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Diversity of Trees on Waterside of the Tapae Canal, Thong Song district, Nakhon Si Thammarat province, Thailand

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The diversity of trees on waterside of Tapae canal, Thong Song district, Nakhon Si Thammarat province, Thailand. The field study of trees on the waterside of Tapae canal was conducted from March, 2015 to September, 2016. The methods of study were sampling the diversity and evenness of trees at 9 stations from distance of Tapae canal waterside is 9 kilometers (1 kilometer/station),the sampling area was used 100 x 100 m^2 and the data was recorded : 1) take a photograph of all trees 2) record the scientific name, family name, the height of trees, diameter of canopy 3) analysis the diversity indices and evenness indices of trees. The result showed that the total of trees in 9 stations were found 1016 trees,78 species, 65 genera and 39 families. The most abundance family are in GUTTIFERAE, PALMAE, EUPHORBIACEAE, respectively. The five most abundance are ; 1) *Garcinia maggostsna* L. (13.78%);2) *Elaeis guinensis* Jacq. (10.83%); 3) *Hevea brasiliensis* Muell.Agr. (8.86%); 4) *Bambusa sp.*. (7.19%); and 5) *Leuaena leucocephala* Lamk. (6.89%), respectively. The diversity indices was found that the most of the diversity indices were shown on station seven 1.25 and the least diversity indices were shown on station two 0.58. The most of the evenness indices were shown on station six and station seven were 0.89 and 0.85, respectively. The least evenness indices was shown on station two in 0.56.

Keywords: diversity, evenness, trees, waterside

Introduction

Thailand has suffered a rapid decline in forest cover over the past three decades, loosing more than one haft of the forest area from the forest of 53.30 % in 1961. Nowadays Thailand has the forest only about 30.92 % of the country

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area (Forestry Statistic of Thailand, 2007). Generally, the loss and degradation of tropical forests are no longer only the concern of affected nations but also of the international community because of the damage such consequences have on the health of the environment. The destruction of tropical forests, therefore, is the topic of major global discussions, especially because science has shown that these resources house rich pools of biodiversity (Preecha Ongprasart, n.d.). Changes in plant diversity are known to affect aboveground ecosystem functioning (Tilman *et al.* 1997, 2001; Hector *et al*. 1999), but it is increasingly recognized that changes in plant diversity also have an impact on belowground ecosystem functioning, including soil processes, soil structure and soil biota (Hooper *et al*. 2001; Wardle *et al*. 2002; Zak et al. 2003; Heemsbergen *et al*. 2004; Bardgett and Shine 1999). The benefits of trees can reduce runoff by intercepting precipitation, absorb pollutants, emit hydrocarbons, and modify solar radiation, air temperature, wind speed and relative humidity. Green landscaping supports the conservation of biodiversity in urban areas (Kummerling and Muller, 2012). Planting more trees can help increasing the quality of urban landscapes by regulating microclimate, increasing the CO_2 sequestration (Merry *et al*, 2013); reducing surface water runoff (Stringer and Ennos, 2013; Soares *et al*, 2011; Wolch *et al*, 2014, Zhang and Liu, 2010); conserving energy (McPherson and Rowntree, 1989); supporting biodiversity and providing wildlife habitats (Ivanko, 2001; William, 2003). Enhancement of tree diversity plays an important role in forest management, by preventing native species lost from disturbance pollutions (Zhang and Jim, 2014).

There are several aspects to be considered in managing the trees in a way that they can efficiently provide ecosystem services, shading provide and reduce runoff of the water.The objective of this study to find out the diversity and evenness of the trees on the waterside of Tapae canal.

Materials and methods

Study area

A field study of the diversity of trees on the waterside of Tapae canal, Thong Song, Nakhon Si Thammarat province in Southern Thailand, was surveyed at the long distance of 9 kilometers along the waterside of Tapae canal, the scale of data recording is 1 kilometers per 1 station, the total survey area of 1 station is 100 x100 square meters of both waterside. The total 9 stations for data recording of this study.

