



The Potential of Indigenous People's Forest: Ecological Benefits and Plants Diversity in Bru People's Spiritual Forest, Northeastern Thailand

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Authors' contributions

This work was carried out in collaboration between both authors. Author TC designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript and managed literature searches. Author TS managed the analyses of the study and literature searches. Both authors read and approved the final manuscript.

Original Research Article

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ABSTRACT

Aims: To study the ecological benefits and biodiversity of plants in the Bru's spiritual forest and the relationship between the Bru's wisdoms and their spiritual forest.

Study Design: This research applied the use of forest ecology and a qualitative research.

Place and Duration of Study: Sakon Nakhon Province, the upper Northeastern Thailand, between June 2011 and June 2012.

Methodology: We surveyed plants diversity in 3 spiritual forests of Bru people's villages and collected primary data about relationship between Bru people and spiritual forest from the site by in-depth interviewing, group discussions with key informants.

Result: The Bru People are a group of indigenous people near the Lower Mekong River and have a culture that is closely related and tied to the spiritual dimension. Their philosophy and fundamental world views are holistic. There are 11 Spiritual Forest in Bru communities of Sakon Nakhon Province. These forests once serve as: an important source of biodiversity and native plants, a source of food and herb to support the Bru

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people's economy and ecology, a spiritual centre of communities, and a foundation to create strength to maintain their idealism and ecological heritage in the Lower Mekhong basin.

Conclusion: Spiritual forests of Bru people have served as important reservoirs of biodiversity, preserving native species of plants, protection air pollution and supporting the ground economy and culture of Bru people.

Keywords: Spiritual forest; indigenous people; plant diversity; ecological benefits.

1. INTRODUCTION

Ever since the Industrial Revolution, natural resources have been destroyed and continuously depleted both in countries that incurred Industrial Revolutions and in remote areas, resulting in economic and political disparity [1,2]. Furthermore, this development with disregard for the consequences of the ecosystem and the environment has become the dominant stream of practice [3]. After the industrial revolution and changing of economic policy, tropical rain forest were damaged by logging, mining, industrial plantation (rubber, sugar cane and cassava) continuously [4]. In various villages near the lower Mekong river in Thailand, part of tropical rain forest, which have a long been to indigenous people [5]. The diversity of indigenous people's culture is grounded in territory and locality, drawing together their social and natural. Marked correlation between areas of biological diversity and areas of cultural diversity, and is particularly significant for rainforests [6]. More than thousands of years indigenous people developed a way of life and spirituality based on respect for the land and all living things, still very much alive [1]. Indigenous people of Asia believe trees and soil have Deva or ghost to take care of as an Asian way of life [7]. Indigenous tribes support and promote ecological and biodiversity preservation through their cultures [7,8] with a concrete knowledge including the indigenous people living around the Lower Mekong River which reflects the lifestyles to take care of biological resources [9]. However, very little study of the potential of Indigenous people in biological conservation under their wisdom, especially Bru people, who are the oldest of indigenous people of the lower Mekhong basin [5]. This research is a study of the ecological benefits-values and biodiversity of plants in the Bru's spiritual forests, including the knowledge and culture of the Bru and their spiritual forests in Thailand's Northeastern province. Hence, this study will lead to the knowledge and an understanding of how indigenous people in the lower Mekong basin preserve natural and biological resources.

2. MATERIALS AND METHODS

2.1 Methodology

This study can be broken down into 4 parts as follows:

2.1.1 Studying and surveying the indigenous people

We investigated the location of the Bru's spatial distribution, the size of these locations, and the distribution of the spiritual forest. The principle data were collected from documents study which regarding the settlement of the local people in Sakon Nakhon basins along with the field research to conduct ethnology survey by interview with the community leaders, non-participatory observations, and ethnic observations which includes physically and through

the use of language to analyze the characteristic of the language and the history of being a Bru.

2.1.2 Primary biological surveying

We studied and surveyed of the primary ecology and plants in the Bru's community, the size and location of the spiritual forests, and to study the characteristic of plants community by using characteristics or faithful species index.

