Research title : Study of environmental factors affecting biodiversity of peat swamp plants in the Southern International Botanical Garden (Thung Khai), Yan Ta Khao District, Trang Province.
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Abstract

Studying of soil quality on the diversity of plants in swamp forest at Peninsular Botanical Garden (Thung Khai), Yan Ta Khao District, Trang Province, was aimed for studying environmental factors which affecting biodiversity of plants in swamp forest at Peninsular Botanical Garden (Thung Khai) by 3 factors, which are soil quality, water quality and air quality, in 3 parts of the forest which are primary swamp forest, secondary swamp forest, and the bordering area of swamp forest and other forest. Based on collecting and studying soil structure, soil temperature, soil pH, soil moisture, soil minerals, water temperature, water pH, air temperature, air relative humidity (RH) and plant biodiversity in the peat swamp forest, the peat baseline changes the condition of the swamp boundary.

The results of the study revealed that environmental factors affecting the biodiversity of plants in swamp forest at Peninsular Botanical Garden (Thung Khai), It was found that the soil quality factor Water quality and air quality tend to be the same. Soil moisture, soil minerals, air temperature soil temperature Water temperature, water pH and soil in the native swamp were the lowest. The relative humidity of the air in the primitive swamp the highest value. The forest junction of other forests with swamp forests has the highest plant biodiversity.

Keywords: Environmental factors, Primary swamp forest (Paprugungdem), Secondary swamp forest (Paprupreansabap), Bordering swamp forest (Paroytoipapru) area

Introduction

Swamp forests are forests which are inundated with freshwater, either permanently or seasonally. They, normally occur along the lower reaches of rivers and around freshwater lakes, are found in a range of climate zones from boreal through temperate and subtropical to tropical and have accumulated a layer of organic matter or organic soil more or less thickly above the actual soil layer. The accumulation of humus and organic matter will occur continuously under flooding conditions. Most of the plants in the swamp have evolved their organs to have a special structure to survive. For example, buttress root, short taproot system but broad and strong branching roots, having a special or supplementary root system, including supporting roots and breathing roots emerge above the soil that has continually residual water helped to support the trunk or help to breathe. The unique characteristics of this swamp forest are different from tropical rainforests with different identities. From other forest ecosystems, swamp forest was only known about 10 years ago while a series of projects were underway to develop the lower southern region of Thailand. Due to in the high valleys and on the sea coast in Thailand, swamp forests can be found in the southern provinces, such as Trang, Phatthalung, Songkhla and Narathiwat. The soil in the swamp is caused by the accumulation of organic matter such as wood chips and leaves over a long period of time, deposited in a thick layer. Most of the humus and organic matter, which are brown, lightweight and good water holding capacity, are submerged below the water surface. Swamp forest has water that slow flow all year round. However, the climate is one factor to growth unless they cannot facilitate the occurrence of swamp forest with bad weather condition. Therefore, when the sequence of steps of the swamp plant society appears, the occurrence of swamp land must be considered at the same time. Peninsular Botanical Garden (Thung Khai, Yan Ta Khao District, Trang Province) is a place to preserve plants, wildlife, and recreation areas in Trang residents covering 2,600 rai, Peninsular Botanical Garden (Thung Khai, Yan Ta Khao District, Trang Province) is suitable for tourists who are interested in ecology, nature and plants. Swamp forest area is diverse and interesting to study. Therefore, the research team is interested in conducting environmental research on the study of environmental factors affecting the biodiversity of swamp forest plants at Peninsular Botanical Garden (Thung Khai), Yan Ta Khao District, Trang Province.

Research objectives

A study of environmental factors in terms of soil quality, water quality, air quality affecting the diversity of peat swamp forest plants in the Southern International Botanical Garden.

Research questions

How do environmental factors affect the diversity of peat swamp flora in the Southern International Botanical Garden, Trang Province?

Research hypothesis

Different environmental factors affect the diversity of peat swamp plants in the Southern International Botanical Garden, Trang Province differently.

GLOBE protocol

Principles of soil measurement pedosphere. Principles of measurement biosphere cover. Principles of atmosphere measurement methods Principles of water measurement methods Hydrosphere

Materials, equipment and methods of conducting research

1. Materials and equipment

1) soil color book	2) tape measure
3) straw rope	4) hygrometer
5) N P K test kit in soil	6) Globe Observer Application
7) Thermometer	8) pH meter
9) Soil texture classification guide	10) Digital soil meter

2. Methodology

Study area

This research was conducted at the Thung Khai Botanical Garden swamp area located on the coordinates latitude 7.46292°N, longitude 99.6398°E.



