

## **Survey Study on Cultural Ecology of Wild Herbs for Geographic Information System Creation Wat Khao Bang Sai, Chonburi Province, Thailand**

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### **ABSTRACT**

**Introduction-** This study objective was to investigate the diversity of medicinal plants or wild herbs in order to create the geographic information system at the cultural forest Khao Bang Sai Temple, Chonburi province. This study was a mixed-method research for creating an innovation using documentary study and the data collection was conducted using survey and fieldwork including in-depth interview, observation form, and focus group discussion in order to study local wisdom in the utilization of medicinal plants. The data of medicinal plant varieties were then analyzed and the results were used to create the geographic information system (GIS) at Khao Bang Sai Temple, Chonburi province.

For the knowledge of medicinal plants, the results showed that medicinal plants were used as both food and medicine. These medicinal plants were used by the folk healers to treat patients with 9 groups of symptoms and the parts commonly used in the herbal medicine formulation were roots, fruits, leaves, and stems. For the biodiversity of medicinal plants, it was found that the area around Khao Bang Sai Temple, Chonburi province is a conservation area, and the ecosystem in this area is still abundant. More than 30 species of medicinal plants were observed and were collected in order to create the database and the geographic information map on the distribution of medicinal plant varieties. In addition, the coordinates of medicinal plants were also specified using the Global Positioning System (GPS) and the characteristics of the foothill vegetation obtained from field data collection in form of digital map data, along with an attribute database consisting of types, names, and locations of medicinal plants using ArcGIS software to provide the guideline for medicinal plants management at Khao Bang Sai Temple, Chonburi province. Therefore, this study contributes to the dissemination of information on the value of medicinal plant resources in this area and makes people aware of the benefits of medicinal plants in natural resources.

### **Keywords**

diversity, medicinal plants, geographic information system

### **INTRODUCTION**

Cultural and herbal wisdom in Thailand from the history of the Buddha era was mentioned in the Tipitaka such as turmeric, ginger, long pepper, Myrabolan, asafoetida, etc. Herbs in the Eastern region also show the most advancement. Because in addition to having the herbal pharmacopeia with a long history, systematic research and development and processing from raw materials into finished products are also promoted. Thai people believe in and use traditional herbal medicine due to the influence of China and Indian traditional medicine along with the spread of Buddhism. Nowadays, “Thai wisdom” or “local knowledge” which is the management of both local knowledge and modern knowledge is used in economic and social development. The foundation of life and culture of Thai people is bound to nature with appropriate resource management based on knowledge from actual experiences accumulated for many generations. Both traditions, beliefs, and religious ceremonies result in a variety of local knowledge in various aspects and result in a beautiful culture (RanidaPingmuang, 2017: 375-389), especially the treatment and use of herbs as food and medicine. As we focus on the development of globalization and the spread of culture focusing on modern technology and science, together with the lack of attention from

the government, the Thai way of life has changed, nature has been destroyed and some archaeological sites are deteriorating.

Forest is an extremely valuable resource and is at the heart of the environment, consisting of soil, trees or vegetation, wildlife, and various organisms. In addition, the forest is also a large source of water absorption, which has both direct and indirect benefits for humans. Forest is considered the most important genetic collection of organisms. Such organisms may be valuable as a source of raw materials for the production of medicines and natural chemicals, maintain the environmental balance, and as the source of the four requisites for human beings. A human can take a variety of advantages from the forest. However, as the population rapidly increases, the use of forests also increases and exceeds the forest's production capacity (TuenchaiKosakul and AruniChantarasnit. **2019: 2**).

Since ancient times to the present, the human way of life has relied on biodiversity of forests, environment, water, soil, and natural ways interconnected for centuries in an interdependent manner. People in the community have relied on collecting forest products, hunting and collecting vegetables that grow in the forest for food, as well as collecting herbal medicines to treat illnesses and using trees and natural materials to build houses and shelters. All of these are valuable for economic, social, cultural, natural, and natural development and contribute to the continuous common development of communities and forests (SuratsawadeeSinwat.2019 :1) Therefore, the forest is considered as a breadbasket of people in the community, which promoted well-being and a creative and natural way of life in the community. Deforestation, in which the forest is like a large center of food and herb for organisms, has severely affected the lifestyle and well-being of the community, causing many problems in the community (BenjapakCharoenmahavit. 2018: 2204).

