

CHAPTER 2

Plant Species Diversity in Fire and Non-fire Dry Dipterocarp Forests

Abstract

The plant species diversity in ecosystems of dry dipterocarp forest (DDF) with annual fire and without fire for at least for 10 years at Intakin Silvicultural Research Station, Chiang Mai province was investigated. Fifteen sampling plots, 40 x 40 m² in size, were arranged based on stratified sampling technique over the forest. The parameters of plant species and communities were frequency, density, dominance, important value index and species diversity index using a Shannon-Wiener function. Four 1-ha permanent plot were made, two plots each for fire and non-fire forests. In each plot, stem girth at breast height and height of all trees with ≥ 1.5 m tall were measured.

Totally, 63 tree and climber species were found in DDF of this area. In DDF with annual fire, 42 tree species in 36 genera and 22 families were observed, whereas those in non-fire DDF was 46 species (38 genera and 25 families). The most dominant tree in the fire and non-fire DDF was *Dipterocarpus tuberculatus*, followed by *Shorea obtusa* and *Gluta usitata*. The Shannon-Wiener indexes of species diversity in fire and non-fire forests were 3.24 and 3.20. The species diversity of tree species in DDF was not different between annual fire and non-fire forests during ten years of fire protection.

2.1 Introduction

The dry dipterocarp forest is a deciduous forest distributed naturally on mainland of Southeast Asia; Burma, Laos, Vietnam, Thailand and India. This forest is scattered in the area of monsoon climate with a marked dry period more than four months a year and total rainfall ranges of 900-1,200 mm. per year (Nalampun *et al.*, 1969). Four dominant xeric dipterocarp tree species are indicator of DDF; *Shorea obtusa*, *S. siamensis*, *Dipterocarpus obtusifolius* and *D. tuberculatus* (Smitinand, 1977; Kutintara, 1975). Many ecologists believe that fire is a limiting factor in DDF, and, thus, it is identified as the fire climax ecosystem. If no fire for a long time, the DDF might be changed to another forest type (Kuchler and Sawyer, 1967; Cooling, 1968). The forest fire usually occurs during December and April.

In Thailand, DDF occurs along the western mountain ranges from Petchaburi province up to the north. In northeastern region, this forest covered extensively in arid zone; drought, poor soil, heavy sand, gravels and rocks on top soil, between 50-1,000 m altitude (Bunyavejchewin, 1979). The natural regeneration and tree growth depend upon soil properties and moisture. The good forest is usually found on sandy clay loam with slightly acid soil. Species diversity and primary production in the forest are lower than other forest types. The good forest was remained at Huai Kha Khaeng Wildlife Sanctuary in Uthai Thani province (Maksirisombat, 1997).

Charuphat (1998) reported that the DDF area in 1980 was 147,000 sq.km (47% of forest area), and decreased to 26,800 sq.km. (20%) in 1998. It was decreased approximately 6,677 sq.km. (1.5%) per year. Dhanmanonda (1994) found that the

destroyed DDF needs about 60 years of gap-phase recovery, 62 years for building phase and 122 years more for development to climax forest.

Forest fire usually affects on tree growth. The wounds caused by fire will lead to disease and insect damage to wood. Annually fire makes the drought condition. This leads to decrease in the tree growth, yield and wood quality (Kaitpraneet, *et al.*, 1988).

The DDF in the Intakin Silvicultural Research Station, Chiang Mai, northern Thailand is a secondary forest recovered from logging in the past dominated by four dipterocarps; *S. obtusa*, *S. siamensis*, *D. obtusifolius* and *D. tuberculatus*. The forest provides benefits to the local people as non-wood products particularly edible mushrooms, vegetables, edible insects, etc. Most forest areas are poor shallow soil with sandy loam texture, and have forest fire every year. Fortunately, an area of about eight hectares has no fire for about ten years. The ecological changes are thought to be occurred in non-fire forest. The objective of this chapter is to assess the plant species diversity in dry dipterocarp forests with and without fire in this station.

2.2 Study Site

The research site was located in the Intakin Silvicultural Research Station, Intakin sub-district, Mae Tang district, Chiang Mai province. It is located on Chiang Mai to Phang road between the 17°08' N latitude and 96°57' E longitude (47 Q 0495421 UTM 2117377) with the altitude of 400 m above mean sea level as shown in Figure 2-1. The average annual rainfall is 1,174 mm with the average of 101 days of rain per year. The average temperature is 26°C with the average maximum and minimum temperatures of 31°C and 20.9°C, respectively. The average relative humidity is 85%. Soil is lateritic and has the low fertility. The forest in the area is only dry dipterocarp forest.

