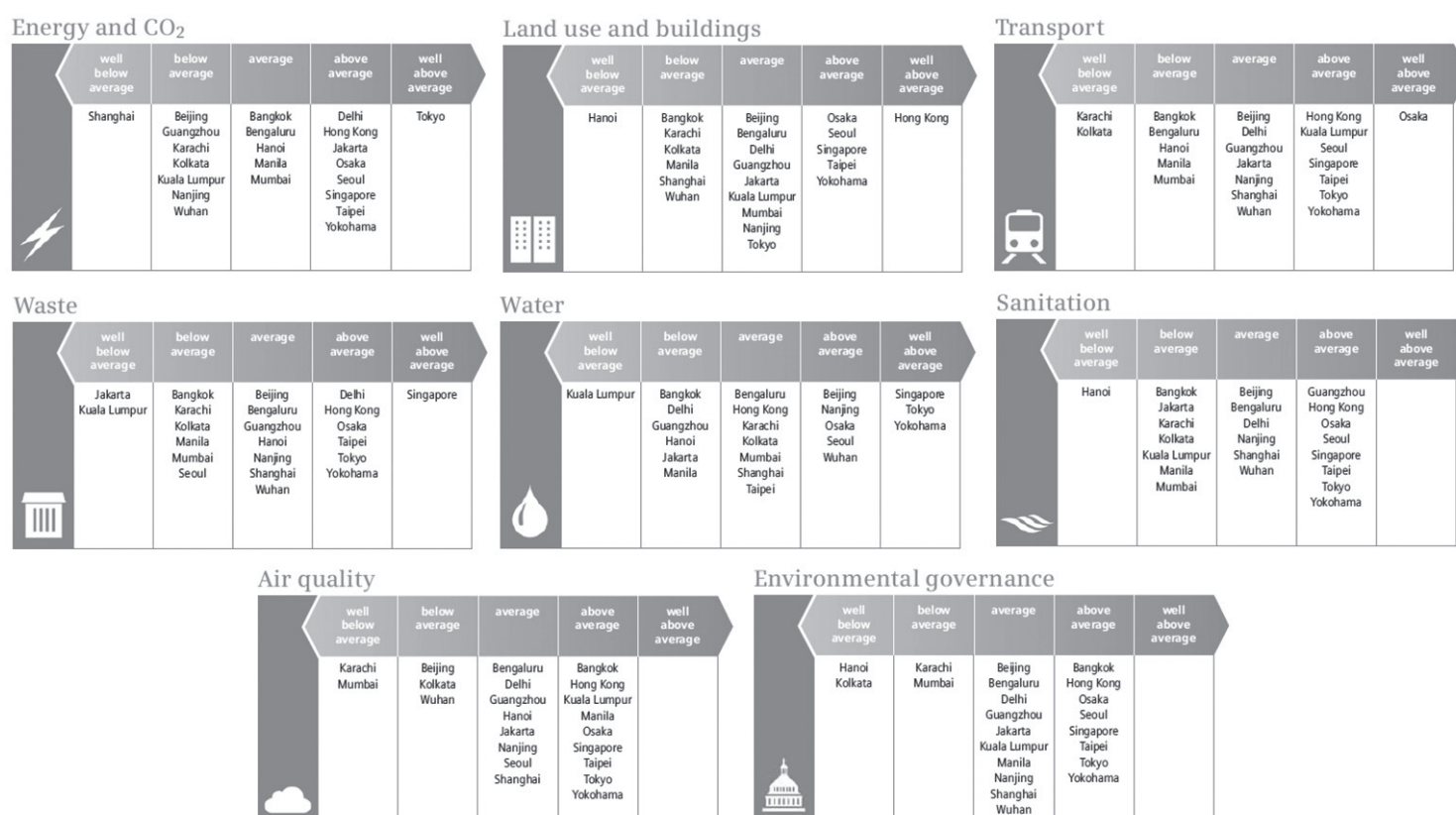


Figure 1 : Bangkok's Green City Status in comparison to other Asian countries, ranked by Siemens

Source : Asian Green City Index (2011)

1. Energy use and CO₂ emissions

According to data on greenhouse gases emissions, Bangkok's energy use and CO₂ emission status in 2007 stood at an average level (Table 1), with 80% of CO₂ emission attributed to two majors sources: 1) transportation, which is the cause of 50%

of all CO₂ released (21.18 million tons/year); and 2) electricity consumption, the source of 34% of total CO₂ released (14.86 million tons/year). Bangkok executives can use this data in developing an GHG emission reduction plan for Bangkok.

Table 1 Estimated CO₂ emissions in Bangkok (2007)

Sector	Amount released (million tons/year)	Percentage
Electricity consumption	14.86	34
Transportation	21.18	50
Garbage and waste water	1.13	3
Others (estimated)	5.58	13
Total (estimated)	42.75	100

Source : Bangkok's Plan for Climate Change (2007-2012)

2. Land use and buildings

Green areas such as small and large parks, flood retaining ponds and street parks not only enhance quality of life but also help balance the urban ecosystem, serving as space for leisure and also help prevent public hazards.

Planting trees also help reduce polluting gases such as ozone, nitrogen oxides (NO_x) and volatile organic compounds (VOC_x), which are released in vehicle exhausts and industries. Green areas can also be remarkably effective in countering the urban heat island effect, significantly lowering local temperatures. Although essential components of all cities, according to 2010 figures in 2010 the area of Bangkok's parks and green areas was below average, with only 4.1 square metres of green area/person and 3,634 persons/square metre of population density.

3. Transportation and traffic

Bangkok's transportation and traffic system is comparatively below average, with only 0.04 kilometre of transportation service/square kilometre. (A survey of 22 Asian cities found an average of 0.17 kilometre/1 square kilometre). Acknowledging this

inadequacy, Bangkok is now continuously developing and improving its public transportation system. Its plan includes improvement and development of bus lines and road networks, and to extend the existing light rail mass transit systems. Its long term goal is to add more bus lines, reach 230 kilometres of transportation service, and reduce CO₂ emission by 5.53 million tons.

4. Waste management

Bangkok's waste management status is inadequate. The city has insufficient capacity even to collect the volume of domestic garbage produced every day. According to data collected by Bangkok's Department of Environment, 50% of garbage collected is waste food, tree leaves and twigs. The lack of segregation is inefficient and creates major environmental and public health threats. These problems can be minimized by effective segregation, which will result in recycling of more than 7,000 tons/day of waste and less garbage to be sent to landfills. Every kilogram of waste reduction is equivalent to 0.3 kg. of CO₂ emission. Therefore, it is essential to upgrade Bangkok's waste recycling facilities and capacity.

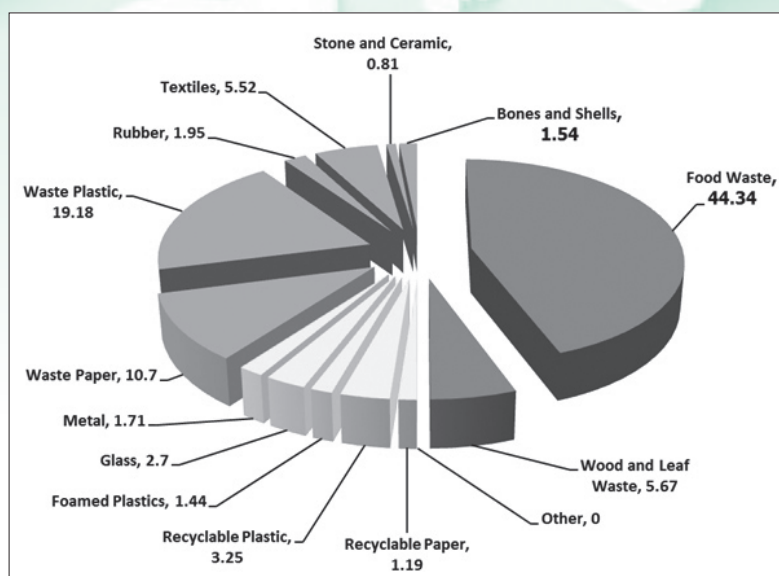


Figure 2 : Composition of waste in Bangkok

Source : Bangkok Department of Environment

5. Water management

Bangkok's water management system is also below average. The average volume of water use in Bangkok is 340 litres/person/day, which is significantly higher than the 278 litres/person/day average of 22 Asian cities (see Figure 3). 90% of water used in Bangkok originates from the Chao Phraya River and Mae Klong River, both of which are highly contaminated, necessitating much treatment to produce raw water. The raw water must then pass through purification processes to before entering the tap system. Furthermore, 35% of tap water is lost while in the tap system, while the average of the Asian countries stands at 22%. This problem must be urgently addressed in order to conserve water.