There is herbal production across Thailand, with a total area of 34,936 rai of commercial production in 2014 and a total production of 295,304 tons. The area of commercial herbal production is reduced by 18% from 2013 with a total survey area of 42,553 rai. This is because farmers have encountered problems regarding the clarity of the herb market, resulting in the change to other types of agriculture. Moreover, the demand for higher quality and standard herbal raw materials is another obstacle to the Thai herbal market as there are only 1,185 farmers certified with good agricultural practices from 9,015 households. A lot of farmers need to improve the production quality including control of the use of chemicals; microorganisms, mold, and heavy metal contamination; and the production process to meet the organic standard (Department of Thai Traditional and Alternative Medicine. 2018: 9). Knowledge of medicinal plants is derived from cultural knowledge, experimentation, selection, and knowledge transfer in the community and society for consecutive years and is learned from the reality of life. Herbs are used in treating diseases as a part of traditional medicine of Thai society for a long time before Western medicine or modern medicine became widespread as today. Thai folk medicine, including the use of herbs, which are traditional wisdom of Thai people, is still a reliable and alternative way of health care for Thai people, especially in rural areas (PhenaphaTipsurat. 2020: 1).

Khao Bang Sai Temple, Mueang District, Chonburi Province is a temple with historical significance and most importantly, in the past, people in this area used a lot of medicinal plants together with the knowledge of local wisdom of folk healers in the community. But nowadays, medicinal plants are scarce and at the same time the local wisdom of folk healers is not well-known as in the past and it is worthwhile to utilize natural herbs in the area for the benefit of the community (SuratsawadeeSinwat. 2019:1-2). These medicinal plants are sources of important, rare, endangered herbs. This temple is located in a mountainous area adjacent to the area of the

21st Infantry Regiment, Queen Sirikit's Guard and is considered an upstream herbal forest that has been preserved and remains intact to the present day. The initial survey shows that there are at least 5 types of important herbs. These herbs are important ingredients of the recipes used to treat symptoms such as skin diseases, digestive diseases, vermicide, etc. For this reason, the researcher is interested in conducting research to explore and analyze the ecology of soil, water, and forests, in order to study the factors affecting the survival and growth of these important herbs by creating a geographic information system. In addition, the coordinates of medicinal plants or wild herbs are also specified. This is to preserve and propagate these important, rare, and endangered medicinal plants by using appropriate technology to be sufficient to be used as Thai traditional medicine, which is a sustainable culture of health care

### **Significance of the study**

1. Gain knowledge of the herbs in the community which can be used by Thai traditional medicine and villagers.
2. The survey and analysis show the diversity of important and rare medicinal plants to be used in preparing medicinal recipes leading to the guidelines for preserving the culture of herbal forest in the community which can be used by the Department of Thai Traditional and Alternative Medicine, Ministry of Public Health and National Office of Buddhism or other related departments.
3. The geographic information system helps in specifying the coordinates and the origin of medicinal plants, which are beneficial to educational institutions related to herbs, especially the Department of Thai Traditional and Alternative Medicine, Ministry of Public Health.
4. The findings of the research can contribute to good academic results, research dissemination, and enhancement of Thai traditional medicine wisdom, which is a culture of Thai health care, to national and international level and can be used by researchers or those interested in Thai traditional medicine as reference for further research.

### **Research objectives**

This research aims (1) to investigate the diversity of medicinal plants used to treat important symptoms of the disease, and (2) to create the geographic information system of important herbs at Khao Bang Sai Temple.

### **Research questions**

1. How diverse are the medicinal plants such as origin, species, topography and the parts commonly used in the herbal medicine formulation for treating important symptoms.
2. How to collect the geographic information of herbs in the forest area of Khao Bang Sai Temple?