2.3 Materials and Methods

2.3.1 Vegetation Sampling

Assessment of forest vegetation in the overall area of DDF in this station was carried out using fifteen temporary plots. Four 1-ha permanent plots were used for studying fire and non-fire forests.

2.3.1.1 Temporary plots

The quadrat method was used for plant community analysis in this forest. Fifteen sampling plots of 40 x 40 m² in size were arranged by stratified random sampling to assess plant species diversity over the forest where forest fire is usually occurred every year. All trees in each plot are measured for stem girth at breast height (gbh) and tree height. The data were calculated for species diversity, relative frequency, relative density, basal area, relative dominance and importance value index.

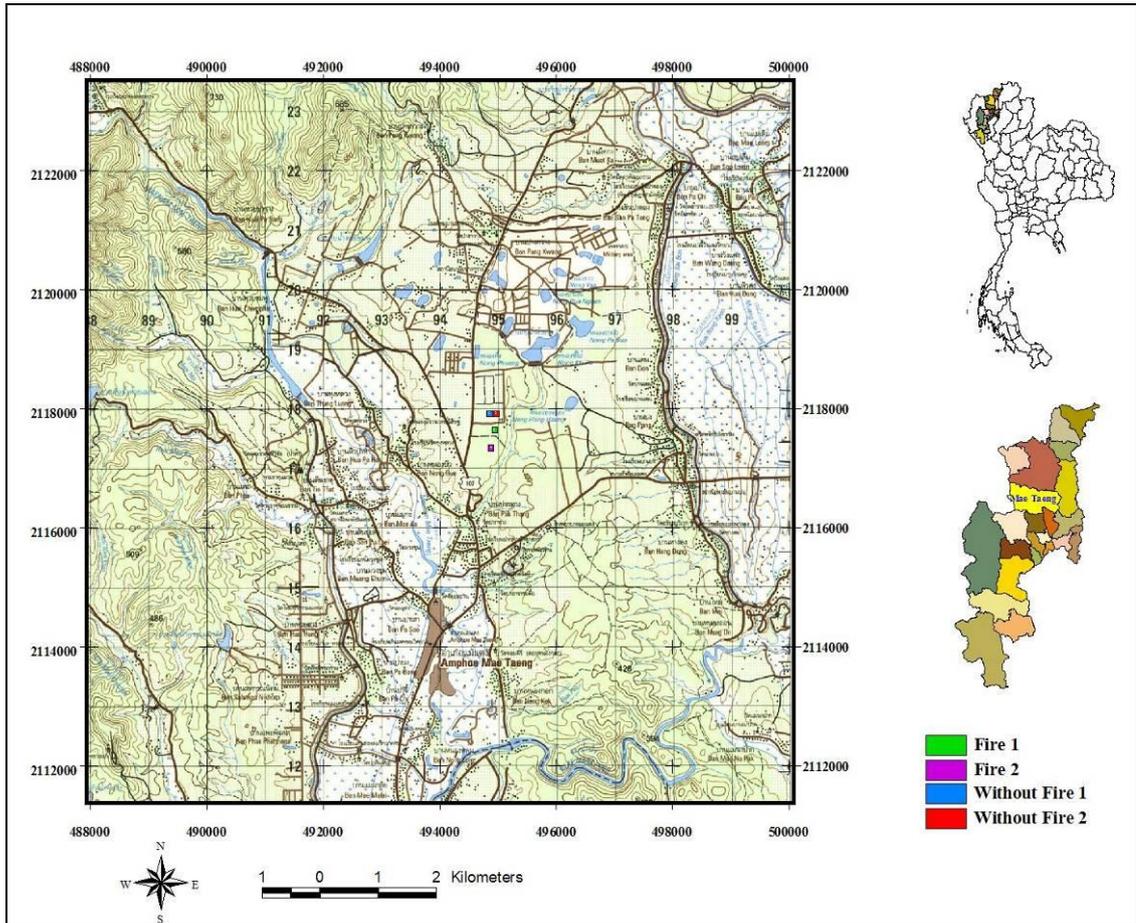


Figure 2-1 The location of study area at Intakin Silvicultural Research Station, Chiang Mai

2.3.1.2 Permanent plots

One 1-ha sampling plot divided into 100 subplots was used for investigation of plant species diversity in fire and non-fire DDF. All trees with ≥ 1.5 m tall were measured for stem girth at breast height (gbh) and tree height. The data were calculated for species diversity, relative frequency, relative density, basal area, relative dominance and importance value index. A small plot of $2 \times 2 \text{ m}^2$ was placed at the corner of each $10 \times 10 \text{ m}^2$ subplot to study number of seedlings and ground-covered species. The natural regeneration was identified from the number of seedlings of tree species.