Figure 1. The swamp forest area of Thung Khai Botanical Garden, Yan Ta Khao District, Trang Province.

Designation of area and study point

The research team collected data, soil data, air data and plant diversity in the swamp. The study path was divided into 3 points, namely primary swamp forest, secondary swamp forest, and the bordering area of swamp forest and other forest.

Operating procedures and data collection

Chapter 1 : Soil quality data collection

Checking the soil quality in primary swamp forest, and the bordering area of swamp forest and other forest in the Peninsular Botanical Garden (Thung Khai). Soil quality measurements were carried out according to the GLOBE method by measuring temperature, pH and soil moisture and the acidity base in the soil as follows:

1) Determine the sampling point of the study path was divided into 3 points, namely primary swamp forest, secondary swamp forest, and the bordering area of swamp forest and other forest.

2) Measure the temperature of the soil by taking a thermometer to measure the temperature at a depth of 10 cm, read the soil temperature by repeating the data collection 3 times.

3) Collect soil samples to study soil properties according to various indices in the laboratory including soil minerals using a test kit and determining soil pH using a pH meter.

4) Send data to GLOBE Data Entry.

Chapter 2: Water quality data collection

Checking the water quality in primary swamp forest, and the bordering area of swamp forest and other forest at Peninsular Botanical Garden (Thung Khai). The water quality measurement was carried out according to the GLOBE method by measuring the water temperature and acidity as follows:

1) Determine the sampling point of the study route was divided into 3 points.

2) Measure the water temperature by taking a thermometer to measure the temperature at a depth of 10 cm. read the water temperature by repeating the data collection 3 times.

3) Measure the pH of the water to find the pH of the water by using the pH Meter.

Chapter 3: Air quality data collection

Checking the air quality in primary swamp forest, and the bordering area of swamp forest and other forest at Peninsular Botanical Garden (Thung Khai). Measure air temperature and air relative humidity in the primitive swamp Swamp forest and a forest that connects other forests with swamp forests in the Southern International Botanical Garden Using a digital hygrometer, record the results.

Chapter 4 Studying the Diversity of primary swamp forest, secondary swamp forest, and the bordering area of swamp forest and other forest at Peninsular Botanical Garden (Thung Khai).

1) Determine the sampling point of the study route was divided into 3 study points.

2) Study the plant species in the study site. The primary swamp forest and the forest junction of other forests with swamp forests are recorded in the table

Data analysis

1) The data obtained were analyzed and compared the relationship. The statistics used in the data analysis were soil temperature, soil moisture, average soil pH, water temperature, average water pH, air temperature, air relative humidity.

2) Make a bar chart showing the average of the comparative data.

3) Summarize the results of the experiment.

Research results

Chapter 1 Checking the soil quality in primary swamp forest, and the bordering area of swamp forest and other forest at Peninsular Botanical Garden (Thung Khai)

Table 1 Physical characteristics of soils in primary swamp forest, secondary swamp forest,and bordering area of swamp forest with other forest at Peninsular Botanical Garden (Thung Khai)

Study point	Soil structure	Soil retention	Soil texture
primary swamp forest	round	friable	loam
bordering area of swamp	round	tight	sandy clay loan
forest with other forest			
secondary swamp forest	round	tight	sandy loam

From the table, it was found that the soil structure in primary swamp forest, secondary swamp forest, and the bordering area of swamp forest with other forest at Peninsular Botanical Garden (Thung Khai), which is round lobes, differing in exactly the same way, the soil texture is loam, sandy clay loam and sandy loam, respectively.

Table 2 Soil temperature of the soil in primary swamp forest, secondary swamp forest,and bordering area of swamp forest with other forest.