### **Scope of research**

**Content:** The scope of content according to the purpose of this research was as follows:

1. To investigate the diversity of medicinal plants varieties used to treat important symptoms of the disease.
2. To collect the geographic information of important herbs in the forest area of Khao Bang Sai Temple.

**Study design:** This study was a mixed method research for creating an innovation using documentary study, content analysis and data analysis in which the data collection was conducted using survey and field study including in-depth interview with open-ended questions, observation

form obtained from focus group discussion and a workshop on the history of Khao Bang Sai Temple. In addition, the ecosystem of herbal forest was then analyzed and the results were used to create the geographic information system (KitawitSook-Oung and Noppadon Kweawchan,2020: 1-10).

**Duration:** This study was conducted during August – October 2019.

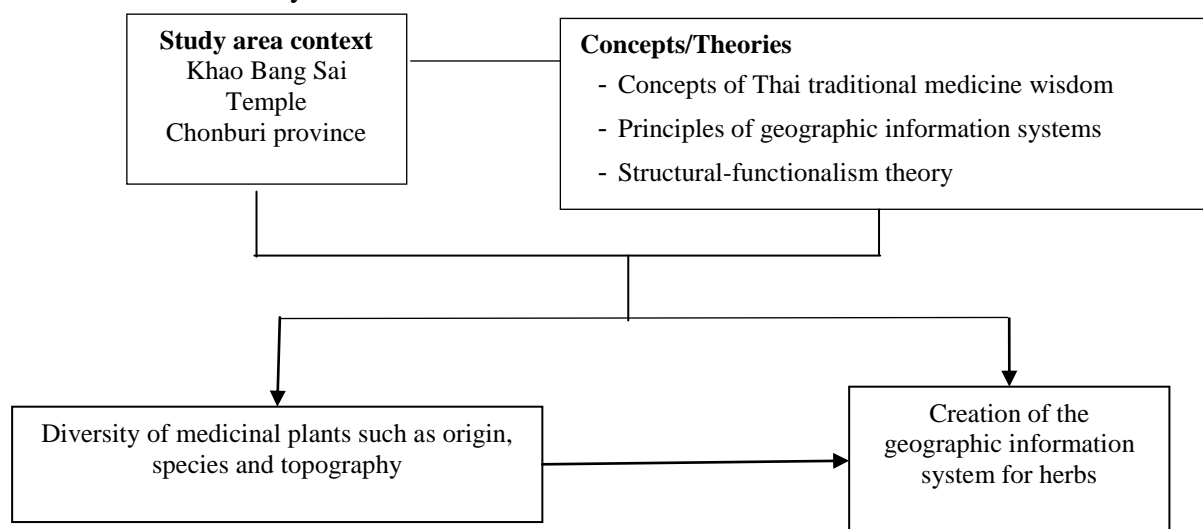
**Study area:** The criteria for selection of the study area were as follows:

1. The area with promotion of school botanical garden in Khao Bang Sai Temple.
2. The wood lot area around the important historical sites of the nation and the Thai monarchy that must be preserved and restored for the preservation of arts and culture.
3. Conservation area, herbal forest at Khao Bang Sai Temple, Chonburi province.

From the above-mentioned criteria, the forest area at Khao Bang Sai Temple (Royal Temple), Chonburi province was selected

## CONCEPTUAL FRAMEWORK

This study aimed at investigating the diversity of medicinal plants varieties in order to create the geographic information system at Khao Bang Sai Temple, Chonburi province. This study was a mixed method research for creating an innovation using 2 qualitative research methods which were field data survey and collection and innovative research method.