2.3.2 Physical Data of Sampling Plots

All plots were recorded for positions using GPS (Global Positioning System) at the center of each plot, altitude, slope aspect and gradient. The slope gradient was measured every ten meters along the plot using abney.

2.3.3 Calculation for Ecological Parameters

The data were calculated for ecological parameters including plant frequency, density, dominance, important value index (IVI), and species diversity index (Krebs, 1985).

(1) Plant Frequency

$$\begin{aligned} \text{Frequency} &= \frac{\text{Number of occupied quadrats}}{\text{Number of all quadrats}} \times 100 \\ \text{Relative frequency} &= \frac{\text{Frequency of species } i}{\text{Sum of frequency of all species}} \times 100 \end{aligned}$$

(2) Plant Density

$$\begin{aligned} \text{Density} &= \frac{\text{Number of individuals of species } i}{\text{Number of all quadrats}} \quad (\text{trees/quadrat}) \\ \text{Relative density} &= \frac{\text{Number of individuals of species } i}{\text{Number of individuals of all species}} \times 100 \end{aligned}$$

(3) Plant Dominance

The relative dominance of tree species is calculated from the stem basal area.

$$\text{Relative dominance} = \frac{\text{Stem basal area of species } i}{\text{Sum of stem basal area of all species}} \times 100$$

(4) Important Value Index (IVI)

The IVI is a composite index based on measures of relative frequency, density and dominance (Mueller-Dombois and Ellenberg, 1974). It is an integrated influence of a tree species in the forest. The value varies between 0 and 300, and can be expressed in term of relative IVI.

$$\begin{aligned} \text{IVI} &= \text{Relative frequency} + \text{Relative density} + \text{Relative dominance} \\ \text{Relative IVI} &= \frac{\text{IVI of species } i}{\text{Sum of IVI of all species}} \times 100 \end{aligned}$$

(5) Index of Species Diversity

The Shannon-Wiener index (SWI) is the proportional weight of the number of individuals per species to the total sample belonging to all species (Krebs, 1985).

$$H = - \sum_{i=1}^S (p_i)(\log_2 p_i)$$

Where H = index of species diversity
 S = total number of species
 p_i = proportion of individuals of species i to total individuals of all species

(6) Index of Forest Conditions (FCI)

The index of species diversity does not imply to the forest condition. Different types of primary forests usually have different species diversity. Some forest types may be classified as species-poor ecosystems whereas the others are the species-rich ecosystems. Within the same forest type, the species diversity is changed with different stages of plant succession. The forests at the early and middle stages may also have the higher diversity than that in the climax stage. The forest conditions as good, intermediate or poor are considered from the number of bigger trees. On the other hand, the poor forests may have mainly small trees.

Assessment of the forest communities as the good, intermediate or poor conditions is proposed here. This is considered from the number of individual trees with different stem-girth classes. The big trees were significant more than small trees whereas plenty of individuals in small size classes that indicates a good regeneration. In this hypothesis, the stem-girth classes of tree species were divided into 0-25, 25-50, 50-75, 75-100,, respectively. The number of tree species in each stem-girth class is based on one rai (40 x 40 m²). The value of forest condition index (FCI) is the sum of the number of individual trees for all classes.

$$\text{FCI} = \sum n_1 \cdot 10^{-2} + n_2 \cdot 10^{-1} + (n_3 + n_4 + n_5 + \dots + n_n) \cdot 1$$

Where FCI = index of forest conditions
 n_1 = number of individual trees with gbh < 25 cm
 n_2 = number of individual trees with gbh 25-50 cm
 n_3 = number of individual trees with gbh 50-75 cm
 n_4 = number of individual trees with gbh 75-100 cm
 n_5 = number of individual trees with gbh 100-125 cm
 n_n = number of individual trees with gbh n cm

The highest number of trees in n_1 class (< 25 cm gbh) using a 40 x 40 m² sampling plot for DDF is about 800-900 trees for the poor dense forest. The importance of this class is given as $n_1 \times 10^{-2}$. For n_2 class, they are the bigger trees (saplings) with 25-50 cm gbh, and the importance is increased to 10^{-1} . The more bigger trees (immature, mature and old trees) have the higher importance.