6. Sanitation

Bangkok's sanitation status is poor, with an adequate sanitation system accessible to only 51% of its population, compared to a 70% average for the 22 Asian cities studied.

Bangkok is able to collect and treat only 12% of its wastewater. The rest is released untreated into canals and rivers, adding greatly to water pollution.

7. Air quality

Air pollution presents as significant public health risk, and is driven by the fast-growing economy of cities such as Bangkok, and burgeoning number of vehicles on the city's roads. The air quality of Bangkok is now slightly above the average for the 22 Asian cities.

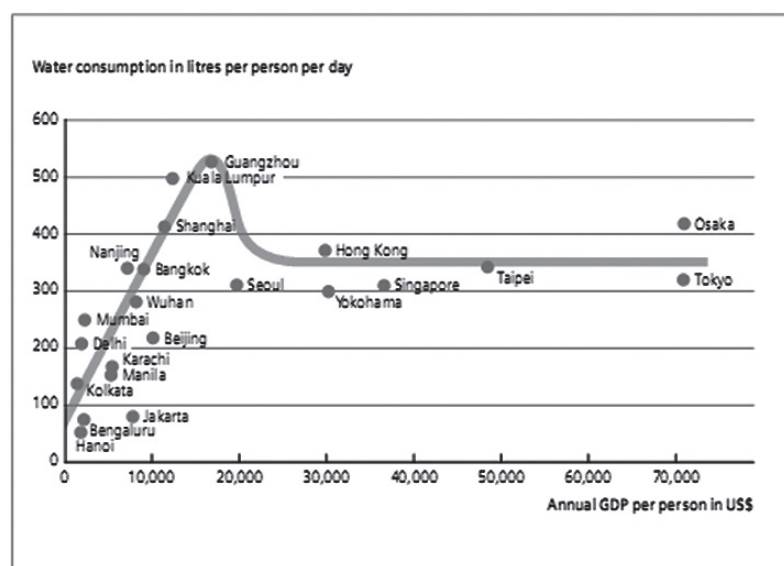


Figure 3 : Water use ratio of cities in 22 Asian countries

Source : Asian Green City Index (2011)

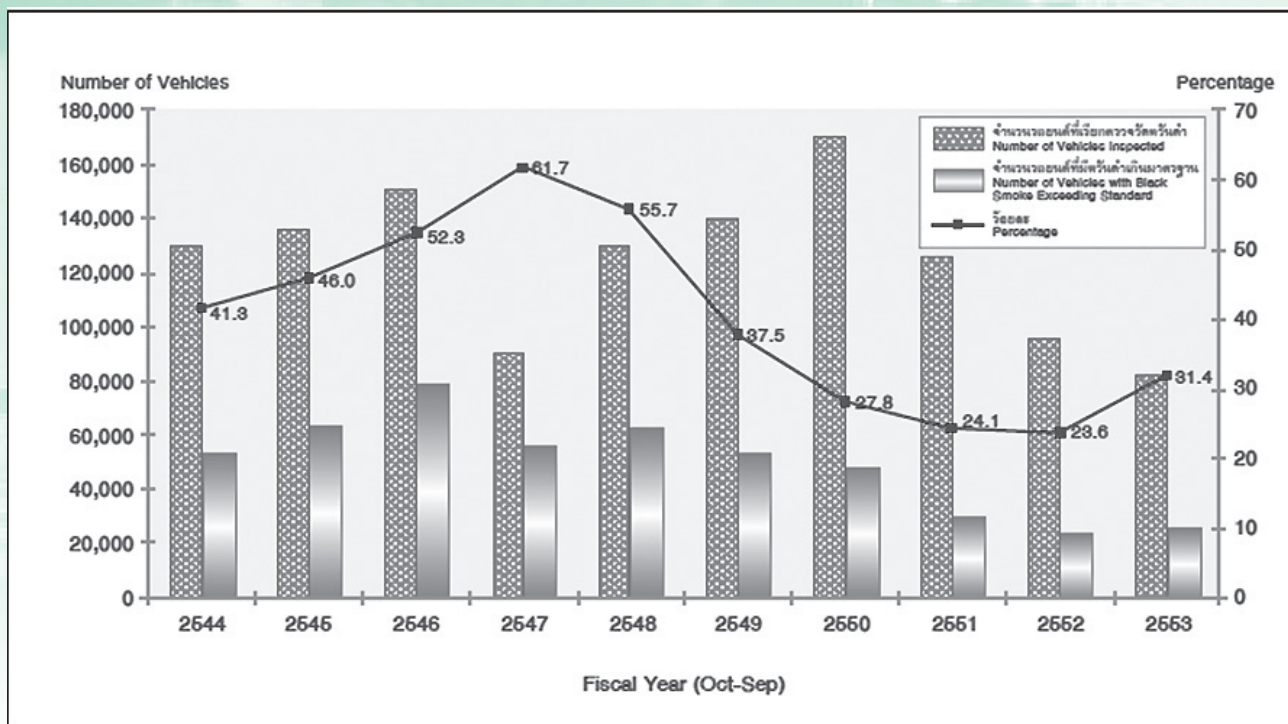


Figure 4 : Vehicles with black smoke in Bangkok (2001-2010)

Source : Bangkok's Department of Environment (2012)

8. Environmental governance

Bangkok has a sound environmental policy framework. Bangkok's Department of Environment is responsible for establish policies and strategies, including improving and updating environment laws and regulations. Moreover, Bangkok promotes public participation by encouraging residents to comment on projects that may have impact on their environment, and by setting up an information system to facilitate public access to data on the environment in Bangkok. As a result, the environmental governance status of Bangkok is slightly above average of the 22 Asian cities studied.

Becoming Bangkok Green City

Bangkok's vision to become a green city. This means that Bangkok's urban management aspires to be eco-friendly, with its people well aware of environmental matters and motivated to live sufficiently, using fewer natural resources, energy, food and water, releasing less toxic waste and heat

into the environment. The city will also meet its needs using less external energy and using more renewable energy and renewable natural resources. The underlying principle of the green city is to minimize our ecological footprint, to reduce environmental pollution, to use land more efficiently, to make greater use of natural materials, and to produce less garbage by recycling or through waste-to-energy processes. Adopting these strategies will mitigate the causes of global warming and help turn Bangkok into a green city.

However, according to Green City indicators, Bangkok still needs to make major improvements in many aspects of its environmental performance in order to become a quality society. Consequently, it has started a campaign and built a network which will improve Bangkok according to the 8 categories of indicators. In order to succeed, all sectors must cooperate, and Bangkok Metropolitan Authority will serve as a focal point and facilitator in this process. We hope that this project will define a framework which will develop Bangkok into a green city and

create a Bangkok Green Society Network embracing government, the private sector, academia, non-government organizations and local communities. We also hope that all sectors will be ready to accustom themselves to a green city lifestyle.

Acknowledgements

This article is a part of a research project “The Study and Development of Participation in the Creation of Bangkok Green City”, funded from Bangkok’s Department of Environment.