Study point	Soil temperature (°C)			
Study point	1st	2nd	3rd	average
primary swamp forest	21	22	21	21.33± 0.58

bordering area of swamp forest with other forest	23	25	25	24.33± 1.15
secondary swamp forest	28	27	28	27.67± 0.58



Soil temperature (°C)

From the study, it was found that the soil temperature of the soil in primary swamp forest was the lowest, followed by the forest at bordering area. And secondary swamp forest is the highest temperature conditions

Table 3. Soil pH values of soils in primary swamp forest, secondary swamp forest,and bordering area of swamp forest with other forest

Study point	Soil pH values			
Study point	1st	2nd	3rd	average
primary swamp forest	4.4	4.6	4.7	4.57± 0.15
bordering area of swamp	61	6.2	6.1	6 13 - 0.06
forest with other forest	0.1	0.2	0.1	0.15± 0.00
secondary swamp forest	7.70	7.80	7.50	7.67± 0.15



The study found that pH in primary swamp forest soil is the lowest was followed by forests at *bordering area*. And in *secondary swamp forest* is the highest pH condition

Study point	Soil minerals					
Study point	N Va	lues	P va	lues	K values	
primary swamp forest	highest	5	high	4	moderate	3
bordering area of swamp forest with other forest	higher	4	high	4	moderate	3
secondary swamp forest	moderate	3	high	4	moderate	3

Table 4. N P K values of soils in primary swamp forest, secondary swamp forest,and bordering area of swamp forest with other forest

From the study of minerals in the soil, it was found that the soil in the primary swamp forest had the highest mineral content. The next is the forest that connects other forests with swamp forests. And in the secondary swamp forest has the lowest mineral content.

Chapter 2 Checking the water quality in primary swamp forest, and the bordering area of swamp forest and other forest at Peninsular Botanical Garden (Thung Khai).

Table 5 Water temperature of the soil in primary swamp forest, secondary swamp forest,and bordering area of swamp forest with other forest.

Study point	Water temperature (°C)			
	1st	2nd	3rd	average
primary swamp forest	28	29	28	28.33± 0.58
bordering area of swamp forest with other forest	30	31	29	30± 1.00
secondary swamp forest	31	32	32	31.67± 0.58



Water temperature (°C)

From the study of water temperature found that the water in *primary swamp forest* was the lowest and in *secondary swamp forest* is the highest temperature conditions

Table 6. pH water values of soils in primary swamp forest, secondary swamp forest,and bordering area of swamp forest with other forest

Study point	pH Water values			
Study point	1st	2nd	3rd	average
primary swamp forest	3.8	3.9	3.8	3.83± 0.06
bordering area of swamp	F 6	FO	()	F 92 + 0 01
forest with other forest	5.0	5.9	0.0	5.85± 0.01
secondary swamp forest	7.2	7.4	7.2	7.27± 0.12



From the study, it was found that the pH water values in primary swamp forest was the lowest, followed by the forest at bordering area. And secondary swamp forest is the highest of pH conditions.

Study point	рН		Temperature (°C)	
Study point	soil water		soil	water
primary swamp forest	4.57± 0.15	3.83± 0.06	21.33± 0.58	study site 28.33±0.58
bordering area of swamp	6 13+ 0 06	6 13+ 0.06 5 83+ 0.01	2/1 22+ 1 15	30+ 1.00
forest with other forest	0.15± 0.00	J.0J± 0.01	24.33± 1.13	JUT 1.00
secondary swamp forest	7.67± 0.15	7.27± 0.12	27.67± 0.58	31.67± 0.58

 Table 7: Relationship between temperature with acidity of soil and water



From the study *Relationship between temperature with acidity of soil and water*, primary swamp forest has a highest temperature of soil and water, but has a lowest pH of soil and water. However, secondary swamp forest has a lowest temperature of soil and water, but has a highest pH of soil and water.

Chapter 3: Checking the air quality in primary swamp forest, and the bordering area of swamp forest and other forest at Peninsular Botanical Garden (Thung Khai).

Study point	Air temperature (°C)			
Study point	1st	2nd	3rd	average
primary swamp forest	26.5	26.4	26.9	26.93± 0.55
bordering area of swamp	27.4	28.3	28.4	28.03+.0.55
forest with other forest	27.4	20.5	20.4	20.05± 0.55
secondary swamp forest	29.8	30.1	31.4	30.43± 0.85

 Table 8. Soil temperature of the soil in primary swamp forest, secondary swamp forest,

 and bordering area of swamp forest with other forest.





From the study, it was found that the air temperature in primary swamp forest was the lowest, followed by the forest at bordering area. And secondary swamp forest is the highest temperature conditions

Table 9. Air relative humidity (RH) in primary swamp forest, secondary swamp forest,and bordering area of swamp forest with other forest.