(7) Forest Regeneration

The number of seedlings of various tree species and ground-covered species were counted in the small plots (2 x 2 m²) which placed at the corner of the each subplot to identify forest regeneration.

2.4 Results

The results of plant species diversity in DDF were divided into two sections; (1) the overall species diversity in the forest, and (2) the species diversity in fire and non-fire forests.

2.4.1 Overall Species Diversity and Forest Conditions

Table 2-1 shows the species list and growth forms of tree and climber species in the overall area of DDF in this station using fifteen temporary plots. Annual fire is usually occurred in this forest.

2.4.1.1 Species richness

Species richness of tree and climber species in the forest was 63 species in 50 genera and 34 families. The number of tree species (species richness) were different among the common families; Leguminosae (8 species), Rubiaceae (7), Euphorbiaceae (5), Dipterocarpaceae (4) and Anacardiaceae (4).

2.4.1.2 Quantitative Characteristics of Plant Species

The quantitative characteristics of tree and climber species based on fifteen temporary plots in dry dipterocarp forest were shown in Table 2-2.

(1) Plant frequency

Among 63 species, five tree species in the forest including *D. obtusifolius*, *S. obtusa*, *D. tuberculatus*, *Aporosa villosa* and *Canarium subulatum*, and a climber species, *Millettia extensa*, had the frequency of 100%. These plant species distributed over the forest. These species had the high frequency and densities, and thus were identified as common species. The less common species were *Gluta usitata*, *Irvingia malayana*, *Bridelia retusa*, *Dalbergia oliveri* and *Catunaregum tomentosa*. These trees had the frequencies of 80-93.33%. The lower values (6.67-73.33%) were observed in the remained species.

(2) Plant density

The average tree density in this forest was 2,715 trees/ha (434 trees/plot). The dominant tree species, *S. obtusa* had the highest density, 757 trees/ha, and followed by *D. tuberculatus* and *D. obtusifolius* (418-420 trees/ha). The lower densities were found for *A. villosa* (297), *M. extensa* (182) and *C. subulatum* (105).

The trees of intermediate densities were *Memecylon scutellatum* (96), *Irvingia malayana* (50), *Gluta usitata* (47), *Strychnos nux-vomica* (40), *Xylia xylocarpa* (39) *Bridelia retusa* (23) and *Dalbergia oliveri* (22). The remainder had the lower densities between 0.4-19 trees/ha.

The densities of various tree species were varied among fifteen sampling plots. *S. obtusa* had the highest density, in range of 47-205 trees/plot (Table 2-3). The other dominant trees including *D. tuberculatus* and *D. obtusifolius* had ranges of 1-143 and



Figure 2-2 Over view of DDF at Intakin Silvicultural Research Station

25-161 trees/plot, respectively. The variations of dominant tree species among sampling plots implied to the different plant communities in DDF of this research station.

(3) Tree dominance

D. obtusifolius had the highest dominance (35.19% of all species), followed by *D. tuberculatus* (24.67%), *S. obtusa* (15.27%), *A. villosa* (5.99%) and *C. subulatum* (3.70%). The remained species had the values below 3%.

Table 2-4 shows the stem basal areas of tree species in fifteen plots. The total stem basal area in the forest was 3.21 m²/plot (20 m²/ha) in average. *D. obtusifolius* had the highest stem basal area, 1.13 m²/plot.

The relative dominance values of dominant tree species varied among fifteen plots (Table 2-5). *D. obtusifolius* had the dominance between 12.38-67.60% of all species. They were 0.06-43.07% for *D. tuberculatus* and 3.48-31.47% for *S. obtusa*. The dominance values of these tree species were greatly varied.

(4) Important value index (IVI)

D. obtusifolius had the high frequency, density and a large number of big trees in the forest, and resulted in the highest IVI (18.19% of all species), and followed by *S. obtusa*, *D. tuberculatus*, *A. villosa*, *M. extensa* and *C. subulatum*. This implied to the highest ecological influence of this dominant tree species in the forest. The sum of relative IVI of three dominant dipterocarp trees, *D. obtusifolius*, *D. tuberculatus* and *S. obtusa*, was high as 48.61%.