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Increasing the Wastewater Reuse Ratio in Map Ta Phut Industrial Estate, Thailand

Assoc. Prof. Dr. Chavalit Ratanatamskul

Department of Environmental Engineering, Faculty of Engineering,
Chulalongkorn University

Introduction

Thailand's industrial sector continues to seek solutions to environmental deterioration and pollution using approaches such as dilution, reduce adverse effects and end-of-pipe treatments. However, such treatments do not necessarily offer environmentally sustainable solutions. To accomplish this goal, in general the most successful strategy has been mitigation. By treating the pollution at its source, manufacturers maximize cost effectiveness of control measures, reduce production costs, increase competitive capacity and minimize health and environmental impacts resulting from pollution by factory effluents.

Controlling point source pollution is critical to addressing water resources and wastewater problems; the 3Rs (Reduce, Reuse, Recycle) and the Zero Liquid Discharge (ZLD) are pre-eminent. These approaches require reuse of virtually all wastewater discharged by an industrial facility and reduce total wastewater discharge. Polluted water must be treated and reused according to quality for various purposes such as watering plants and gardens.

Feasibility study of wastewater reuse

This study aimed to gather information on approaches to wastewater reuse implemented at different industrial districts located within the Map Ta Phut Industrial Estate, Rayong Province, Thailand. The study focused on three industry sectors: steel, chemicals and petrochemicals. The data were used to evaluate the wastewater reuse capacity for the Map Ta Phut Industrial Estate in order to develop an effective wastewater

management plan.

Treated wastewater can replace potable water for many activities such as irrigation, road or floor cleaning, use as cooling water in air conditioners or industrial processes that do not require high quality. Treated wastewater can also be used in some manufacturing processes, dust control in concrete manufacture, construction purposes, toilet water and water fountains. This saves costs and conserves high quality water for potable use.

Study area

This study was conducted at the Map Ta Phut Industrial Estate in Rayong Province, Thailand. The Map Ta Phut area comprises five industrial estates: Map Ta Phut Industrial Estate, Padaeng Industrial Estate, Asia Industrial Estate, Hemaraj Eastern Industrial Estate and RIL Industrial Estate; these are together referred to as the “Map Ta Phut Complex” (Figures 1 and 2). The Map Ta Phut Industrial Estate was the first to be established under the government’s policy to develop areas for the petrochemicals industry and other heavy primary industries which serve as upstream industries for other industry sectors.

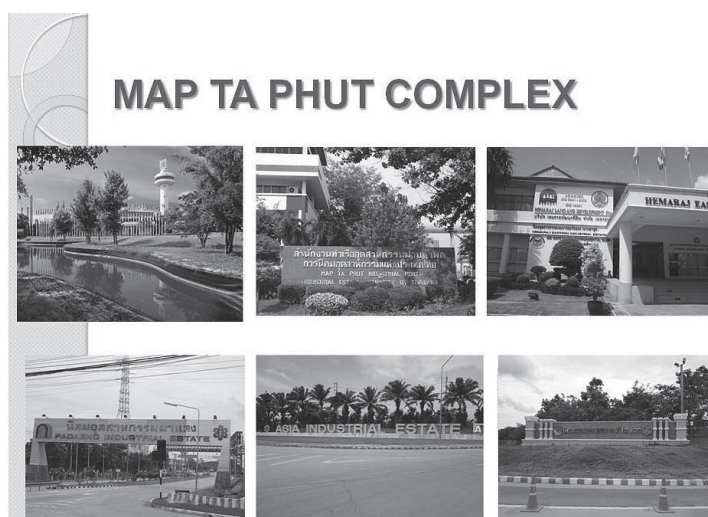


Figure 1: Map Ta Phut Complex

Source : Map Ta Phut Industrial Estate, 2013

Data collection

At present, steel, metals, chemicals and the petrochemical industry are the largest consumers of water in the Map Ta Phut Industrial Estate. Data were collected using surveys designed for the three industries, corroborated using primary data from field surveys to improve accuracy and robustness.

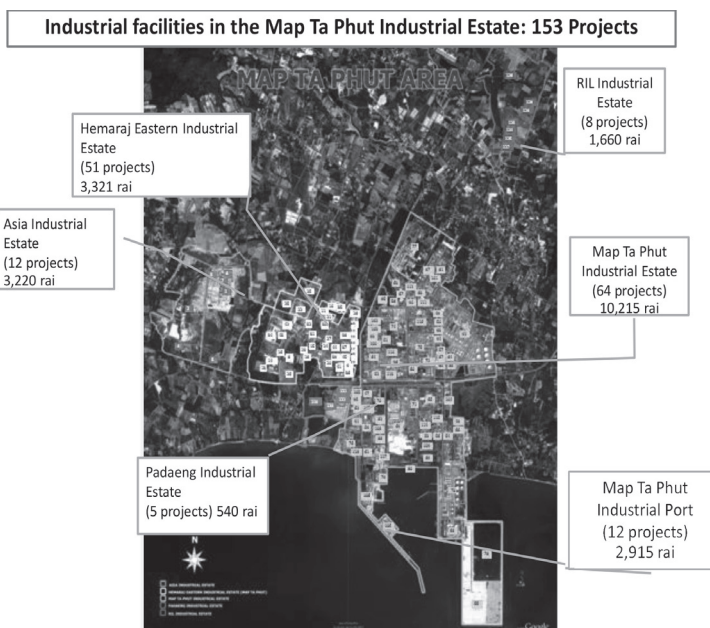


Figure 2 : Industrial facilities in the Map Ta Phut Complex

Source : Map Ta Phut Industrial Estate, 2013

Results

Analysis of surveys and field data revealed the following results, by industry category:

(1) Steel and metals

Two factories in this industry sector were found to implement the zero liquid discharge approach. They discharged no polluted water into the environment, and all wastewater was processed and reused in manufacturing processes. As shown in Figure 3, 20% of factories in this category reused more than 50% of its wastewater, while 10% reused 10-20% of the wastewater, but as many as 70% reused less than 10% of wastewater. This industry sector has high potential for reusing wastewater, particularly if the closed-recycle system is encouraged.

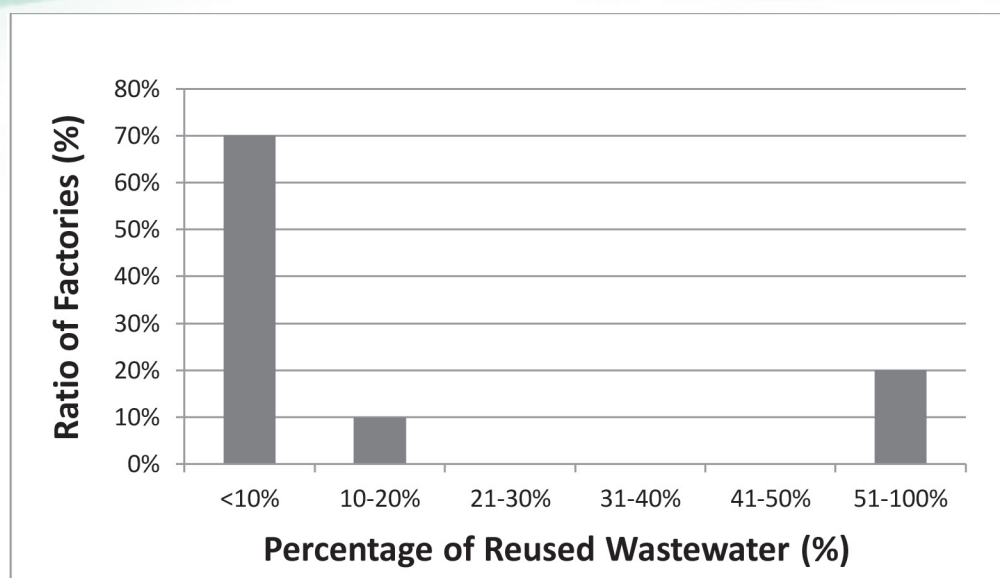


Figure 3 : Ratio of wastewater reuse in steel and metal manufacturing facilities

(2) Chemicals

Although some factories in this sector have attempted to implement the zero liquid discharge approach with a target of zero wastewater discharge within 2-3 years, none has so far reached this goal. As shown in Figure 4, only 14% of factories reused more than 40% of their wastewater, with 20% reusing

10-20%, while the percentage reusing less than 10% of wastewater was as high as 45% of the total. This industry could potentially reuse wastewater within manufacturing units using the water loop closure system together with the recycling approach.