2.1.3 Surveying plants diversity in the sample plot

The type and biodiversity of plants in the biggest spiritual forest were surveyed by selecting a sample from each category of the forest with the biggest area of Dry Evergreen Forest (Baan Na Lao's spiritual forest), Mixed Deciduous Forest (Baan Hin Tak's spiritual forest), and Deciduous Diptorocarp Forest (Baan Na Phiang Mai's spiritual forest) [10,11]:

Set up a square plot measuring 10x10 m worth 10 percent of the total area of study, in order to study trees with a height of around 1.30 m from the ground and a diameter at breast height (DBH) of more than 4.5 cm (girth at breast height, GBH more than 14.14 cm)

Analyzed the diversity in plant species and made a list of those species to characterize and categorize them according to their local and scientific names by comparing them to an encyclopedia of plants and Thai herbarium.

2.1.4 Studying the value of the biodiversity and the relationship between local culture and the spiritual forest

Data were collected by in-depth interviewing with key informants [12] and through focus groups with those who can provide relevant information and by non-participatory observations [13].

INTERVIEWS

- [1] Chalerm Keawchaiya (May 31st, 2011) 51 years old. Village Headsman. Interview
- [2] Sawaii Keawchaiya (May 31st, 2011) 70 years old. Village sage. Interview
- [3] Mong Cheurkamhod (April 20th, 2011) 68 years old. Farmer. Interview
- [4] Yang Vongkaso (September 25th, 2012) 74 years old. Farmer. Interview
- [5] Sao Vongkaso (February 2nd, 2012) 75 years old. Sage Farmer. Interview
- [6] Thonglin Varikit (June 31st, 2011) 72 years old. Farmer. Interview
- [7] Klaharn Varikit (April 4th, 2012) 68 years old. Farmer. Interview

2.2 Area/Location and Time Frame of the Study

Location: The research focused on the Bru people (tribe) in Sakon Nakhon Province, in the upper Northeastern Province of Thailand that part of the lower Mekhong basin between June 2011 and June 2012. Therefore, the research chose to study 3 communities (Fig. 1) which were:

Baan Na Phiang Mai, Na Phiang sub district, Kusuman district, Sakon Nakhon Province
Baan Hin Tak, Rai sub district, Phanna Nikhom district, Sakon Nakhon Province
Baan Nalao, Na Nai sub district, Phanna Nikhom district, Sakon Nakhon Province.

In addition, they represent communities with 3 types of spiritual forests which are Dry Evergreen Forest, Mixed Deciduous Forest, and Deciduous Dipterocarp Forest.



Fig. 1. Area Study: Sakhon Nakhon Province, Thailand [14,15]

2.3 Scopes of the Study

The scopes of this study divided into 2 parts, which were:

1. Studying plant diversity in the spiritual forest, analyzing plant diversity in the sample plot, studying the values and benefits of the plants and the forest upon the local community, and the biodiversity of trees and climbers that have diameter at breast height (DBH) of more than 4.5 cm (girth at breast height, (GBH) more than 14.14 cm).
2. Studying the way of the forest and the preservation of the spiritual forest by analyzing the relationship between culture and basic wisdom that related to the natural ecology of the Bru and the preservation of the spiritual forest.

3. RESULTS AND DISCUSSION

3.1 Native Habitat and Basic Ecological Characteristics of the Bru People in the Upper Northeast

The Bru people are a type of indigenous people around the Mekong River basin and have settled down in the Northeastern provinces of Thailand, arriving prior to the establishment of the Thai state [16]. The settlements of the Bru people in Sakon Nakhon province and the upper Northeastern Thailand, have spread out across different areas but their main dwellings or central settlements are around mountain ranges or in between the Phu Phan Mountains. In Sakon Nakhon Province, the Bru people have important settlements around Phu Phan mountain ranges which are Baan Huai Bun, Baan Na Tan, and Baan Na Lao in Na Nai sub district, Phanna Nikhom district and Baan Nong Hai Yai, Baan Nong Hai Noi, Baan Khok Sa-Ard, Rai sub district, Phangkhon district, Sakon Nakhon Province. Besides the Bru population in Sakon Nakhon Province, other Bru population also resides in Phu Phan mountain ranges in Dong Luang district in Mukdahan Province.