Table 2-1 Species list and growth forms of tree species in overall DDF

	Thai name	Scientific name	Growth form*
1	Anacardiaceae		
1	มะม่วงหัวแมงวัน Mamuang hua maeng wan	<i>Buchanania lanzan</i> Spreng.	T
2	รักใหญ่ Rak yai	<i>Gluta usitata</i> (Wall.) Ding Hou	T
3	รักขี้หนู Rak khi mu	<i>Semecarpus albescens</i> Kurz	T
4	รักขน Rak khon	<i>Semecarpus anacardium</i> Linn.f.	T
2	Annonaceae		
5	ปอขี้แฮด Po khi haet	<i>Goniothalamus laoticus</i> (Finet & Gagnep.)	ST
3	Apocynaceae		
6	โมกเครือ Mok khrua	<i>Aganosma marginata</i> (Roxb.) G. Don	C
4	Bignoniaceae		
7	แคฝอย Khae foi	<i>Stereospermum neuranthum</i> Kurz	T
5	Burseraceae		
8	มะกึ่ม Ma koem	<i>Canarium subulatum</i> Guillaumin	T
6	Combretaceae		
9	รกฟ้า Rok fa	<i>Terminalia alata</i> Heyne ex Roth	T
10	สมอไทย Samo thai	<i>Terminalia chebula</i> Retz. var. <i>chebula</i>	T
7	Combretaceae		
11	ตะแบกเลือด Ta baek lueat	<i>Terminalia mucronata</i> Craib & Hutch.	T
8	Dilleniaceae		
12	ส้าน San	<i>Dillenia obovata</i> (Blume) Hoogland	ST
9	Dipterocarpaceae		
13	เหียง Hiang	<i>Dipterocarpus obtusifolius</i> Teijsm. ex Miq.	T
14	พลวง Phluang	<i>Dipterocarpus tuberculatus</i> Roxb.	T
15	เต็ง Teng	<i>Shorea obtusa</i> Wall.	T
16	รัง Rang	<i>Shorea siamensis</i> Miq.	T
10	Ebenaceae		
17	ตับเต่าตัน Taptao ton	<i>Diospyros ehretioides</i> Wall. ex G. Don	T
11	Ericaceae		
18	ตาชีเคย Ta-chi-khoei	<i>Craibiodendron stellatum</i> (Pierre) W.W.Sm	ST
12	Euphorbiaceae		
19	ม่าดำ Moa dam	<i>Antidesma ghaesembilla</i> Gaertn.	ST
20	ม่าขาว Moa khao	<i>Antidesma acidum</i> Retz.	ST
21	เหมือดหลวง Mueat luang	<i>Aporosa villosa</i> (Wall. ex Lindl.) Baill.	ST
22	เปาหนาม Teng nam	<i>Bridelia retusa</i> (L.)	T
23	เหมือดหอม Mueat hom	<i>Symplocos racemosa</i> Roxb.	T
13	Fagaceae		
24	ก่อพะพะ Ko phae	<i>Quercus kerrii</i> Craib	T
14	Flacourtiaceae		
25	ตะขบป่า Ta khop pa	<i>Flacourtia indica</i> (Burm.f.) Merr.	ST
15	Guttiferae		
26	ดี้ว Tio	<i>Cratoxylum formosum</i> (Jack) Dyer subsp.	T
27	ชะมวง Cha muang	<i>Garcinia cowa</i> Roxb. ex DC.	T
28	ขี้ผึ้ง Khi phueng	<i>Garcinia merguensis</i> Wight	ST
16	Irvingiaceae		
29	กระบก Hkrabok	<i>Irvingia malayana</i> Oliv. ex A. Benn.	T
17	Labiatae		
30	กาสวมปีก Ka sam pik	<i>Vitex peduncularis</i> Wall. ex Schauer	T
31	ตินนง Tin nok	<i>Vitex pinnata</i> L.	T
18	Lauraceae		
32	หมี่เหม็น Mi men	<i>Litsea glutinosa</i> (Lour.) C.B.Rob.	T
19	Leguminosae		
33	แดง Daeng	<i>Xylocarpus xylocarpa</i> (Roxb.)	T
34	บึ้ง Pi phong	<i>Dalbergia cana</i> Graham ex Kurz	T