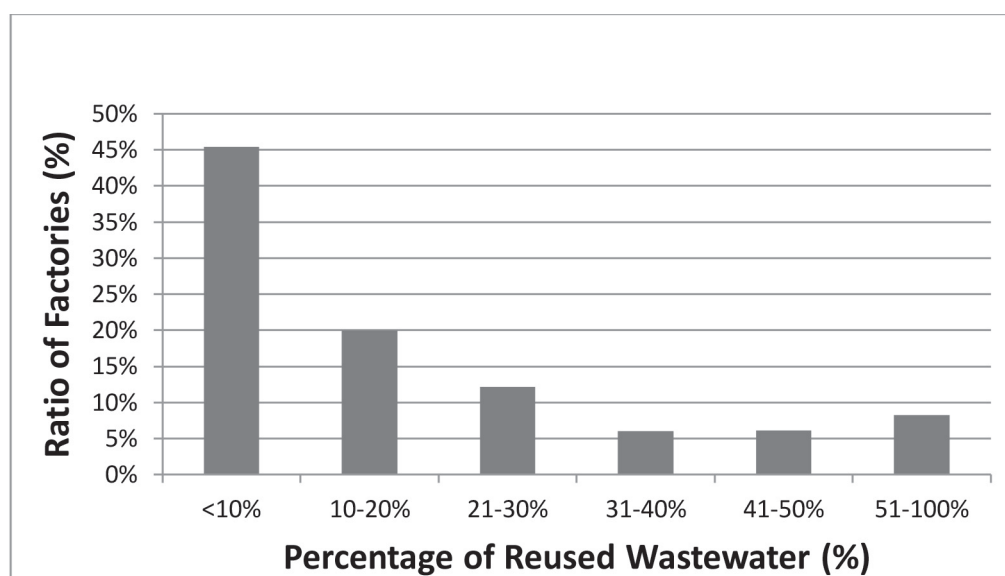


Figure 4 : Wastewater Reuse in chemical manufacturing facilities



(3) Petrochemicals

This study focused on two oil refineries, both of which consumed large quantities of water. These factories have implemented the zero liquid discharge approach, but neither has accomplished its goal. At the time of this study, wastewater reuse percentages for the two refineries stood at only 35% and 40%. This industry has a high potential for reuse of waste water if the closed-recycle system is employed together with reuse of wastewater in some manufacturing processes. Moreover, in the petrochemical industry, a high proportion of total water use is allocated to cooling and water feed, enhancing the potential for reuse.

Wastewater reuse in industry

Industrial wastewater from every industry can contain a wide range of toxic organic and inorganic contaminants including heavy metals. Reducing point-source pollution could be accomplished by changing products or adjusting various manufacturing parameters such as raw materials, manufacturing technologies, management or plant administration. Reuse and recycling of industrial wastewater could be accomplished either directly through using the wastewater directly in manufacturing processes, or by reusing the water following full physical, chemical and biological treatment.

Proposed guidelines for mitigating and reusing industrial wastewater

- ◆ Reuse of industrial wastewater should be incentivized using policy levers such as standards, tax and other privileges, in tandem with increased enforcement and penalties for violations.
- ◆ The responsibilities of industrial operators should be highlighted using social media and other communication tools to foster cooperation in reducing total water use and reducing emissions from production plants.
- ◆ Promote use of other tools to stimulate reuse of wastewater such as adapting technology, promoting knowledge management, distributing information, reorganising, developing of human resources and creating and bridging the network.

Acknowledgement

This article is part of the “Promoting Industrial Sector in the Map Ta Phut Industrial Estate to Increase the Reuse of Industrial Wastewater” research project, funded by the Industrial Estate Authority of Thailand.





Interview

Exploring Antarctica with the First Thai Marine Biologist: Ecological Linkages between Antarctic and Tropical Marine Ecosystems



Associate Professor Dr. Voranop Viyakarn was the first Thai marine biologist nominated by the National Science and Technology Development Agency (NSTDA) to participate in the 46th Japanese Antarctic Research Expedition (JARE-46). The expedition aimed to study the impact of environmental change on the marine ecosystem along the coast of the Japanese Syowa Station in Antarctica. The project ran from November 2004 to March 2005.

Assoc. Prof. Dr. Voranop Viyakarn is today the head of the Reef Biology Research Group, Department of Marine Science, Faculty of Science, Chulalongkorn University. His group was the first in Thailand to successfully cultivate mass coral cultures using sexual reproduction techniques. The project was supported by the Plant Genetic Conservation Project under the Royal Initiative of Her Royal Highness Princess Maha Chakri Sirindhorn (RSPG) and the Naval Special Warfare Command (NSWC), Royal Thai Navy. He is also a deputy director of two institutions: Chula Unisearch and the Thai Sea and Island Natural History Museum. Assoc. Prof. Dr. Voranop is a sought-after speaker who instills awareness among students, young people and the general public of the critical importance of conserving our priceless marine resources.

Can you tell us about the Antarctic research project?

“...I was only thinking about how my ongoing research projects could be applied when I was in Antarctica ...”

“At that time we were undertaking two research projects. The first was to study the environmental factors that affect reef organisms, including corals, while the second project was on using sexual reproduction techniques for restoration of reef ecosystems. Both studies were based on the premise that reef ecologies were threatened by both natural and human-induced



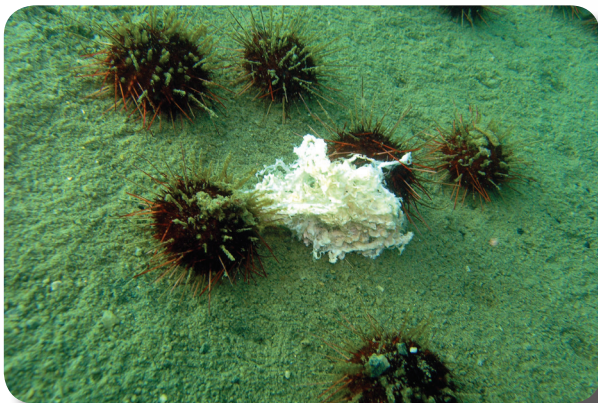


environmental change. We realized then that we needed to create the new basic knowledge to restore and rehabilitate the reef ecology. The Antarctic project explored the environmental factors affecting marine ecology, and drew comparisons between Antarctic and tropical ecosystems.”

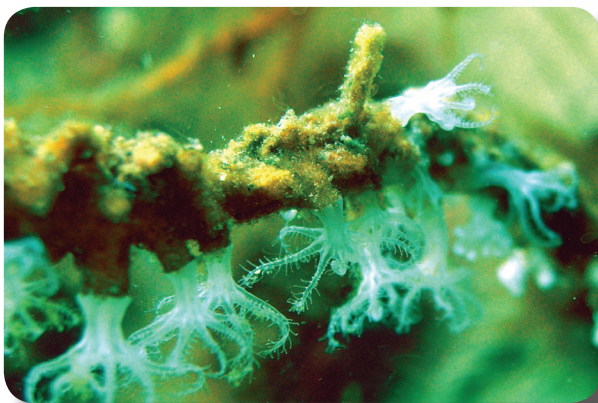
“The AGB Shirase, an icebreaker under the Japanese Maritime Self-Defense Force (JMSDF) embarked from Fremantle, Australia and traversed both the Pacific and Indian oceans. During this part of the journey, we studied the phytoplankton biomass in the Antarctic regions by measuring the underwater optic in various depths. The optical data from 20 research stations will be collected by using the Profiling Reflectance Radiometer. Then we investigated the feeding behavior of Antarctic fish by studying the stomach contents after AGB Shirase anchored on the sea ice area in front of the Syowa Station located at longitude of 39 degrees East and



First experience of the freezing Antarctic water beneath the sea ice
(water temperature was about -1 degree Celsius)



Red sea urchin
Sterechinus neumayeri (Meissner, 1900)



Stoloniferous soft coral
Clavularia frankliniana Roule, 1902

latitude of 69 degrees South. Our final task was to study the distribution of intertidal benthic invertebrates associated with macroalgae under the Antarctic sea ice. We also used scuba equipment to collect some living specimens under the sea ice.”