Data recording

A field study of the tree diversity was conducted in 19 months from March, 2015 to September, 2016. The process of study were recorded : 1) take a photograph of tree 2) record the scientific name, family name, the height of tree, diameter of canopy and 3) analysis the diversity indices and evenness indices of trees.

Analysis and classified of the trees diversity and evenness

The trees diversity were uses the Shannon-Weiner Species Diversity Index (Krebs, 1985). The formula is as follows:

$$H' = - \sum_{i=1}^{s} pi \ln pi$$

where :

H' is the species diversity index,

s is the number of species,

pi is the proportion of individuals of each species belonging to the i^{th} species of the total number of individuals

The trees evenness were uses the reference of Hill,1973. The formula is as follows:

$$E = H^{/} / \ln S$$

where :

E is the species evenness index

$H^{/}$ is the diversity of Shannon- Wiener's

S is the number of species

Results

Diversity and evenness of tree

The result of the diversity indices of trees in 9 stations of Tapae canal waterside in Thong district, Nakhon Si Thammarat Thailand, were found the diversity indices of trees in station one to station nine 0.71 0.58 0.81 0.83 1.04 1.23 1.25 0.62 and 0.88, respectively. The most of the diversity indices were shown on station seven 1.25 and otherwise, the least diversity indices were shown on station two in 0.58 (Table 1). The result of the evenness indices of trees in 9 stations were found the evenness indices of trees in station one to station nine 0.79 0.56 0.73 0.69 0.75 0.89 0.85 0.74 and 0.81, respectively.

The most of the evenness indices were shown in station six and station seven were 0.89 and 0.85, respectively, on otherwise, the least evenness indices were shown on station two in 0.56 (Table 1).

The result of the total of trees in 9 stations of Tapae canal waterside were found 1016 trees, 78 species, 65 genera and 39 families. Table 1 shows the most abundance of 3 families are in GUTTIFERAE, PAMAE and EUPHORBIACEAE, respectively. The five most abundant are; 1) *Garcinia mangostana* L. (13.97%); 2) *Elaeis guinenisis* Jacq. (10.83%); 3) *Hevea brasiliensis* Mull.Agr. (8.86%); 4) *Bambusa sp.*. (7.18%); and 5) *Leucaena leucocehpala* Lamk. (6.89 %), respectively.

Tree size

Average tree canopy diameter of total 139 trees from 9 stations on the Tapae canal waterside showed that the most trees (46.04 percent) are in small with the canopy diameter 3-4 m, the second number of canopy diameter in small size with the canopy diameter 1-2 m are 43.88 percent and the biggest size of canopy diameter with the canopy diameter 5-6 m are 9.35 percent(Table 2) . The average tree height of total 1016 trees was showing the most tree height is 74.82 percent with the tree height 1-10 m, the medium tree height 22.30 percent with the tree height 11-20 m and the small number of tree height 2.87 percent with the tallest tree height 21-30 m

Table 1 The diversity and evenness of trees on the waterside of Tapae canal, Thong Song, district, Nakhon Si Thammarat, Thailand

Scientific Name	Family	Station									N	%	ranks
		ST 1	S T2	S T3	S T4	S T5	S T6	S T7	ST 8	ST 9			
Bambusa sp.	Gramineae/ Poaceae	15	3	8		22	4	5	6	10	73	7.19	4
Cocos nucifera L.	Palmae	2				2			4	21	29	2.85	9
Nephelium lappaceum L.	Sapindaceae		4			11			2		17	1.67	14
Garcinia mangostana L.	Guttiferae	2	78			31	1	2	26		140	13.78	1
Durio zibethinus Murray	Bombacace-ne	2									2	0.20	25
Chrysalidocarpus lutescens H.Wendl.	Palmae	7		7	5	8	1	1	23	3	55	5.41	6

Table 1.*(Cont.)* The diversity and evenness of trees on the waterside of Tapae canal, Thong Song, district, Nakhon Si Thammarat, Thailand