## RESEARCH METHODOLOGY

The study of diversity of medicinal plants varieties in order to create the geographic information system at Khao Bang Sai Temple, Chonburi province was a mixed method research for creating an innovation using 2 qualitative research methods which were survey and field work for collecting data of local wisdom from local leaders, heads of government, Buddhist monks and general public as well as the innovative research method.(Songkoon Chantachon,2020 : 118-151)

**Population and sample:** population of qualitative research were community leaders, heads of government, Buddhist monks and general public. Purposive sampling method was used which resulted in a sample of **23** people consisting of: (1) Key informants, consisting of (a) 1 Abbot, (b) 1 Mother superior, (c) 3 Doctors and specialists in Thai traditional medicine, (d) 2 Scholars/ village scholars in Thai traditional medicine. (2) Causal informants, consisting of (a) 3

Buddhist monks, and (b) 3 Nuns. (3) General informants, consisting of 10 interested general public

**Research Tools and Quality Testing** in the qualitative study consisted of (1) Data collection: The researcher collected the primary data. (2) Observation: Participant and non-participant observation. (3) Structured interview and unstructured or open-ended interview or in-depth interview. (4) Focus group discussion for general informants. (5) Workshop for summarization of the for accurate and precision of all the data conducted 10 experts

**Preparation of geographic information system:** The geographic information system was prepared using the following tools: (1) Vector map, (2) GPS: Global positioning system, (3) GIS software, (4) Camera and voice recorder.

**Data collection:** (1) Literature review such as population, topography, climate, vegetation, herbs, rainfall, etc. (2) Survey of hiking routes, resource usage and resource management such as firebreak, fence and forest protection system of related organizations. (3) Survey and collection of medicinal plants varieties by the survey of herb gathering routes with the cooperation of the people and Thai traditional medicine doctors who had expertise in routes and knowledge of herbs.

Innovative study consisted of survey of sources of important herbs used to treat important symptoms of the disease and the location of important places at Khao Bang Sai Temple in order to specify the geographic coordinates for creating the Geographic Information System (GIS). The research tool in this study was the Geographic Information System which is the computer-based spatial data processing used to define data and information related to spatial positions.

Data analysis Initial data validation was performed simultaneously throughout the research period and once the field data collection is complete. The data from the records, interview transcription, and photography was categorized as specified by the researcher. The data completeness and reliability were determined using triangulation method to obtain information according to the research objectives. If there is any part incomplete, the additional data collection would be collected for the missing part.

**Data presentation:** the data was analyzed using descriptive analysis to explain the purpose of the research, including a diversity of medicinal plants and the preparation of geographic information system by using theoretical concepts as well as the conceptual framework of relevant literatures and the data was presented with some illustrations.

**Expected results:** (1). The findings of this study can contribute to good academic results, research dissemination and enhancement of Thai traditional medicine wisdom, which is a culture of Thai health care, to national and international level and can be used by researchers or those interested in Thai traditional medicine as reference for further research. (2) Provide the academic literature as the useful reference of the academic research results. (3) The species and origin of not less than 100 important herbs were observed. And (4) the findings of this study can provide new treatment methods which can be used as a guideline to promote further medical research in the utilization of other medicinal plants.

## RESULTS

The results of this study were divided and presented according to the objectives as follows:

1. The diversity of medicinal plants used to treat important symptoms of the disease.

1.1 Topography: Khao Bang Sai Temple, Chonburi province has the forest area of approximately 200 rai and is located at the latitude 13°39'N, longitude 100°99'E. This area is a

conservation forest under the Department of Fine Arts, Region 7 and the 21<sup>st</sup> Infantry Regiment, Queen Sirikit's Guard and is under the supervision of Khao Bang Sai Temple. The soil in this area is sandy loam. There is no permanent stream in this area, but there are streams formed only during the rainy season which result in capillary water flowing as small streams down to the foothills.

According to the Climatological Center, Meteorological Development Division, Meteorological Department, total annual rainfall in Chonburi province in January 2019 is more than 1,200 millimeters. In particular, Mueang district had total annual rainfall of 1,295.6 mm with 120 days of rainfall. The wettest period is September, with an average rainfall of 268.9 millimeters and 20 days of rainfall. The highest rainfall in 24 hours measured in this province is 319.6 millimeters. There are some depression tropical cyclones during October and November each year. The temperature in Chonburi province does not change much since this province is located near the sea. The weather in winter is not very cold with average temperature of **28.5** °C throughout the year.