“The study showed low levels of chlorophyll from offshore areas, consistent with the low levels of phytoplankton found in the water mass. For fish collected by hook and line from various levels of depth, from 20 meters to 200 meters, we found three main species of fish. Emerald rockcod *Trematomus bernacchii* was the dominant species which found from all depths. Not significantly different of stomach content analysis explained the stability of the water mass below the sea ice, which was not disturbed by changes in currents, wind, temperature or other environmental factors, which remained mostly stable throughout the year. Therefore, we found that the fish, including marine invertebrates, in this polar region were well-adapted to live vertically between shallow to deep water. In contrast, tropical marine life could

not do that so they lived by selecting distinct habitats at different depths to suit with the daily changes of wind, waves, and tides. Scuba diving allowed me to experience the incredible world beneath the sea ice. There was an abundance of marine life resulting from the calm and stable environment underneath the sea ice, for example brittle stars, sea stars, sea urchins, soft corals, molluscs, and seaworms. We found lots of red sea urchins *Sterechinus neumayeri* with macroalgae adhering to the spines, different from decorated sea urchins in Thai waters that carried rubble, small stones, etc. on their back. We also discovered quite a bit about the feeding habits of the emerald rockcod. The fish would lie perfectly still on the seafloor and we could catch them with bare hands. They waited patiently for their prey to come within range before attack. This unique hunting behavior showed its adaptation to the harsh environment by minimizing unnecessary energy expenditure.”

From the first phase of the research to the present

“...The Antarctic research project supported by NSTDA may have ended, but if we continue the work, this might provide an opportunity for other researchers ...”

“We would say that our research project did not fully accomplish all our goals. “Why does it have to be the Antarctica?” One of our goals was to raise



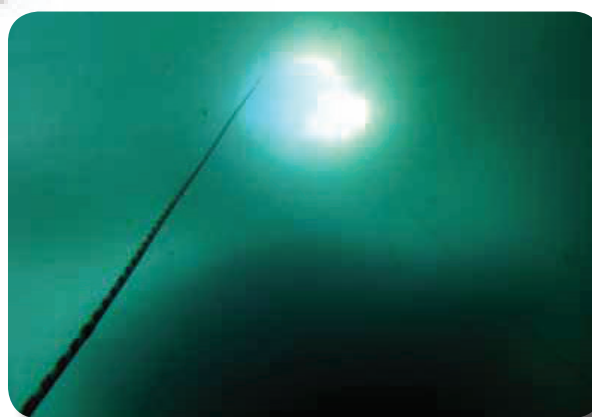
During specimens collecting under the water
(at about 10 meters depth; -1.0 degree Celsius)



Above : Emerald rockcod *Trematomus bernacchii* Boulenger, 1902

Below : Bold rockcod *Pagothenia borchgrevinki* (Boulenger, 1902)

the awareness of Antarctica among Thai young and stimulate their curiosity. At the time the main challenge was that Thailand was recovering from the Indian Ocean earthquake and tsunami that occurred on the 26 December 2004. However, we tried to maintain the relationship and collaboration with the National Institute of Polar Research (NIPR) in Japan, hoping that there would be an opportunity for other researchers to carry out their research projects in Antarctica. Finally, the dreams came true when Japan acquired a new icebreaker, under the same name of AGB Shirase II, in 2009. The new ship could accommodate 20 more researchers-a total of 80 researchers. Assoc. Prof. Dr. Suchana Chavanich, Department of Marine Science, Faculty of Science, Chulalongkorn University, was selected by NIPR to join the research team of JARE-51 to Syowa Station. She remained there from November 2009 to March 2010, continuing the research project on the feeding behavior of fish to evaluate climate change factors



“Lifeline”, the only one connecting hope for returning back
sea surface in case of emergency



that might affect the oceanic food chain. The research played an important role in strengthening relationship between Thai and Japanese researchers working in various fields in the Antarctic. Since 2011, the project has been promoted in the Climate Change Cluster, and is also supported by the Office of the Higher Education Commission and Chulalongkorn University under the National Research University project.”

“One interesting study finding was that feed behavior of fish had changed over the period 2004/2005 to 2010/2011. Even if the Antarctic krill and amphipod dominated the samples taken in both 2004/2005 and 2009/2010, but the ratio decreased drastically from 57–62% to 33–46%. In contrast, there was no squid and octopus found in 2004/2005, but they comprised 6-17% of the total samples in 2009/2010. Moreover, we also found parasites adhering to the fish and living in the stomach.”

“Asst. Prof. Dr. Onruthai Pinyakong, Department of Microbiology, Faculty of Science, Chulalongkorn University, who helped us in the study of diversity of bacteria and genes related to decomposition of toxic materials from Antarctic soils collected around the Syowa Station. She was surprised to discover the presence of Sphingomonas, a bacteria that degrades polycyclic aromatic hydrocarbons (PAH) in the soil samples. This finding could be important in predicting trends in natural degradation of PAHs in the study area.”



Melting sea ice during summer



A parasite found on a fish

Ecological Linkages between Antarctic and Tropical Marine Ecosystems

“...Everything is interconnected, air and water alike. Anything that happened to one may happen to the other...”

“Researchers in Antarctica are learning lessons from the past in an attempt to predict future trends in this pristine environment with no human habitation. The ice sheet, which can be more than 2,500 meters in average, has persisted for millennia through natural phenomena and planetary changes over time. For example, in the past, atmospheric carbon dioxide concentrations increased only very slowly, whereas now the rate has accelerated drastically in just two decades. We can track these changes over time through tiny air bubbles captured in the ice. If we do not act now to reduce our carbon dioxide emissions, we can expect more extreme climate events and natural disasters in the near future.”

“The fact that Antarctica is located far from other continents and remains untouched by human hands makes it an historic archive that captures the environmental impacts of human activities. Air and ocean currents carry pollutants to Antarctica, where they are retained within the ice. Antarctica’s isolation is its primary attraction as a location for studying the effects of climate change and pollution.”



“The changes in the emerald rockcod’s prey and the increasing numbers of parasites and herminths found in the fish illustrates the effects of rising sea temperatures on marine life in the Antarctic. We have not seen the same effects in tropical ecosystems, where rising sea levels threaten low-lying coastal areas and sea temperature rises of only 1 – 2 degrees Celsius threaten coral reef systems across the tropics. We need to understand the key drivers of these phenomena so we can prepare for inevitable changes and learn to adapt. Everything is interconnected, air and water alike. Anything that happened to one may happen to the other.”

How should we adapt to the changing environment?

“...Humans should realize the environmental changes happening all around us.

We should learn how to reduce the problem, adapt and prevent our activities from causing further problems. We have a duty to protect ourselves, our world and our future generations...”

“Thais tend to take our unique environment for granted; we tend not to care about what we can term our ‘natural capital’, which provides valuable natural resources that we can utilize. Instead of conserving nature, we exploit it. Then we try to recreate the nature that we destroyed, but when we fail, everybody loses. However, if we try to understand nature, and consume natural resources appropriately, we can slow down the alarming changes we see taking place around us, allowing us and the planet time to adapt.”

“...Thai scientists are renowned for their research abilities.

They are able to foster relationship and initiate global collaboration...”

“Our participation as global researchers contributes to the development of knowledge, ideas and research abilities. We contribute to the global research community and, currently, Thai scientists are renowned for their research abilities and their skills can be developed to become leaders in their respective fields.”