Scientific Name	Family	Station									N	%	ranks
		ST 1	S T2	S T3	S T4	S T5	S T6	S T7	ST 8	ST 9			
Parkia speciosa Hassk.	Leguminosae	1				2					3	0.30	24
Metroxylon sagus Rottb.	Palmae	1	1							1	3	0.30	24
Azadirachta indica A.Juss.	Meliaceae		9			29		3			41	4.04	7
Flacourtia indica (Burm.f.) Merr.	Flacourtiaceae		2	1							3	0.30	24
Antidesma ghaesembilla Gaertn.	Euphorbiaceae		1	1							2	0.20	25
Annona muricata L.	Annonaceae		1								1	0.10	26
Lansium domesticum Corr.	Meliaceae		7								7	0.69	21
Manilkara zapota (L.) P.Royen	Sapotaceae		2								2	0.20	25
Garcinia cowa Roxb.	Guttiferae		2				1				3	0.30	24
Leucaena leucocephala (Lamk.)	Leguminosae			21		15	14	1		19	70	6.89	5
Ficus religiosa L.	Moraceae			1	4						5	0.49	22
Pterocarpus indicus Willd	Leguminosae			1							1	0.10	26
Moringa oleifera Lam.	Moringaceae			3			2				5	0.49	22
Barringtonia acutangula (L.) Gaertn.	Lecythidaceae			1		1					2	0.20	25
Oroxylum indicum (L.) Kurz	Bignoniaceae			1							1	0.10	26

Table 1. *(Cont.)* The diversity and evenness of trees on the waterside of Tapae canal, Thong Song, district, Nakhon Si Thammarat, Thailand

Scientific Name	Family	Station									N	%	ranks
		ST 1	S T2	S T3	S T4	S T5	S T6	S T7	ST 8	ST 9			
Terminalia catappa L.	Combretaceae			1		1					2	0.20	25
Lagerstroemia floribunda Jack	Lythraceae			2		9					11	1.08	17
Elaeis guineensis Jacq.	Palmae				1		6		103		110	10.83	2
Alpinia galanga (L.) Willd.	Zingiberaceae				40						40	3.94	8
Musa sapientum L.	Musaceae				3		6				9	0.89	19
Psidium guajava L.	Myrtaceae				1						1	0.10	26
Hevea brasiliensis Muell. Arg.	Euphorbiaceae				60	30					90	8.86	3
Dolichandrone spathacea Schum.	Bignoniaceae				1						1	0.10	26
Ficus racemosa L.	Moraceae				5		2			3	10	0.98	18
Lansium parasiticum	Meliaceae				19						19	1.87	12
Musa acuminata Colla	Musaceae				8		3		9	1	21	2.07	11
Momordica cochinchinensis (Lour.) Spreng.	Cucurbitaceae				1						1	0.10	26
Caryota mitis Lour.	Palmae				3			1			4	0.39	23
Sandoricum koetjape (Burm. f.) Merr.	Meliaceae				1	1					2	0.20	25
Feroniella lucida (Scheff.) Swingle	Rutaceae				1						1	0.10	26

Table 1.*(Cont.)* The diversity and evenness of trees on the waterside of Tapae canal, Thong Song, district, Nakhon Si Thammarat, Thailand

Scientific Name	Family	Station									N	%	ranks
		ST 1	S T2	S T3	S T4	S T5	S T6	S T7	ST 8	ST 9			
Dillenia obovata (Blume) Hoogland	Dilleniaceae					1					1	0.10	26
Flacourtia indica (Burm.f.) Merr.	Flacourtiaceae					6	1				7	0.69	21
Memecylon myrsinoides Blume	Melastomaceae					1					1	0.10	26
Glochidion Perakense Hook. f.	Euphorbiaceae					4					4	0.39	23
Salacca wallichiana Mart.	Arecaceae					3					3	0.30	24
Artocarpus heterophyllus Lam.	Moraceae					3	1				4	0.39	23
Dipterocarpus alatus Roxb. ex G.Don	Dipterocapaceae					1					1	0.10	26
Anacardium occidentale L.	Anacardiaceae					1		3			4	0.39	23
Lagerstroemia speciosa (L.)	Lythraceae					1		10			11	1.08	17
Duabanga grandiflora (DC.) Walp.	Lythraceae					1					1	0.10	26
Streblus asper Lour.	Moraceae						8				8	0.79	20
Mangifera indica Linn.	Anacardiaceae						1				1	0.10	26
Alstonia scholaris (L.) R. Br.	APOCYNACEAE						1				1	0.10	26