3.2 The Bru Spiritual Forests of Sakhon Nakhon Province, Thailand

In Bru people traditional beliefs, gods who reside in mountains, forests, and rivers are guardians of such areas. The belief in the inseparable connection between the material world and the spiritual is also common among the Bru people in the lower Mekhong basin (Thai, Laos and Vietnam) [17]. Regarding their traditional ecological knowledge, when the Bru founded their village, they chose a forest area with big trees, believing that it was a dwelling place of divinities. They made a decision by casting lots in a traditional ritual. The gods were then invited to serve as the gods of the community. They were called by different names depending on regions: some were called Phi Ao, Phi Mahesak, or Phi Pu Ta. A small house was built for the supreme god to reside in. The purpose of this was to ask the god to protect the offspring of the community, bring peace to the community, and ensure agricultural productivity. This sacred space which the founders of the Bru village allocated as the dwelling place of the deities has become a spiritual forest which is commonly found in several Bru communities of Thailand.

3.3 Characteristics of Spiritual Forests in Bru Communal Areas

From the ecological ethnicities survey (research) of the spiritual forests in Sakon Nakhon Province, it is revealed that there are 13 Bru villages within 5 sub districts and 4 districts which are Phangkhon district, Kusuman district, Phanna Nikhom district, and Meaung district. There are a total of 11 spiritual forests (2 Bru villages share the same spiritual area, making a total of 13). The spiritual forests can be divided into 3 categories according to the characteristics of the species of plants grown in Thailand [18]. The first type is the Dry Evergreen Forest and is found in 7 locations, each have an area of 1 rai, 2 rai, 5 rai, 8 rai (2 locations), 17 rai, and 70 rai (6.25 rai = 1 hectares (ha)). The second type is the Mixed Deciduous Forest and has 3 locations measuring at 5 rai, 15 rai, and 17 rai. The third type is the Deciduous Dipterocarp Forest and has 1 location measuring at 80 rai, making the average size of the Bru's spiritual forest 23.90 rai. Therefore, the types of plants that grow and cover all the areas in these spiritual forests are local and natural plants.

3.4 Biodiversity of Plants and Sacred Trees in the Spiritual Forests

Out of the 11 spiritual forests, a sample was chosen for each of the 3 types of spiritual forests based on the biggest forest in each category. This means that the spiritual forests from Baan Na Lao, Baan Hin Tak, and Baan Na Phiang Mai were chosen as samples for the Dry Evergreen Forest, the Mixed Deciduous Forest, and the Deciduous Dipterocarp Forest respectively. A survey of the species of plants was conducted in these 3 forests and the results of the biodiversity of trees and climbers are as follows. In Baan Na Lao's spiritual forest, there are 155 species of plants and the types with importance value indexes (IVI) are Yang Na (*Dipterocarpus alatus* Roxb), Siamese rough bush (*Streblus taxoides* Kurz), White Myrtle (*Lagerstroemia calyculata* Kurz), and Lady nut (*Entada pursaetha* DC). Baan Hin Tak's spiritual forest had a plant diversity of 55 species. The importance value index (IVI) that was found were Iron Wood (*Xylia xylocarpa* Taub.var. *kerri*) Pradu (*Pterocarpus macrocarpus* Kurz), and Phai Rai (*Gigantochloa albociliata* Monro). Baan Na Phiang Mai's spiritual forest had a plant diversity of 78 species where Tengwood (*Shorea obtusa* Wall.) and Dark Red Meranti (*Shorea siamensis* Miq.) were found to have the highest importance value index (IVI). From the 3 spiritual forests that were surveyed, the plant diversity that was found was 214 species (Table 1).