Associate Professor Dr. Voranop Viyakarn

Assoc. Prof. Dr. Voranop received a Royal Thai Government Scholarship to study in Japan from 1979 to 1993. He studied in Japan since high school until he completed his Ph.D. in Fisheries Science, mastering in Aquatic Biosciences from the Tokyo University of Fisheries (Tokyo University of Marine Science and Technology in present).

He is currently working on several research projects:

- 1) Corals and their relationship with other reef organisms
- 2) Corals cultivation using sexual reproduction techniques for reef restoration and rehabilitation
- 3) Climate changes and their impact on marine life and ecosystems
- 4) Culture of marine invertebrates to medical and pharmaceutical use
- 5) Reproduction biology and diversity of gorgonian
- 6) Fish nutrition and aquaculture





Tourism Industry Declined: Time to Reform Tourism Policy

The term “**Tourism Industry**” was firstly introduced to Thailand in 1987 when General Prem Tinsulanonda was appointed as a prime minister of Thailand. He promoted 1987 as the “**Thailand Tourism Year**” with the aim of distributing income to rural areas and areas with tourism potential. Gen. Prem’s new tourism policy stimulated development throughout the country. Some provinces were designated as primary or secondary tourist cities in order to attract more travellers, especially foreigners, to destinations across the country. The policy prioritized improvement of essential public facilities in key tourism destinations.

The success of the Thailand Tourism Year campaign led Thailand’s neighbours to adapt the same policy themselves, and Vietnam, Myanmar and Cambodia soon launched their own respective “**Tourism Year**”. As a consequence, competition among the tourism sectors of Thailand and its neighbours intensified. However, an assessment conducted before launching the 1987 Tourism Policy had shown that Thailand’s competitors were hampered by constraints to tourism development that reduced their competitiveness compared with Thailand. However, in recent years Vietnam, Myanmar and Cambodia have recently addressed many of these constraints; their new openness to tourism has greatly boosted tourist numbers in just a few years. The rapid advancement of the tourism sector among Thailand’s neighbouring countries provides good reason for Thailand to

seriously revisit and revise its tourism policy.

The 1987 tourism policy stimulated tourism development throughout the country. Tourism was promoted as one of the country’s key national priorities, but focused primarily on boosting tourist numbers and revenues. Responsible sectors were assigned to create a plan to promote tourism destinations that were important and unique, in order to attract different categories of tourist; each province created its own tourism plan to highlight its prime attractions. The policy was a success; since 1987 tourism has become a mainstay of the national economy. However, tourism pressure brought with it adverse impacts, particularly on the environment and local cultures. With few legal impediments to unfettered tourism development, environmental degradation, habitat destruction, traffic congestion and pollution have all reduced the attraction of traditional destinations, leading to a call for action to place limits on development and protect tourist destinations from adverse impacts. 25 years after introduction of the 1987 tourism policy, Thailand is now in urgent need of promoting new destinations and restoring the damage caused to many popular locations.





As a leader in tourism development in the ASEAN region, Thailand launched a tourism standard for various categories of tourism, in order to assess and certify tourist attractions and promote adoption of best tourism management practices. However, due to frequent political changes, the tourism standard policy was not effectively implemented, and adverse impacts on tourism destinations continued and accelerated as tourism numbers grow year by year.

Gen. Prem's 1987 tourism policy was highly successful in establishing Thailand among the world's top tourist destinations, and has since contributed immensely to economic growth. However, policies to stimulate sectoral growth need also to incorporate from the outset a mitigation strategy to reduce and prevent adverse social and environmental impacts that might result from the development, and also, to ensure that an equitable share of tourism revenues accrue to the adjacent local community.

From the fourth quarter of 2013, Thailand has suffered a period of continuing political unrest. Fewer tourists visited Thailand, especially Bangkok. However, tourists numbers rose for other major destinations such as Chiang Mai, Phuket and Songkhla. Thailand's National Tourism Strategic Plan

forecasts that by 2015, national tourism revenues will reach 2.2 trillion baht. But in order to reach this ambitious goal, and particularly in view of the impact of the recent political unrest, Thailand must review and reform its tourism strategy for the both the short and long term.

Agencies responsible for tourism need to urgently review their base assumptions and priorities, and analyze changing needs, priorities and demographics of today's tourists. For example, tourist expectations have changed vastly, and environment and local culture have become as important as accommodation, entertainment and transport infrastructure. Globally, the concept of sustainability has influenced all business sectors, and competitiveness today is increasingly defined by the long-term sustainability of the operation. The concept of sustainable tourism development is no longer an 'alternative'; for Thailand to retain and strengthen its competitiveness. It is essential to embed the principles of sustainability in both legislation and core business processes.

The increasing thirst for knowledge of local cultures has helped shape modern tourism attractions. In 2004, UNESCO proposed a global





programme to support and maintain cultural diversity. The Creative Cities Network project was launched to foster collaboration among cities and prepare them for the benefits and impacts of globalization and the increasing internationalization of tourism. The Network also aimed to strengthen the engagement between tourists and local people. The “Creative Tourism” framework was established to boost and maintain the following:

1. Engagement among participating cities
2. Cross-cultural engagement/Cultural experience
3. Spirit of place/deep meaning/understanding of the specific cultural of the place
4. Hands-on experience
5. Exchange information/transformation and transformative experiences
6. More participate than observe
7. Co-creative tourism experience
8. Authentic both process and product/genuine experience
9. Memorable (I hear and I forget, I see and I remember, I do and understand)
10. Tailor-made approach.

Due to the prolonged political crisis, the number of tourists visiting to Bangkok has fallen dramatically; tourists are evidently avoiding the

capital and are instead flying direct to other destinations such as Chiang Mai, Phuket, and Samui. In such situation, agencies responsible for Creative Tourism could well turn crisis into opportunity, in order to offer tourists this experience, which includes a glimpse of unique local cultures, arts, traditions and ways of life in the different regions of Thailand. Tourism businesses that ‘manufacture’ claims of uniqueness usually fail to impress tourists as they lack authenticity; on the other hand, the creative tourism concept carries tremendous possibilities to unlock the tourism potential offered by real local arts and cultures, and real communities. Moreover, creative tourism offers the opportunity to interact and exchange opinions and experiences with local people. Creative tourism development may progress relatively slowly, and certainly present new challenges for local people in terms of training and capacity building for local personnel, planning of activities, and facilities. However, the results are unquestionably beneficial; tourists will experience authentic destinations, cultures, and traditions, and revenues will be distributed to local people.

In order to promote restoration and best management of tourism destinations, there is an urgent need for a common monitoring and





evaluation framework. This will be an essential prerequisite for assessing local needs such as training or facilities etc., to ensure the tourist attraction, facilities and services meet visitor expectations. Entry fees and prices of food, beverages and souvenirs should be fair and reasonable, and local people should also be provided with relevant training, e.g. in languages and tourism site management.

To further strengthen the tourism sector, Thailand should adapt the policy to create a wider diversity of tourist attractions, in order to distribute tourists across the country and cater for specialized interests. This should present little in the way of technical challenges, but will nevertheless require efficient planning, coordination and logistics. Such a policy would boost tourist numbers and distribute more tourist dollars to local communities.

Most importantly, the genuine smiles and kindness of Thai people everywhere will stay with every visitor; a satisfied tourist is our best ambassador.

When the political situation has calmed, we are confident that tourists will return to Bangkok as well as to other attractions that offer creative tourism, and may be persuaded to spend more time in Thailand. We hope that this effort to enrich the tourism experience through collaboration and knowledge-sharing will help the tourism development to develop along a planned and sustainable trajectory.





Creative tourism is a new form of tourism that integrates both cultured-based tourism and creativity-led tourism as an approach to improve traditional cultural tourism.

Creative tourism can be considered a new travel paradigm and a new direction for tourism nowadays. This type of tourism considers sustainability as a main factor. It emphasizes the engagement between tourists, visitors or guests and their host destinations. Tourists get to experience specific cultural aspects of the places they visit through active participation in events at their destination. This results in a profound understanding and immersion in the local culture. The idea of creative tourism was initially created by the Creative Cities Network, a project under the patronage of UNESCO. The aim of UNESCO Creative Cities Network is to support cooperation among local communities for development at an international level and connect various cities together by creating new activities and creative tourism opportunities. Tourists can be part of the both the tangible culture of their destination such as cuisine and traditional costumes and the intangible culture which includes beliefs and cultural practices.