Study point	Air relative humidity (RH) (%)				
Study point	1st	2nd	3rd	average	
primary swamp forest	74	75	74	74.33± 0.58	
bordering area of swamp	72	72	70	72 22 - 0 1	
forest with other forest	12		12	72.35± 0.1	
secondary swamp forest	67	65	64	65.33± 1.53	



📕 Air relative humidity (RH) (%)

From the study, it was found that the Air relative humidity (RH) in primary swamp forest was the lowest, followed by the forest at bordering area. And secondary swamp forest is the highest Air relative humidity (RH).

Chapter 4: Studying the Diversity of primary swamp forest, secondary swamp forest, and the bordering area of swamp forest and other forest at Peninsular Botanical Garden (Thung Khai).

No.	plant name	Scientific name	family
1	Hlumphi	Eleiodoxa conferta (Griff.) Burret	PALMAE
2.	Hway na	Calamus godefroyi Becc.	PALMAE
3.	Hmakhelụxng	Pinanga perakensis Becc.	PALMAE
4.	Rakum	Salacca wallichiana C.Mart.	PALMAE
5.	Ka xxk	Artocarpus elasticus Reinw. ex Blume	MORACEAE
6.	Pheka phru	Radermachera pinnata (Blanco) Seem. subsp.	BIGNONIACEAE
		acuminata (Steenis) Stenis	
7.	Chamwng kwang	Garcinia cowa Roxb.	CLUSIACEAE
8	Wa na , Ph wa na	Fagraea racemosa Jack	GENTIANACEAE
9	Kk lek	Cyperus pulcherrimus Willd. & Kunth	CYPERACEAE
10	Phlạbphlụng thar	Crinum thaianum J.Schulze	AMARYLLIDACEAE

Table 10. Diversity of primary swamp forest at Peninsular Botanical Garden (Thung Khai).

Table 11. Diversity of secondary swamp forest at Peninsular Botanical Garden (Thung Khai).

No.	plant name	Scientific name	family
1	Chaphlu pa, Takhan hnu	Piper aurantiacum Miq.	PIPERACEAE
2	Nepenthes	Nepenthesgracilis Korth.	NEPENTHACEAE
3	sundew	Drosera peltata Sm.	DROSERACEAE
4	Krakakorn	Possiflora foetida L.	PASSIFLORACEAE
5	Kud kin	Diplazium esculentum	Thelypteridaceae
6	Liphea hangki	Lygodium circinnatum	Lygodiaceae
7	Sam Roi Yot	Lycopodium clavatum var.	Lycopodiaceae
		devaricatum	

8	early mimosa	Mimosa pigra L. LEGUMINOSAE-	MIMOSOIDEAE
9	dew grass	Drosera indica L.	DROSERACEAE
10	Mạng re	Melastoma cyanoides Sm.	MELASTOMATACEAE
11	Hya rạngka khaw , Hya kk	Cyperus iria L.	CYPERACEAE
	thray		
12	H <u>y</u> a sab ka	Hygrophila incana Nees	ACANTHACEAE

Table 12. Diversity of bordering area of swamp forest and other forestat Peninsular Botanical Garden (Thung Khai).

No.	plant name	Scientific name	family
1	Hlumphi	Eleiodoxa conferta (Griff.) Burret	PALMAE
2.	Hway na	Calamus godefroyi Becc.	PALMAE
3.	Yellow Mak	Pinanga perakensis Becc.	PALMAE
4.	Raka	Salacca wallichiana C.Mart.	PALMAE
5.	Ka xxk	Artocarpus elasticus Reinw. ex Blume	MORACEAE
6.	Pheka phru	Radermachera pinnata (Blanco) Seem. subsp. acuminata (Steenis) Stenis	BIGNONIACEAE
7.	Chamwng kwang	Garcinia cowa Roxb.	CLUSIACEAE
8	Wa na , Ph wa na	Fagraea racemosa Jack	GENTIANACEAE
9	Kk lek	Cyperus pulcherrimus Willd. & Kunth	CYPERACEAE
10	Plubplungtharn	Crinum thaianum J.Schulze	AMARYLLIDACEAE
11	tamarind	Bouea oppositifolia (Roxb.) Meisn.	ANACARDIACEAE
12	Ra mị pa, Khwạykhaw	Baccaurea bracteata Mull.Arg	EUPHORBIACEAE
13	Chiang Pra Nang Ae	Carallia brachiata	Rhizophoraceae
14	Taew	Cratoxylum formosum	Hypericaceae
15	Cạnthn mwng	Myristica elliptica Wall. Ex Hook.f.& Thomson.	MYRISTICACEAE