Table 2-1 (Continued)

	Thai name	Scientific name	Growth form*
	35 เกิดคำ Ket dam	<i>Dalbergia cultrata</i> Graham ex Benth.	T
	36 ชิงชัน Chingchan	<i>Dalbergia oliveri</i> Gamble	T
	37 เครือปี Khrua pi	<i>Dalbergia velutina</i> Benth.	C
	38 เครือกวาว Kwao khrua	<i>Millettia extensa</i> Benth.	C
	39 ประดู่ Pra du	<i>Pterocarpus macrocarpus</i> Kurz	T
	40 เครือพันช้าย Khrua phan sai	<i>Spatholobus parviflorus</i> (DC.) Kuntze	C
20	Lythraceae		
	41 อินทนิลบก Inthanin bok	<i>Lagerstroemia macrocarpa</i> Wall.	T
21	Melastomataceae		
	42 เหมือดซี่ Mueat chi	<i>Memecylon scutellatum</i> Naudin.	ST
	43 เหมือดฟอง Mueat fong	<i>Memecylon plebejum</i> Kurz. var. <i>ellipsoideum</i>	ST
22	Meliaceae		
	44 ขี้ไต้ Khi ai	<i>Walsura robusta</i> Roxb.	ST
23	Myrtaceae		
	45 หว้า Wa	<i>Syzygium cumini</i> (L.) Skeels	T
24	Ochnaceae		
	46 ตาลเหลือง Tan lueang	<i>Ochna integerrima</i> (Lour.) Merr.	ST
25	Olacaceae		
	47 ขี้หนอนหนาม Khi non nam	<i>Schoepfia fragrans</i> Wall.	ST
26	Rubiaceae		
	48 เค็ด Ma khet	<i>Catunaregam tomentosa</i> (Blume ex DC.)	ST
	49 มะกั้งแดง Ma khang daeng	<i>Dioecrescis erythroclada</i> (Kurz) Tirveng.	ST
	50 กำมอกน้อย Khammok noi	<i>Gardenia obtusifolia</i> Roxb. ex Kurz	ST
	51 กำมอกหลวง Khammok luang	<i>Gardenia sootepensis</i> Hutch.	ST
	52 สุ่มกว่าว Tum kwao	<i>Mitragyna rotundifolia</i> (Roxb.) Kuntze	T
	53 ขอป่า Yo pa	<i>Morinda coreia</i> Ham.	ST
	54 แข็งกวาง Khaeng kwang	<i>Wendlandia tinctoria</i> (Roxb.) DC.	ST
27	Sapindaceae		
	55 ตะคร้อ Ta khro	<i>Schleichera oleosa</i> (Lour.) Oken.	T
	56 ลำไยป่า Lamyai pa	<i>Dimocarpus longan</i> Lour. subsp. <i>longan</i> var.	T
28	Sapotaceae		
	57 ละมุดป่า Lamut pa	<i>Manilkara littoralis</i> (Kurz) Dubard	T
29	Smilacaceae		
	58 เครือเตา Khrua dao	<i>Smilax ovalifolia</i> Roxb.	C
30	Strychnaceae		
	59 แสลงใจ Salaeng chai	<i>Strychnos nux-vomica</i> L.	ST
31	Theaceae		
	60 สารภีป่า Saraphi pa	<i>Anneslea fragrans</i> Wall.	ST
32	Tiliaceae		
	61 ปอขาบ Po yap	<i>Colona flagrocarpa</i> (C.B.Clarke) Craib	ST
33	Ulmaceae		
	62 ลูกสืบ Lup lip	<i>Ulmus lancaefolia</i> Roxb. ex Wall.	T
34	Unknown		
	63 เม่าเครือ Mao khrua	Unidentified species	C

Note: * T = Tree, ST = Shrubby Tree, C = Climber

Table 2-2 Quantitative characteristics of tree species in fifteen temporary plots of dry dipterocarp forests