The development of creative tourism depends on the country's cultural and tourism capital. Cultural diversity determines a country's suitability for creative tourism. In the case of Thailand, the accumulated wisdom, cultures and the cultural diversity of various communities can be considered a great advantage. Moreover, the concept of creative tourism in Thailand was developed from the concept of "Creative Economy". OTOP Tourism Village was part of this concept. The policy was more obvious when the government issued the statement of creative tourism to the parliament in 2008.

Currently, there are several pilot projects of creative tourism in the areas managed by the Designated Areas for Sustainable Administration of Thailand. The Historical Parks of Sukhothai, Sri Satchanalai and Kamphaeng Phet offer activities on mud-soaked textile and the cooking of "Khao Poep", a form of soup noodle, at Ban Na Ton Chan, Sri Satchanalai; the production of "Sangkhalok" in Sukhothai; and the making of clay amulets of Nakhon Chum, Kamphaeng Phet. The designated areas for sustainable tourism in Loei province offer the making of cotton-padded blankets in Chiang Khan, Loei and the making of "Ton Phueng" or wax tree in Dan Sai, Loei.



Research Clinic

A Project to Enhance Research Capacity



Among the requirements for Chulalongkorn University to qualify as a World Class National University, the university must establish an excellent publication record in acclaimed international peer-reviewed journals. In light of Chulalongkorn University's commitment to its role as a leader in both academic research in the Kingdom, the Area-based Approach has been adopted in order to focus on research that addresses real-world problems relevant to Thailand. Research that contributes to the development of the agricultural and industrial sectors is especially encouraged. The University aims to serve as a repository of high-level knowledge that can be freely disseminated in order to benefit our society.

The University is committed to the aspirations of King Rama VI's that Chulalongkorn University become "*University of the Kingdom*". In order to help realize this vision, **Unisearch**, the University's agency for academic services, has offered its services to contribute to the university's mission. **Unisearch** has therefore launched its "*Research Clinic*" project to offer support for academic staff, researchers and post-doctoral students to assist in publishing their research in leading academic journals at national and international levels.

The Research Clinic also aims to assist academic staff with research grant proposals and research management to provide guidance on ethical issues and avoidance of potential conflicts of interest, and ensure the highest standards of excellence in the University's academic output. The Research Clinic operates through two main divisions, as follows :

1. Publication Support Division : In order to ensure the highest standards of excellence in submitted manuscripts, this division provides support for publication of research papers prepared by University academic staff, researchers and postdoctoral students.

The Research Clinic offers manuscript editing and evaluation services by a team of experienced native English-language editors familiar with the key academic fields covered by the scope of the Clinic's mandate. By using the Clinic's services, authors benefit not only from a submission-ready manuscript, but also from a first-level unbiased academic critique, allowing early correction or clarification prior to submission for peer review. Manuscripts may be submitted in all typical academic formats, including the following:





-  manuscripts for national/international research journals
-  book chapters
-  manuscripts for encyclopedia entries
-  short communications.

2. Research Support Division : This Division provides support for research projects under the **Unisearch** research management service. (Research projects supported by the National Research University Project of Thailand (NRU) and the Research Cluster are not included). In order to be considered for publication, the manuscript must first be granted official permission by its funding body. Our current capacity allows us to support the publication of up to 20 research articles and academic articles per year. Services include:

 Editing of manuscripts by native English - speaking editors who are also subject matter specialists in their respective fields.

 Financial support for manuscripts/ research articles that are accepted for publication.

Overall the two above Divisions of the Research Clinic project framework are designed to serve the University's strategy by delivering five categories of services:

1. Publication Service : assistance in editing English-language research articles and reports for submission/publication in research journals at both national and international levels.

2. Research Information Service : supplies news and information about research to academic staff, researchers and postdoctoral students.

3. Research Training Service : offers various types of professional development training for



academic staff, researchers and postdoctoral students, such as training on successful proposal-writing techniques to pursue research funding, research methodologies and effective research management techniques.

4. Research Sharing Service : hosting of regular talks by successful researchers to share insights and experience in addressing the many challenges faced by researchers and research managers.

5. Research Mentor Service : provides a consultation and mentoring service for academic staff, researchers and postdoctoral students, including guidance on ethical issues and conflicts of interest.

Unisearch is confident that the Research Clinic will make a significant contribution to the elevation of academic standards and the publication record of Chulalongkorn University, and also to realize the University's goal of becoming *"a primary source of knowledge and references for the Kingdom; an intellectual leader for sustainable development"*.

Academic staff, researchers and postdoctoral students associated with Chulalongkorn University are invited to follow us, **"Research Clinic"** at www.unisearch.chula.ac.th or contact 02-218-2880 for further details.



HRH Princess Maha Chakri Sirindhorn attended the opening ceremony of “Smile Milk” in Chiang Mai



On Thursday 23rd January 2014, HRH Princess Maha Chakri Sirindhorn presided over the opening ceremony of “Smile Milk” at the Office of Academic Affairs, Chiang Mai University in Chiang Mai. The Princess was welcomed by Prof. Mongkol Techakumphu, DVM, Ph.D., CEO and Assoc. Prof. Thavivongse Sriburi, Ph.D., Managing Director.

The new 65 m² Smile Milk outlet serves as a model shop and is supported by FTA funds, the Ministry of Commerce and *Chula Unisearch*. The objective is to create novelty and add value to dairy products under the “Smile Milk” trademark. The majority of products available are manufactured from fresh milk from dairy cooperatives in Chiang Mai. The outlet aims to support local dairy farmers: an alternative occupation provided by His Majesty King Bhumibol Adulyadej since 1962.

Smile Milk is one of the results of the project: “*Research and Development of Thailand’s 100% Fresh Milk Marketing Strategies Mechanism*”, undertaken by *Chula Unisearch* on behalf of the Department of Foreign Trade since 2010. The project aimed to develop marketing strategies to address the problem of periodic market surpluses of milk in the Thai market. Under the leadership of Assoc. Prof. Nopparat Rungouthaisiri, the project opened the “Smile Milk” franchise to sell drinking milk and processed dairy products manufactured from Thai fresh milk. Currently, Smile Milk is establishing 3 model shops and is also developing a franchise. For more information, please visit www.smilemilkthailand.com.

“CREAM #7” seminar opening ceremony

On Tuesday 28th January 2014, Prof. Pirom Kamolratanakul M.D., Chulalongkorn University’s president, presided over the opening ceremony of the 7th generation of a training course “*CREAM #7 (Competent Robust Efficient Agile Manager)*”. Prof. Pirom was also a special lecturer on the subject “*Chulalongkorn University’s Challenges in the Future*”, attended by 64 participants to inform of Chulalongkorn’s journey towards excellence.



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Unisearch has organized this professional development programme since Generation 1, with the objective to equip Chula managers and administrative staff with improved understanding of effective undergraduate study management, enhance leadership skills, and increase the efficiency of operation in order to drive Chulalongkorn University towards its goal of academic excellence. The seminar included lectures, group discussions, brainstorming sessions and case studies, field trips and reports, with a total 117 training hours. CREAM #7 seminars are held every Tuesday from 28 January – 17 June 2014 at Meeting Room 201, Chulalongkorn Research Building.



CU-SCG Industrial Think Tank

Under a Memorandum of Understanding on R&D between Chulalongkorn University and the Siam Cement Group (SCG), the “*CU-SCG Industrial Think Tank*” was held on Thursday 6 March 2014 at Hall 1, 10th Floor, Anek Prasong Building at Siam Cement Group, Bang Sue. The event was held to promote cooperation in developing many fields of research.