Table 1.*(Cont.)* The diversity and evenness of trees on the waterside of Tapae canal, Thong Song, district, Nakhon Si Thammarat, Thailand

Scientific Name	Family	Station									N	%	ranks
		ST 1	S T2	S T3	S T4	S T5	S T6	S T7	ST 8	ST 9			
Rhapis excelsa (Thunb.) Henry	Arecaceae Palmae						3				3	0.30	24
Costus speciosus (J.G.Kieng) Sm.	Zingiberaceae						4				4	0.39	23
Polyscias fruticosa Harms.	Araliacaeae						10				10	0.98	18
Tamarindus indica L.	Leguminosae						2	2			4	0.39	23
Senna siamea (Lam.) Irwin & Barneby	Leguminosae-Caesalpinioideae						10	3		27	40	3.94	8
Ceiba pentandra (L.) Gaertn.	Malvaceae						1	2			3	0.30	24
Amorphophallus paeoniifolius (Dennst.) Nicolson	Araceae						4				4	0.39	23
Amorphophallus paeoniifolius (Dennst.) Nicolson	Araceae						7				7	0.69	21
Garcinia cowa Roxb.	Guttiferae		2				1			1	4	0.39	23
Cyrtostachys renda	Palmae							2			2	0.20	25

Table 1.*(Cont.)* The diversity and evenness of trees on the waterside of Tapae canal, Thong Song, district, Nakhon Si Thammarat, Thailand

Scientific Name	Family	Station									N	%	ranks
		ST 1	S T2	S T3	S T4	S T5	S T6	S T7	ST 8	ST 9			
Swietenia macrophylla King	Meliaceae							14			14	1.38	15
Fagraea fragrans Roxb.	Gentianaceae							1			1	0.10	26
Cassia fistula L.	Fabaceae							1			1	0.10	26
Dieffenbachia seguine (Jacq.)	Araceae							5			5	0.49	22
Millingtonia hortensis L.f.	Bignoniaceae							3			3	0.30	24
Bauhinia saccocalyx Pierre	Caesalpinioideae							2			2	0.20	25
Cycas cirinalis L.	Cycadaceae							1			1	0.10	26
Plumeria spp.	Apocynaceae							22			22	2.17	10
Syzygium cumini Druce	Myrtaceae							1			1	0.10	26
Hopea odorata Roxb.	Dipterocarpaceae							1			1	0.10	26

Table 1.*(Cont.)* The diversity and evenness of trees on the waterside of Tapae canal, Thong Song, district, Nakhon Si Thammarat, Thailand

Scientific Name	Family	Station									N	%	ranks
		ST 1	S T2	S T3	S T4	S T5	S T6	S T7	ST 8	ST 9			
Bougainvillea spp.	Nyctaginaceae							5			5	0.49	22
Calotropis gigantea (L.) Dryand.	Apocynaceae							1			1	0.10	26
Caesalpinia pulcherrima (L.) Swartz.	Caesalpiniaceae							1			1	0.10	26
Delonix regia (Boj. ex Hook.) Raf.	Caesalpiniaceae							2			2	0.20	25
Microcos paniculata Linn.	Tiliaceae							2			2	0.20	25
Acacia pennata (L.) Willd.	Fabaceae								18		18	1.77	13
Phyllanthus acidus (L.) Skeels	Phyllanthaceae									5	5	0.49	22
Capsicum annuum L.	Solanaceae									13	13	1.28	16
Solanum torvum Sw.	Solanaceae									3	3	0.30	24
	Total Number Of Trees	30	112	48	153	184	94	97	191	107	1016	100 %	
	Number Of Trees At Each Station	8	11	12	16	22	24	28	6	12			
	Evenness Indices	0.79	0.56	0.70	0.69	0.77	0.89	0.85	0.74	0.81			
	Diversity Indices	0.71	0.58	0.81	0.83	1.04	1.23	1.25	0.62	0.88			