Table 1. Plant diversity in Bru tribes' spiritual forest

Order	Location of Spiritual Forest	Type of Forest	Species of Plants
1	Baan Na Phiang Mai	Deciduous Dipterocarp Forest	78
2	Baan Hin Tak	Mixed Deciduous Forest	55
3	Baan Na Lao	Dry Evergreen Forest	155
Total species of plants from all 3 forests			214

Furthermore, in the sample plots that the study of plant diversity were conducted, namely in Baan Hin Tak, Baan Na Lao, and Baan Na Phiang Mai communities, sacred trees were found. This means that the Brus believe that these trees have spirits and gods dwelling inside them, protecting and guarding their villages. At Baan Na Lao, this was the White Thingan (*Hopea odorata* Roxb.) which measures at 37 meters tall and a GBH of 4 meters. At Baan Hin Tak, the sacred tree was the Yang Na (*Dipterocarpus alatus* Roxb.) measuring at 43 meters tall and 4.40 meters in GBH and the sacred tree at Baan Na Phiang Mai was the Chak Lin (*Walsura trichostemon* Miq.) which measures at 7 meters tall and 0.8 meter in GBH. These sacred trees are considered the heart and center of these spiritual forests because that each village believes have spirits or gods residing in them to protect and guard the descendants and lineage of each village.

3.5 Size and Quantity of Trees in the Spiritual Forests

There are all sorts of species of plants in the Brus' spiritual forests located in the Northeastern parts of Thailand, ranging from herbarceas, shrub to trees. The biggest tree in these spiritual forests is the Pradu (*Pterocarpus macrocarpus* Kurz) in Baan Na Phiang Mai's spiritual forest (Deciduous Dipterocarp Forest), which measures at 1.56 meters GBH and 24 meters tall. In Baan Hin Tak's spiritual forest (Mixed Deciduous Forest) is Mesawa (*Anisoptera costata* Korth) with GBH of 3.08 meters and 22 meters tall and in Baan Na Lao's spiritual forest (Dry Evergreen Forest) is the White Myrtle (*Langerstroemia calyculata* Kurz) measuring at 4.7 meters GBH and 30 meters tall. Most of the biggest trees found are located

in Baan Na Lao's forest, Dry Evergreen Forests, and Baan Hin Tak's forest, Mixed Deciduous Forest, and their GBH and height put them in the crown category (Table 2).

Table 2. Top 10 biggest trees in Brus' spiritual forests

Local Name	Scientific Name	Girth at Breast Height, (GBH,m)	Total Height (m)	Location of Spiritual Forest
White Myrtle	<i>Langerstroemia calyculata</i> Kurz	4.70	30	Baan Na Lao
Ficus tree	<i>Ficus consociata</i> Bl.	4.70	17	Baan Na Lao
Yang Na	<i>Dipterocarpus alatus</i> Roxb. ex G.Don	4.02	45	Baan Na Lao
Kanun Pa	<i>Artocarpus rigidus</i> Bl.	3.70	40	Baan Na Lao
Makamong	<i>Azelia xylocarpa</i> (Kurz) Craib.	3.20	27	Baan Hin Tak
Mesawa	<i>Anisoptera costata</i> Korth.	3.08	22	Baan Hin Tak
Pradu	<i>Pterocarpus macrocarpus</i> Kurz	2.90	25	Baan Hin Tak
Velvet	<i>Dialium cochinchinense</i> Pierre	2.07	12	Baan Hin Tak
Tamarine	<i>Haldina cordifolia</i> (Roxb.) Ridsdale	1.89	20	Baan Na Lao
Haldu	<i>Erythrophleum succirubrum</i> Gagnep	1.79	25	Baan Hin Tak

The top 4 biggest species are found in Baan Na Lao's spiritual forest, which is a Dry Evergreen Forest. Following this is Baan Hin Tak's spiritual forest, Mixed Deciduous Forest, while Baan Na Phiang Mai's forest contains mostly smaller species. Furthermore, the Brus' spiritual forests are a gathering ground for plant biodiversity and it produces and gathers many useful types of trees and woods. According to a calculation by FAO (2013) (measurable by multiplying the cross sectional area with height and a constant of 0.42), it was found that each spiritual forests can produce a lot of useful wood for villagers to use (Table 3).