This meeting provided an opportunity for lecturers and leading researchers from Chulalongkorn University and SCG to exchange views and experiences and explore areas of cooperation in product R&D. The meeting was led by Prof. Mongkol Techakumphu, DVM, Ph.D, Vice President Research and Innovation, and Assoc. Prof. Pintip Pongpetch, Ph.D, Committee Chairman of Research Coherence Drive to Industry, and was accompanied by lecturers from several faculties and institutes, including Prof. Bundhit Eua-arporn,

Ph.D, Dean of the Faculty of Engineering; Prof. Tharapong Vitidsant, Ph.D, Director of the Energy Research Institute; Assoc. Prof. Sompong Sirisoponsilp, Ph.D, Director of the Transportation Institute; Asst. Prof. Ekasit Nisaratanaporn, Ph.D, Director of the Metallurgy and Materials Science Research Institute; Assoc. Prof. Pramoch Rangsunvigit, Ph.D, Director of the Center of Excellence on Petrochemical and Materials Technology; Assoc. Prof. Orathai Chavanparit, Ph.D, Environmental Specialist and Mr. Supichai Tangjaitrong, Ph.D, Director of the Department of Industrial Association Development, Chula Unisearch. In addition, a number of lecturers delivered lectures on the potential

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and progress in research in a range of fields at Chulalongkorn University. Participants were warmly welcomed by Ms. Vilaiporn Jetanajun, Ph.D., Director of the Technology Institute and Ms. Chawiwan Witchuphanun, Senior President of Technology Alliance, Siam Cement Group.

The event allowed Chula lecturers, SCG specialists and researchers to exchange information on the progress of research in the fields of energy, environment, materials science, ICT for supply chain development and petro-chemicals. Ideas from the conference contributed to R&D cooperation in these diverse fields. This is considered as part of Chulalongkorn University's active research policy to transfer research to industry, which can apply them for commercial benefit.



"The Prospect #5" seminar opening ceremony

On Tuesday 18 March 2014, Prof. Pirom Kamolratanakul M.D., Chulalongkorn University's President, presided over the opening ceremony of *Chulalongkorn University's Academic Directors Seminar or "The Prospect #5"*. He also delivered a special lecture on *"Chulalongkorn University's Strategies"* to the 36 participants so that they are informed and ready to support the University's executives in bringing their units to meet the University's goals and missions.

Unisearch was assigned by Chulalongkorn University to organize *Chulalongkorn University's Academic Directors Seminar or "The Prospect #5"* from generation 1 to the latest generation 5. The objective is to enhance the performance and readiness of academic directors to support the university's executives. The seminar focuses on professional leadership, management and networking skills to equip staff for possible future roles as executives. It utilizes innovations in conducting lectures, group discussions, self-assessments, learning networking, field trips and other activities offered by participants over a total of 129 training hours. Seminars under the course were held from 18 March-29 July 2014 at Meeting Room, 7th floor every Tuesday, and at Meeting Room 201, 2nd floor every Thursday and Saturday at Chulalongkorn Research Building.



Bangkok Festival: Eco Friendly City

Unisearch, and the Department of Environment, the Bangkok Metropolitan Administration, held “*Bangkok Festival: Eco Friendly City*” under the Bangkok Green City project from 22-23 March 2014 at Activity Zone A, B, Asiatique Riverfront with Mr. Jumpol Sampaopol, Deputy Bangkok Governor, presided over the ceremony. The festival aimed to raise awareness among Bangkok’s residents of preparations for Bangkok’s Green City programme and its activities on environmental issues. These included the Bangkok Green City Exhibition, which is divided into 3 zones: 1) the HM The King Honor Exhibition and Bangkok Green City Exhibition; 2) the Academic Networking Association Exhibition; and 3) the Green Private Networking Association. The exhibitions included booths and showcases (e.g. the Zero Baht Shop and Green Market) and on-stage activities such as discussions on environmental issues. All in all, the festival attracted a great deal of interest; with over 1,000 visitors in total.



Unisearch Activities News

Unisearch’s 28th foundation anniversary ceremony



14 February is *Unisearch’s Foundation Day*, and in 2014, *Unisearch* celebrated its 28th anniversary with a ceremony to make merit and dedicate food and offerings to 9 monks. On this occasion, Prof. Pirom Kamolratanakul M.D., Chulalongkorn University’s president, including deans, directors, lecturers and researchers from many faculties and institutes participated in the ceremony, together with *Unisearch* executives and staff.



Unisearch 2014's staff seminar



From 27 February - 2 March 2014, *Unisearch* held its 2014 staff seminar to promote unity, understanding and spirit among the organization's executives and staff, and to help prepare the organization to support the university's policy to become a world-class tertiary education and research institution. The seminar was conducted in two parts: the first, conducted on 27 February, focused on the theme of *"Efficient Project Management Regulations"*. The objective was to promote understanding in the Unisearch's new rules and regulations, and to offer Unisearch staff an opportunity to contribute to work processes relating to the university's rules and regulations. Moreover, they can exchange their knowledge on project management and offer sustainable solutions to problems which will promote more effective and efficient project management.



In its second seminar, *Unisearch* executives and staff participated in a seminar under the theme: *"High Effective Team Building"* from Friday 28 February – Sunday 2 March 2014 at Centara Grand West Sands Resort & Villa Hotel, Phuket. The objective was to promote unity and understanding among executives and staff, and enhance teamwork skills. On this occasion, *Unisearch* executives (Prof. Mongkol Techakumphu, DVM, Ph.D, CEO; Assoc. Prof. Dusadee Sanguanchart, Executive Director; Assoc. Prof. Thavivongse Sriburi, Ph.D, Managing Director; Assoc. Prof. Voranop Viyakarn, Ph.D, Deputy Director; and Miss Saowanee Wijitkosum, Ph.D, Deputy Director) joined the team building activities and offered guidance to participants to contribute to organizational growth and support the development of staff potential.



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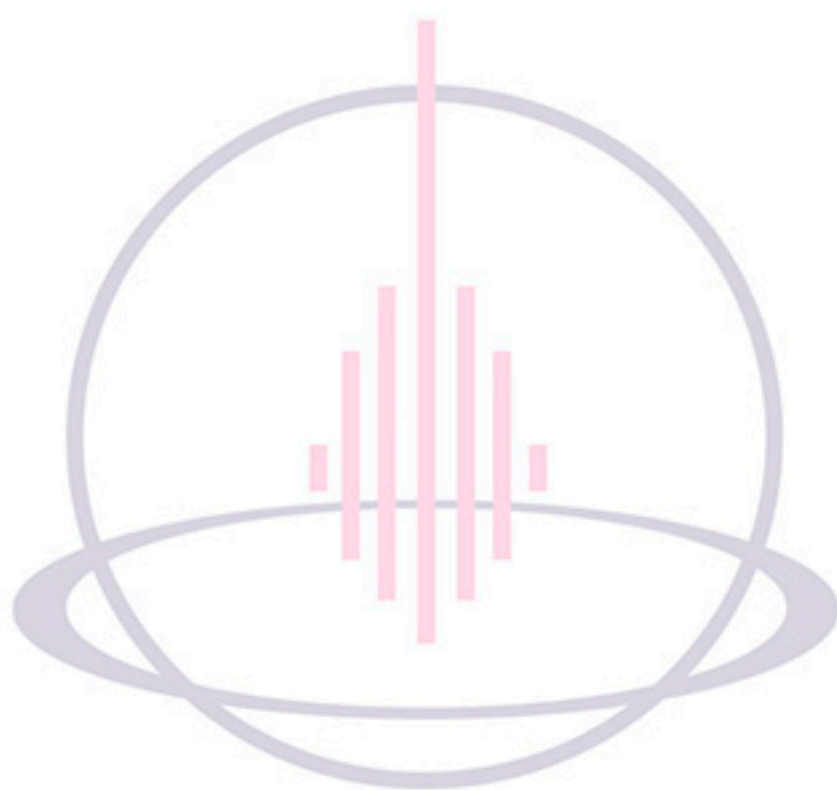
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