Table 2 The kind of trees from survey area (100 m^2) at station 1-9 on waterside of Tapae canal , Thong Song district, NakhonSi Thammarat province, Thailand

Station 1 Scientific Name	Family	Frequency	Percent (%)	Average of tree height (m)	Average of canopy diameter (m)
Bambusa sp.	Gramineae	15	0.15	15	5
Cocos nucifera L.	Palmae	2	0.07	14	3
Nephelium lappaceum L.	Sapindaceae	1	0.10	16	3
Garcinia mangostana L.	Guttiferae	2	0.07	10	3
Durio zibethinus Murray	Bombacacene	2	0.07	10	4
Chrysalidocarpus lutescens H.Wendl.	Palmae	7	0.14	9	3
Parkia speciosa Hassk.	Leguminosae	1	0.04	16	3
Metroxylon sagus Rottb.	Palmae	1	0.04	5	2
Station 2 Scientific Name					
Azadirachta indica A.Juss.	Meliaceae	9	0.08	3.5	4
Flacourtia indica (Burm.f.) Merr.	Flacourtiaceae	2	0.04	1.7	2
Bambusa sp.	Gramineae	3	0.03	18	5
Antidesma ghaesembilla Gaertn.	Euphorbiaceae	1	0.01	2	1
Annona muricata L.	Annonaceae	1	0.01	3.5	1
Garcinia mangostana L.	Guttiferae	78	0.12	12	2
Durio zibethinus Murray	Bombacacene	16	0.11	12	1
Lansium domesticum Corr.	Meliaceae	7	0.07	11	2
Manilkara zapota (L.) P.Royen	Sapotaceae	2	0.02	6	3
Garcinia cowa Roxb.	Clusiaceae Guttiferae	2	0.02	6	3
Metroxylon sagus Rottb.	Palmae	1	0.01	6	4

Table 2. *(cont.)* The kind of trees from survey area (100 m^2) atstation 1-9 on waterside of Tapae canal , Thong Song district, NakhonSiThammarat province, Thailand

Station 3 Scientific Name					
Bambusa sp.	Gramineae	8	0.12	16	6
Leucaena leucocephala (Lamk.)	Leguminosae-Mimosoideae	21	0.15	5	2
Chrysalidocarpus lutescens H.Wendl.	Palmae	7	0.12	10	3
Antidesma ghaesembilla Gaertn.	Euphorbiaceae	1	0.03	4	2
Ficus religiosa L.	Moraceae	1	0.03	7	5

Station 3 Scientific Name	Family	Frequency	Percent (%)	Average of tree height (m)	Average of canopy diameter (m)
Flacourtia indica (Burm.f.) Merr.	Flacourtiaceae	1	0.03	6	3
Pterocarpus indicus Willd	Leguminosae-Papilionoideae	1	0.03	8	4
Moringa oleifera Lam.	Moringaceae	3	0.07	8	4
Barringtonia acutangula (L.) Gaertn.	Lecythidaceae	1	0.03	9	3
Oroxylum indicum (L.) Kurz	Bignoniaceae	1	0.03	5	2
Terminalia catappa L.	Combretaceae	1	0.03	9	3
Lagerstroemia floribunda Jack	Lythraceae	2	0.05	12	3

Station 4 Scientific Name	Family	Frequency	Percent (%)	Average of tree height (m)	Average of canopy diameter (m)
Elaeis guineensis Jacq.	Palmae	1	0.01	10	5
Alpinia galanga (L.) Willd.	Zingiberaceae	40	0.14	2	0.5
Ficus religiosa L.	Moraceae	4	0.03	7	3
Musa sapientum L.	Musaceae	3	0.03	4	2
Psidium guajava L.	Myrtaceae	1	0.01	3	1
Hevea brasiliensis Muell. Arg.	Euphorbiaceae	60	0.15	28	3

Table 2. *(Cont.)* The Kind Of Trees From Survey Area (100 M^2) Atstation 1-9 On Waterside Of Tapae Canal , Thong Song District, Nakhonsithammarat Province, Thailand