For the diversity of medicinal plants, it is found that the soil in this area is sandy loam which herbs grow in sparse forests, tropical areas on sandstone mountains consisting of various types of vegetation such as tubers, climbers, grasses, bamboos, shrubs and medium and large sized perennial plants. There is no important water source except small streams and groundwater as capillary water which keep the plants moist. There are also wild animals such as reptiles, small four-legged animals, various birds and insects. These resources complement each other, forming a food chain and eco-diversity. Therefore, this area is a center of various important herbs to be used in the treatment of important symptoms of the diseases in Thai traditional medicine.

## 1.2 Type of vegetation

- 1) Unicellular plants: Unicellular plants represent more than 80% of the total plants consisting of grasses such as Lalang, bamboo and other grasses which are the habitats of insects, birds, rats and reptiles. In addition, there are also tubers such as potatoes and medicinal tubers.
- 2) Shrubs can be found at patch such as Siam weed and *Dregea volubilis*. Shrubs are the habitats of small birds and insects.
- 3) Perennial plants. Many species of perennial plants were found such as Indian *Phyllanthus emblica*, *Terminalia bellirica* (Gaertn.), *Bridelia ovata* Decne, *Dalbergia cochinchinensis*, *Pterocarpus macrocarpus* and *Dalbergia oliveri* Gamble. These perennial plants are the habitats of wild animals such as bird, snake and reptiles like chameleon.

## 1.3 Diversity of medicinal plants used to treat important symptoms of the diseases.

There are many herbs found in the forest area of Khao Bang Sai Temple that can be used as a medicine to treat patients with all 9 groups of symptoms listed in the following table.

### 1) Gastrointestinal tract

No.	Common name	Scientific name	Family	Part used	Properties	Coordinate	
						Latitude	Longitude
1	Ragah	<i>Bridelia ovata</i>	Euqhorbiaceae	Leaf	Mild laxative	13.395915	100.99234
2	Belleric Myrobalan	<i>Terminalia bellirica</i>	Combretaceae	Fruit	Laxative, antidiarrhoeal, anti-dysentery	13.394694	100.992472

3	Angola Pea	<i>Euphorbia neriifolia</i>	Euqhorbiaceae	Leaf  Gum	-Pound and mixed with alcohol, mask to relieve abscess, pain, antidote - Mild laxative, vermifuge	13.396528	100.990417
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## 2) Restorative tonic

No.	Common name	Scientific name	Family	Part used	Properties	Coordinate	
						Latitude	Longitude
1	KoKhao Khlon	<i>Dregeavolubilis</i> (L.f.) HooK.f.	Asclepiadaceae	Root	2) Restorative tonic, antipyretic, anti-cholecystitis, promote sleeping	13.394917	100.99325
2	Bale fruit	<i>Aeglemarmelos</i>	Rutaceae	Raw fruit	Restorative tonic, increase appetite, refreshing drink	13.39575	100.99263
3	Fame Flower	<i>Talinumpaniculatum</i>	Portulacaceae	Rhizome	Nourishing, restorative tonic elemental tonic, reduce fatigue, galactic	13.396516	100.990415

## 3) Vermifuge

No.	Common name	Scientific name	Family	Part used	Properties	Coordinate	
						Latitude	Longitude
1	Ebony tree	<i>Diospyros mollis</i>	Ebenaceae	Fruit	Vermicide	13.395757	100.991256
2	Afzelia wood	<i>Afzeliaxylocarpa</i>	Leguminosae Caesalpiniaceae	Stem	Vermifuge, treatment for hemorrhoid, Dermatologic agents	13.394861	100.993806
3	Ankota	<i>Alangiumsalviifolium</i>	Alangiaceae	Fruit	Elemental tonic, vermifuge, relieve colic	13.393416	100.995861