Table 3. Amount of wood/trees produced in Bru's spiritual tribes

Order	Location of spiritual forest	Total amount of wood/trees (cubic meters)	Amount of wood/trees per family (cubic meters)
1	Baan Na Phiang Mai	7,816	54.65
2	Baan Hin Tak	9,504.36	58.66
3	Baan Na Lao	33,656	1,450.67

3.6 Values and Benefits of the Brus' Spiritual Forests

The values and benefits of Bru's spiritual forests can be summarized in 3 points, which are:

- 1) In terms of biology and ecology, the Bru's spiritual forest are a source and collection of various plant diversity, especially their roles in collecting genetic of local plants or

acting as a genetic bank for the 214 species of local and natural plants. Meanwhile, they are a source of plant biomass as well as carbon sequestration due to photosynthesis.

- 2) In terms of health and food stability for the local population, the biological diversity of the plants in the spiritual forests is beneficial to those who are poor and act as a food and herbal medication bank. Everyone in the Bru's community benefits from the forest as the source of pure food and local herbal medicine through local ecological knowledge and act as an economic base for the community because majority of the Bru's people are farmers and live a sufficient lifestyle, dependent on nature [19]. Spiritual Forest of the Bru is regarded as source of self-sufficiency economy especially to the poor – Food Bank of grassroots people. From the field survey, forest products are deemed important to every Bru villages as a source of food: bamboo shoots, mushrooms and other local vegetable plants and, importantly, several species are herbs which people use as medicine: Mailangdam (*Diospyros castanea* Fletcher), Dooksai (*Suregada multiflorum* Baill. Syn.) Khoi (*Streblus asper* Lour.), Ben (*Flacourtia indica* (Burm.f.) Merr.) etc., which modern medicine cannot cure sickness and are too expensive for poor Brus [20].
- 3) In terms of culture and national strength, the spiritual forests are also ceremonial grounds for the Brus, such as their Halloween which they called "Phee Aho". All of the Bru would come and participate in such ceremonies which forms a strong bond because "Aho" or the village ghosts are cursed as the village ghost [21]. Furthermore, the ceremonial grounds are a place to pass on the uniqueness of the tribe because the area is a free ground for all villagers to perform ceremonies to pass on the uniqueness of their tribes, further passing on their tribes' honor.

Moreover, as a place of Bru ritual performance, the researcher concludes that it generates unity and becomes a heritage of identity of this tribe, so that its identity will not be destroyed but will maintain its ancestors' prestige. In the restoration and conservation of biodiversity besides giving a role to the locality in its participation, the importance or right of knowledge such as primitive knowledge or ecological science must be given to these indigenous people so that they will perform their role in solving ecological problems, both at practice level and policy level.

4. CONCLUSION

The spiritual forests in Bru Communities of Thailand are born from the culture and knowledge of the Bru People. In Bru people traditional beliefs, gods who reside in mountains, forests, and rivers are guardians of such areas. Bru people believe in guardian Spirit/house Spirit to protect all that lives in the community which leads to the formation of Don Ho or Dong Ao as sacred forest. This sacred space has become spiritual forests which are commonly found in several Bru communities of the lower Mekhong basin. Spiritual Forest of Bru people are sources of plant biodiversity with ecological value about native plant conservation, biomass and community support, and also serve as a centre of spiritual comfort for all people. They are conservation areas that preserve many important plant species in Thailand. They create and collect biomass and wood as well as provide food and herbal medicine for the Bru population. They serve as a food bank that supports the economy and the lives of the community. More importantly, they are important in collecting and passing on the national spirit and deep abstract values.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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