Dolichandrone spathacea Schum.	Bignoniaceae	1	0.01	10	4
Nephelium lappaceum L.	Sapindaceae	11	0.07	15	3
Ficus racemosa L.	Moraceae	5	0.04	14	3
Chrysalidocarpus lutescens H.Wendl.	Palmae	5	0.04	13	2
Lansium parasiticum	Meliaceae	19	0.18	12	1
Musa acuminate Colla	Musaceae	8	0.06	4	2
Momordica cochinchinensis (Lour.)	Cucurbitaceae	1	0.01		2
Caryota mitis Lour.	Palmae	3	0.03	4	2
Sandoricum koetjape (Burm. f.) Merr.	Meliaceae	1	0.01	15	2
Feroniella lucida (Scheff.) Swingle	Rutaceae	1	0.01	3	1.5

Station 5 Scientific Name	Family	Frequency	Percent (%)	Average of tree height (m)	Average of canopy diameter (m)
Bambusa sp.	Gramineae	22	0.11	17	5
Garcinia mangostana L.	Guttiferae	31	0.13	10	3
Azadirachta indica A.Juss.	Meliaceae	29	0.13	10	3
Lagerstroemia floribunda Jack	Lythraceae	9	0.06	15	4
Dillenia obovata (Blume) Hoogland	Dilleniaceae	1	0.01	4	2
Chrysalidocarpus lutescens H.Wendl.	Palmae	8	0.06	13	3
Leucaena leucocephala (Lamk.)	Leguminosae-Mimosoideae	15	0.09	7	4
Flacourtia indica (Burm.f.) Merr.	Flacourtiaceae	6	0.05	5	2
Memecylon myrsinoides Blume	Melastomaceae	1	0.01	5	2
Glochidion perakense Hook.	Euphorbiaceae	4	0.03	4	1.5
Salacca wallichiana Mart.	Arecaceae	3	0.03	5	2.5

Table 2. The kind of trees from survey area (100 m^2) at station 1-9 on waterside of Tapae canal , Thong Song district,NakhonSi Thammarat province, Thailand

Barringtonia acutangula (L.) Gaertn.	Lecythidaceae	1	0.01	6	3
Artocarpus heterophyllus Lam.	Moraceae	3	0.03	8	2
Dipterocarpu salatus Roxb. ex G.Don	Dipterocapaceae	1	0.01	30	4
Hevea brasiliensis Muell. Arg.	Euphorbiaceae	30	0.13	25	2
Cocos nucifera L.	Arecaceae	2	0.02	2	1
Anacardium occidentale L.	Anacardiaceae	1	0.01	10	4
Lagerstroemia speciosa (L.)	Lythraceae	1	0.01	8	3
Duabanga grandiflora (DC.) Walp.	Lythraceae	1	0.01	7	3
Terminalia catappa L.	Combretaceae	1	0.01	6	4
Parkia speciosa Hassk.	Leguminosae	2	0.02	28	6
Sandoricum koetjape (Burm. f.) Merr.	Meliaceae	1	0.01	7	3

Station 6 Scientific Name	Family	Frequency	Percent (%)	Average of tree height (m)	Average of canopy diameter (m)
Bambusa sp.	Gramineae	4	0.05	9	4
Flacourtia indica (Burm.f.) Merr.	Flacourtiaceae	1	0.20	4	2
Ficus racemosa L.	Moraceae	2	0.03	6	2
Streblus asper Lour.	Moraceae	8	0.08	2.2	1
Mangifera indica Linn.	Anacardiaceae	1	0.02	4.4	2
Alstonia scholaris (L.)R. Br.	Apocynaceae	1	0.02	8	3
Rhapis excelsa (Thunb.) Henry	Arecaceae Palmae	3	0.04	1.5	1
Costus speciosus (J.G.Kieng) Sm.	Zingiberaceae	4	0.05	1	1
Polyscias fruticosa Harms.	Araliacaeae	10	0.10	1.3	1
Tamarindus indica L.	Leguminosae-Papilionoideae	2	0.03	5	3