## 4) Respiratory system and antipyretic

No.	Common name	Scientific name	Family	Part used	Properties	Coordinate	
						Latitude	Longitude
1	Monkey-ladders	<i>Bauhinia scandens</i>	Leguminosae	Vine	Antipyretic, treat mouth ulcer,	13.396501	100.990768

			Caesalpinioideae		sudorific, antidote		
2	NamjaiKrai	<i>Oxapsettacorum</i>	Olacaceae	Leaf	Pound and mask on head to relieve cold, nasal congestion and headache	13.395500	100.991416
3	Khontha	<i>Harriosniaperforata</i>	Simaroubaceae	Root	Reduce body heat, healing crisis of fever and toxic	13.394694	100.995028

### 5) Skin disease symptoms

No.	Common name	Scientific name	Family	Part used	Properties	Coordinate	
						Latitude	Longitude
1	Creeping woodsorrel	<i>Oxalis comiculata</i>	Oxalidaceae	Leaf	-External ointment for curing bunion, warts and other types of bulging. -Pound and mixed with alcohol, mask to relieve abscess, pain and swelling	13.395560	100.991617
2	Ylang-ylang	<i>Cananga odorata</i>	Annonaceae	Leaf	Treat skin diseases, ringworm and chloasma and has antipruritic effect	13.396516	100.990415
3	Iron wood	<i>Xylocarpus</i>	Mimosaceae	Seed	Pound and mask to relieve abscess, pain and infected wound	13.397528	100.992889
4	Ramontchi	<i>Flacourtia indica</i>	Flacourtiaceae	Stem	Dermatologic agents, relieve skin affliction and rash	13.394611	100.994694

### 6) Erectile dysfunction treatments

No.	Common name	Scientific name	Family	Part used	Properties	Coordinate	
						Latitude	Longitude
1	Finger Root	<i>Boesenbergia rotunda</i>	Zingiberaceae	Rhizome	Nutritive, elixir, increase sexual performance	13.395500	100.991417
2	Konjac	<i>Amorphophallus</i>	Araceae	Tuber	Increase sexual performance	13.395531	100.991547



3	KoKhao Khlon	<i>Dregeavolu bilis</i> (L.f.) HooK.f.	Asclepiadace ae	Root	Restorative, healing crisis of fever and toxic, anti- cholecystitis, promote sleeping	<b>13.39491 7</b>	<b>100.99325</b>
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#### 7) Circulatory system

No.	Common name	Scientific name	Family	Part used	Properties	Coordinate	
						Latitude	Longitude
1	Phlapphla	<i>Microcosto mentosa</i>	Tiliaceae	Fruit	Laxative, haematonic, enhance distribution of blood flow	<b>13.396501</b>	<b>100.99076 8</b>
2	Iron wood	<i>Xyliaxylocar pa</i>	Mimosaeae	Wood	Haematonic, relieve follicular pharyngitis and blood disease	<b>13.399486 1</b>	<b>100.99225 0</b>
3	Mamao	<i>Antidesmag haeseimbilla</i>	Euphorbiace ae	Leaf and fruit	Bath in infused water, reduce yellow skin and eyes from anemia, poor blood flow	<b>13.394778</b>	<b>100.99383 3</b>

#### 8) Musculoskeletal System

No.	Common name	Scientific name	Family	Part used	Properties	Coordinate	
						Latitude	Longitude
1	Chinese violet	<i>Asystasiaga ngatica</i>	Anderson	Leaf	Relieve swelling, arthritis and muscle pain and vermifuge	<b>13.39555 6</b>	<b>100.99136 1</b>
2	Asian Crape Myrtle	<i>Lagerstroem ia floribundo</i>	Lythraceae	Root	Reduce muscle pain	<b>13.39466 7</b>	<b>100.99491 7</b>
3	KoKhao Khlon	<i>Dregeavolu bilis</i> (L.f.) HooK.f.	Asclepiadace ae	Root	Restorative, healing crisis of fever and toxic, anti-cholecystitis, promote sleeping	<b>13.39491 7</b>	<b>100.99325</b>