16	Payom	Shorea roxburghii G.Don.	Dipterocarpaceae
17	Tangthong	Litsea lancifolia Hook. f.	LAURACEAE
18	Da tako	Diospyros wallichii King & Gamble.	EBENACEAE
19	Cheiy	Cinnamomum iners Reinw. ex Blume	Lauraceae
20	Hæl chx	Dehaasia kurzii King ex Hook.f.	Lauraceae
21	Ya rwng phru	Buchanania arborescens (Blume) Blume	ANACARDIACEAE
22	Sila	Ilex cymosa Blume	AQUIFOLIACEAE
23	Khạnthxngphyabath	Suregada multiflorum (A.Juss.) Baill.	EUPHORBIACEAE
24	Tạng hn bi hiy	Calophyllum soualattri Burm. f.	Calophyllaceae
25	Nang prn	Campnosperma auriculatum (Bl.) Hook.f.	LYTHRACEAE
26	San da	Dillenia excelsa (Jack) Martelli ex Gilg	DILLENIACEAE
27	Chum Saeng	Xanthophyllum ellipticum Korth.	Polygalaceae
28	Px sxng si	Sterculia gilva Miq.	MALVACEAE
29	satiao	Madhuca motleyana (de Vriese) J. F. Macbr.	SAPOTACEAE
30	Krwy na	Horsfieldia irya (Gaertn.) Warb.	Myristicaceae

From Studying the Diversity of primary swamp forest, secondary swamp forest, and the bordering area of swamp forest and other forest at Peninsular Botanical Garden (Thung Khai), the bordering area of swamp forest and other forest has the highest plant biodiversity. Others have a similar plant biodiversity.

Summary of research results

Chapter 1 Checking the soil quality in primary swamp forest, secondary swamp forest, and the bordering area of swamp forest and other forest at Peninsular Botanical Garden (Thung Khai).

From the study of soil physical characteristics, it was found that the soil structure in the primary swamp forest, secondary swamp forest, and the bordering area of swamp forest and other forest at Peninsular Botanical Garden (Thung Khai), which is round lobes, differing in exactly the same way, the soil texture is loam sandy clay loam The soil temperature of the soil in the original peat forest was lowest, followed by the forest boundary between other forests and the peat swamp forest. The highest temperature was changed in the peat swamp forest. The soil pH in the original peat swamp was the lowest, followed by forests at the boundary of other forests with peat forests. and in the peatlands the highest pH change for soil minerals. It was found that the soil in the primitive swamp had the highest mineral content. The next is the forest that connects other forests with swamp forests. and in the transformed swamp forest has the lowest mineral content.

Chapter 2 Checking the water quality in primary swamp forest, secondary swamp forest, and the bordering area of swamp forest and other forest at Peninsular Botanical Garden (Thung Khai).

From the study of water temperature found that the water in the primary swamp forest was the lowest. The next is the forest that connects other forests with swamp forests. and in peatlands, temperature change was the highest, water pH was lowest in the original peat forest, followed by forests at the boundary of other forests with peat forests. and in the swamp change the highest pH condition

Chapter 3 Air Quality Monitoring in primary swamp forest, secondary swamp forest, and the bordering area of swamp forest and other forest at Peninsular Botanical Garden (Thung Khai).

From the study of air temperature It was found that the air in the primitive swamp was the lowest. The next is the forest that connects other forests with swamp forests. and in the swamps change the highest temperature conditions air relative humidity In the original peat swamp forest, the lowest was followed by the forest boundary between other forests and the peat swamp forest. And in the swamp change the relative humidity of the air to the maximum.

Chapter 4 Studying the Diversity of Traditional Swamp Forest Plants Swamp forest and a forest that connects other forests with swamp forests in the Southern International Botanical Garden

From the study of biodiversity of peat forest plants It was found that forests at the junction of other forests with swamp forests had the highest plant biodiversity. In the primitive and transformed peatlands, there is a similar plant biodiversity.

Discuss the results of the research.

The study of environmental factors affecting the biodiversity of peat swamp plants in the Southern International Botanical Garden. Yan Ta Khao District, Trang Province found that the soil quality factor Water quality and air quality tend to be the same. Soil moisture, soil minerals, air temperature. The relative humidity of the air in the primary swamp forest is the highest, whereas the soil temperature Water temperature, water pH and soil are the lowest. However, the bordering area of swamp forest and other forest has the highest plant biodiversity.

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