Table 2. The kind of trees from survey area (100 m^2) at station 1-9 on waterside of Tapae canal , Thong Song district,NakhonSi Thammarat province, Thailand

Chrysalidocarpus lutescens H.Wendl.	Palmae	1	0.02	7	2
Garcinia mangostana L.	Guttiferae	1	0.10	10	4
Senna siamea (Lam.) Irwin &Barneby	Leguminosae-Caesalpinioideae	10	0.05	7	3
Cocos nucifera L.	Palmae	4	0.02	17	4
Ceiba pentandra (L.) Gaertn.	Malvaceae	1	0.12	12	3
Leucaena leucocephala (Lamk.)	Leguminosae-Mimosoideae	14	0.12	4	2
Elaeis guineensis Jacq.	Palmae	7	0.08	13	3
Artocarpus heterophyllus Lam.	Moraceae	1	0.02	8	3
Musa acuminate Colla	Musaceae	3	0.04	3	1
		2	0.03	5	2
Moringa oleifera Lam.	Moringaceae				
Musa sapientum L.	Musaceae	6	0.07	3	1
Amorphophallus paeoniifolius (Dennst.) Nicolson	Araceae	4	0.05	0.5	1
Amorphophallus paeoniifolius (Dennst.) Nicolson	Araceae	7	0.08	0.5	1
Garcinia cowa Roxb.	Clusiaceae Guttiferae	1	0.02	7	4

Station 7 Scientific Name	Family	Frequency	Percent (%)	Average of tree height (m)	Average of canopy diameter (m)
Tamarindus indica L.	Leguminosae-Papilionoideae	4	0.03	8	4
Cyrtostachys renda	Palmae	2	0.03	5	2
Swietenia macrophylla King	Meliaceae	14	0.11	15	4
Bambusa sp.	Gramineae/Poaceae	5	0.06	7	3
Fagraea fragrans Roxb.	Gentianaceae	1	0.01	10	3
Garcinia mangostana L.	Guttiferae	2	0.03	11	3
Cassia fistula L.	Fabaceae	1	0.01	14	5
Dieffenbachia seguine (Jacq.)	Araceae	5	0.06	1.5	1

Table 2. The kind of trees from survey area (100 m^2) at station 1-9 on waterside of Tapae canal , Thong Song district,NakhonSi Thammarat province, Thailand

Millingtonia hortensis L.f.	Bignoniaceae	3	0.04	6	2
Azadirachta indica A.Juss.	Meliaceae	3	0.04	7	3
Bauhinia saccocalyx Pierre	Caesalpinioideae	2	0.03	9	2
Cycas cirinalis L.	Cycadaceae	1	0.01	1.4	1
Lagerstroemia speciosa (L.)	Lythraceae	10	0.09	12	3
Plumeria spp.	Apocynaceae	22	0.14	3	1.5
Syzygium cumini Druce	Myrtaceae	1	0.01	5	2
Caryota mitis Lour.	Palmae	1	0.01	1.8	4
Hopea odorata Roxb.	Dipterocarpace Ae	1	0.01	16	3
Senna siamea (Lam.) Irwin &Barneby	Leguminosae-Caesalpinioideae	3	0.04	8	2
Leucaena leucocephala (Lamk.)	Leguminosae-Mimosoideae	1	0.01	4	1
Bougainvillea spp.	Nyctaginaceae	5	0.06	1.8	2
Caesalpinia pulcherrima (L.) Swartz.	Caesalpiniaceae	1	0.01	5	1.5
Calotropis gigantea (L.) Dryand.	Apocynaceae	1	0.01	2	3
Nephelium lappaceum L.	Sapindaceae	2	0.03	10	4
Delonix regia (Boj. ex Hook.) Raf.	Caesalpiniaceae	2	0.03	9	3
Chrysalidocarpus lutescens H.Wendl.	Palmae	1	0.01	10	2
Microcos paniculata Linn.	Tiliaceae	2	0.03	3.6	4
Anacardium occidentale L.	Anacardiaceae	3	0.04	8	3
Ceiba pentandra (L.) Gaertn.	Malvaceae	2	0.03	10	3
Station 8 Scientific Name	Family	Frequency	Percent (%)	Average of tree height (m)	Average of canopy diameter (m)
Bambusa sp.	Gramineae/Poaceae	6	0.04	14	5
Elaeis guineensis Jacq.	Palmae	103	0.14	16	4