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#### 10) Urinary system

No.	Common name	Scientific name	Family	Part used	Properties	Coordinate	
						Latitude	Longitude
1	NamjaiKrai	<i>Olaxpsittacorum</i>	Olacaceae	Stem	Relieve pains and aches, antidote, antipyretics, cure kidney malfunction	13.395500	100.991416
2	Mamao	<i>Antidesmahaesembilla</i>	Euphorbiaceae	Leaf and fruit	Bath in infused water, reduce yellow skin and eyes from anemia, poor blood flow	13.394778	100.993833
3	KoKhaoKhlon	<i>Dregeavolubilis</i> (L.f.) HooK.f.	Asclepiadaceae	Root	Restorative, healing crisis of fever and toxic, anti-cholecystitis, promote sleeping	13.394917	100.99325

Note: Field data of medicinal plants, using Global Positioning System (GPS)

From the utilization of medicinal plants for all 9 symptoms including gastrointestinal system, restorative tonic, vermifuge, respiratory system and antipyretic, skin disease, erectile dysfunction treatment, circulatory system, musculoskeletal system and urinary system, it is found that folk healers and villagers can use these medicinal plants throughout the year. In addition, these plants can be used interchangeably for each season, both for household consumption and as medicine. From the study, it is found that there are a variety of medicinal plants at Khao Bang Sai Temple. Twenty-eight species of medicinal plants are observed with 5 species of high medicinal properties as follows: **1) Khontha (*Harriosniaperforata*)** is used as an ingredient of Ya-Ha-Rak Remedy or Ben-Cha-Lo-Ka-Wi-Chian Remedy which is included in the National Drug List and used in place of modern medicine such as Paracetamol, analgesic and antipyretic. In ancient times people smashed Khontha branches and used to brush their teeth which was called Khontha toothpaste. Therefore, Khontha branches are included in the eight necessities of a Buddhist monk in the bag of the Dhammyuttika monk on pilgrimage. Khontha root is bitter, astringent with anti-diarrheal effect and healing crisis of fever and toxic by put it in boiling water and used as antipyretic potion. In addition, Khontha can be used to treat Roseolainfantum which requires healing crisis. Khontha trees often grow in deep forests along the foothills, on the termite hill and slope. The special characteristic of this tree is that the roots are grown diagonally down to the ground and do not spread its roots to the ground. It is very difficult to dig up the roots. Therefore, Khontha roots are hard to find in the market and very expensive. **2) KoKhaoKhlon (*Dregeavolubilis* (L.f.) HooK.f.)** is used as carminative. It can be found only on the slopes of the mountains. KoKhaoKhlon helps improve digestion, increase appetite. It is used as an ingredient in aperitive and bitter medicine with antipyretic effect such as used in Sin-Thorn cordial, some cordial recipes, liver nourishing recipes, for example 25-Fah-Sawang (25 bitter pills). **3) BellericMyrobalan (*Terminaliabelirica*)** is called “intelligence remedies” which means it can act as both anti-diarrheal and laxative. The fruit has antipyretic effect and can be used as expectorants. Fever causes body discomfort. In addition, BellericMyrobalan is included as an

ingredient in Triphala and Trisamawand it can grow in general areas. **4) Ragah (*Brideliaovata*)** is widely used as laxative recipes and as Ya-ru in ancient time which has laxative effect. The important part of Ragah is leaves. In the past, fresh Ragah leaves were roasted and used to relieve abdominal cramp and also used as bedtime Ragah leaf tea. **5) Indian Gooseberry (*Phyllanthusemblica* Linn.)** is an important ingredient of Triphala. It has mucolytic and narcoticeffects and is consumed as fruit in India. In the Buddha era, Indian Gooseberry is called Amanda which considered as sacred tree because it is a tree that the 21<sup>st</sup> Buddha, PhraUttha, attained enlightenment. This tree was associated with Tripitaka, in which the Buddha said that seeing the state of nature is like placing Indian Gooseberry fruit on the palm and seeing that Indian Gooseberry fruit has a round shape that can be seen from every angle. In ancient times, people often planted Indian Gooseberry trees along the roadside to relieve their thirst. It is used in Triphala, Chatupalatika and Mahapikad to relieve disorders of water element.

## 2. Preparation of geographic information system for important medicinal plants at Khao Bang Sai Temple, Chonburi province

### 2.1 Routes

1) Ascent route: There are 2 ascent routes, route for small cars and motorcycles and another route is a stairway more than 100 steps build by the temple along the slopes, suitable for those who are healthy and love to exercise while travel.

2) Hiking route: Villagers and Thai traditional medicine doctors use this route to collect forest products and find various herbs, even though it is a conservation forest.

The research team used both routes for field data collection by carrying equipment to explore the forest and prepare a geographic information system.

### 2.2 Herb finding and collection methods

Villagers and Thai traditional medicine doctors were the navigators in finding and collecting important herbs. GPS devices were used to record data in the survey. Photo of herbs with scale including photos of soil, topography and biodiversity conditions were taken. In addition, the interviews with Thai traditional medicine doctors and villagers were recorded in order to confirm the species and local names of herbs to enable the research team to analyze and compare with the research papers to ensure the completeness of data.

### 2.3. GPS coordinates

Of 100 species of medicinal plants found in this area, it is found that there are 30 important medicinal plants used to treat 9 syndromes and there are 5 medicinal plants which are relatively rare in Chanthaburi province and can be used to treat all 9 symptoms, namely Ragah, Belleric Myrobalan, Ko Khao Khlon, Indian Gooseberry and Khontha.



Illustration: Fieldworkarea, Bang Sai Sub-district, Mueang District, Chonburi Province

Among all the herbs, the herbs that can be found and collected throughout the year according to their growing season are as follows:

- 1) January – April or dry season: Flower, pollen, fruit, bark, leaves and heartwood
- 2) May – August or rainy season: Shrub, climber, stem, shoot and bark
- 3) September – December or winter: tuber and seed

The coordinates of these medicinal plants were also specified to find locations that will be useful for education, maintenance, propagation and conservation in various ways in the future.



Illustration: rare and endangered important herbs

## CONCLUSIONS AND DISCUSSION

In conclusion, the results of this study show that the diversity of medicinal plants used in the treatment syndromes can be found in forest area of Khao Bang Sai Temple, Mueang District Chonburi province as this area is a conservation forest under the Department of Fine Arts, Region 7 and the 21st Infantry Regiment, Queen Sirikit's Guard which is under the supervision of Khao Bang Sai Temple. Within an area of about approximately 200 rai, more than 100 species of herbs are observed. This area is a sparse forest with sandy loam. There is no permanent stream in this area, but there are streams formed only during the rainy season which result in capillary water flowing and keeping the plants moist.

For the preparation of geographic information system, local people and traditional Thai medicine doctors who specialized and have knowledge of herbs were the navigators in the survey, in which the GPS (Global Positioning System) devices were used to determine the coordinate of each medicinal plants.

According to the research, important and rare herbs in this forest that can be used to treat up to 9 symptoms were observed. This study also results in new innovation, the geographic information

system that can determine the coordinates of important herbs on this hill, which will also benefit and facilitate the search of herbs for the collection, propagation and conservation of rare medicinal plants in various ways. This is in accordance with the concept of traditional Thai medicine wisdom that is to treat patients with herbs and also in accordance with cultural ecology theory that is people can make use of forests as the four requisites for living. In addition, it is also in accordance with the structural-functionalism theory that is one of the sub-structures of society is health. The poor public health can lead to poor and unstable society.

### Suggestions

1. More studies should be conducted in order to thoroughly search for herbs in the forest area of Khao Bang Sai Temple, including the preparation of geographic information system.
2. Soil where these herbs grow should be analyzed.
3. The important substances of the herbs should be extracted in order to determine the quantity and compare with the same herbs in other areas.

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