Table 2. *(cont.)* The kind of trees from survey area (100 m^2) atstation 1-9 on waterside of Tapae canal , Thong Song district, NakhonSiThammarat province, Thailand

Chrysalidocarpus lutescens H.Wendl.	Palmae	32	0.11	12	2
Musa acuminate Colla	Musaceae	9	0.06	4	2
Acacia pennata (L.) Willd.	Fabaceae	13	0.07	1.4	1.5
Garcinia mangostana L.	Guttiferae	26	0.11	10	3

Station 9 Scientific Name	Family	Frequency	Percent (%)	Average of tree height (m)	Average of canopy diameter (m)
Senna siamea (Lam.) Irwin &Barneby	Leguminosae-Caesalpinioideae	27	0.15	10	3
Cocos nucifera L.	Palmae	21	0.13	15	3
Ficus racemosa L.	Moraceae	3	0.04	8	2
Metroxylon sagus Rottb.	Palmae	1	0.01	6	3
Musa acuminate Colla	Musaceae	1	0.01	3	1
Bambusa sp.	Gramineae/Poaceae	10	0.09	14	5
Leucaena leucocephala (Lamk.)	Leguminosae-Mimosoideae	19	0.13	3	2
Phyllanthus acidus (L.) Skeels	Phyllanthaceae	5	0.06	4	2
Garcinia cowa Roxb.	E Guttiferae	1	0.01	8	3
Capsicum annuum L.	Solanaceae	13	0.11	1.5	1
Chrysalidocarpus lutescens H.Wendl.	Palmae	3	0.04	10	2
Solanum torvum Sw.	Solanaceae	3	0.04	1.5	0.8
	Total	1,016	100 %	-	-

Discussion

The diversity and evenness observations of trees are varied by area and climatic around the world. In Lisbon, Portugal, street tree community was dominated by *Celtis australis* L., *Tillia*s *pp*., and *Jacaranda mimosifolia* D. which together counted 40% of tree population (Soares *et al*, 2011). In Bangalore, India, the four most commomly found species; *Albizia saman*, *Peltophorum pterocarpum*, *Spathodea campanulata*, and *Pongamia pinnata*, while *Albizia saman*is common species that was found less than 10% of the population (Nagendra and Gopal, 2010).The most of trees in schools the main

benefit use for propose of shading 78 percent. The primary and high school in urban of Thailand, they are popular to grow the perennial plat for the student use a shading during at noon time and sometime the use a shading for the class activity. The minority of beneficial use of trees for landscaping and the aesthetics (Na Nakorn *et al*, 2016). The diversity of trees on the Tapae canal waterside at the distance of 9 kilometers were found 1016 plants, the most abundance family were GUTTIFERAE, PALMAE, EUPHORBIACEAE, respectively, because of this family can grow well in tropical area and it is the important plant for economics planting of the people in the southern part of Thailand. In this study shown that, higher plant diversity in the survey area may have influenced of economics trees is relationship of plant species richness. The diversity of tree sometime depends on the benefit used.

Conclusion

The diversity of trees on the Tapae canal waterside were found 1016 trees, 78 species, 65 genera and 39 families. The most abundance family are in GUTTIFERAE, PALMAE, EUPHORBIACEAE, respectively. The five most abundant are;1) *Garcinia maggostsna* L. (13.78%);2) *Elaeis guinensis* Jacq. (10.83%); 3) *Hevea brasiliensis* Muell.Agr. (8.86%); 4) *Bambusa Sp.*. (7.19%); and 5) *Leuaena leucocephala* Lamk. (6.89%), respectively. The diversity indices were found that the most of the diversity indices were shown on station seven 1.25 and the lest diversity indices were shown on station two in 0.58. The most of the evenness indices was shown in station six and station seven were 0.89 and 0.85, respectively. The least evenness indices were shown on station two 0.56.

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