No	Species	Frequency (%)	Density (trees/plot)	Density (trees/ha)	Basal area (m ² /ha)	Relative (%)			IVI	
						Frequency	Density	Dominance	300	%
1	<i>Dipterocarpus obtusifolius</i>	100.00	66.93	418.3	7.0608	3.98	15.41	35.19	54.57	18.19
2	<i>Shorea obtusa</i>	100.00	121.13	757.1	3.0636	3.98	27.88	15.27	47.13	15.71
3	<i>Dipterocarpus tuberculatus</i>	100.00	67.20	420.0	4.9508	3.98	15.47	24.67	44.12	14.71
4	<i>Aporosa villosa</i>	100.00	47.46	296.7	1.2021	3.98	10.92	5.99	20.89	6.96
5	<i>Millettia extensa</i>	100.00	29.13	182.1	0.5187	3.98	6.71	2.58	13.27	4.42
6	<i>Canarium subulatum</i>	100.00	16.80	105.0	0.7415	3.98	3.87	3.70	11.54	3.85
7	<i>Gluta usitata</i>	93.33	7.47	46.7	0.4859	3.71	1.72	2.42	7.85	2.62
8	<i>Irvingia malayana</i>	93.33	8.06	50.4	0.3969	3.71	1.86	1.98	7.55	2.52
9	<i>Memecylon scutellatum</i>	53.33	15.40	96.3	0.1954	2.12	3.54	0.97	6.64	2.21
10	<i>Bridelia retusa</i>	93.33	3.73	23.3	0.0877	3.71	0.86	0.44	5.01	1.67
11	<i>Strychnos nux-vomica</i>	73.33	6.40	40.0	0.0954	2.92	1.47	0.48	4.87	1.62
12	<i>Dalbergia oliveri</i>	80.00	3.53	22.1	0.1551	3.18	0.81	0.77	4.77	1.59
13	<i>Xylia xylocarpa</i>	60.00	6.20	38.8	0.1819	2.39	1.43	0.91	4.72	1.57
14	<i>Catunaregam tomentosa</i>	80.00	2.20	13.8	0.0325	3.18	0.51	0.16	3.85	1.28
15	<i>Shorea siamensis</i>	53.33	3.07	19.2	0.1324	2.12	0.71	0.66	3.49	1.16
16	<i>Terminalia chebula</i>	73.33	1.73	10.8	0.0284	2.92	0.40	0.14	3.46	1.15
17	<i>Dillenia obovata</i>	66.67	1.13	7.1	0.0487	2.65	0.26	0.24	3.16	1.05
18	<i>Terminalia alata</i>	60.00	2.00	12.5	0.0578	2.39	0.46	0.29	3.14	1.05
19	<i>Gardenia sootepensis</i>	60.00	1.80	11.3	0.0417	2.39	0.41	0.21	3.01	1.00
20	<i>Wendlandia tinctoria</i>	60.00	1.93	12.1	0.0232	2.39	0.44	0.12	2.95	0.98
21	<i>Dalbergia cultrata</i>	53.33	2.07	12.9	0.0413	2.12	0.48	0.21	2.80	0.93
22	<i>Dioecrescis erythroclada</i>	53.33	1.40	8.8	0.0135	2.12	0.32	0.07	2.51	0.84
23	<i>Mitragyna rotundifolia</i>	40.00	2.40	15.0	0.0274	1.59	0.55	0.14	2.28	0.76
24	<i>Ulmus lancaefolia</i>	46.67	0.73	4.6	0.0155	1.86	0.17	0.08	2.10	0.70
25	<i>Gardenia obtusifolia</i>	46.67	0.80	5.0	0.0071	1.86	0.18	0.04	2.08	0.69

Table 2-2 (Continued)

No	Species	Frequency (%)	Density (trees/plot)	Density (trees/ha)	Basal area (m ² /ha)	Relative (%)			IVI	
						Frequency	Density	Dominance	300	%
26	<i>Stereospermum neuranthum</i>	40.00	0.87	5.4	0.0431	1.59	0.20	0.21	2.01	0.67
27	<i>Antidesma ghaesembilla</i>	40.00	0.67	4.2	0.0052	1.59	0.15	0.03	1.77	0.59
28	<i>Quercus kerrii</i>	33.33	0.67	4.2	0.0576	1.33	0.15	0.29	1.77	0.59
29	<i>Garcinia cowa</i>	33.33	1.27	7.9	0.0276	1.33	0.29	0.14	1.76	0.59
30	<i>Symplocos racemosa</i>	33.33	0.87	5.4	0.0276	1.33	0.20	0.14	1.66	0.55
31	<i>Diospyros ehretioides</i>	33.33	0.67	4.2	0.0238	1.33	0.15	0.12	1.60	0.53
32	<i>Lagerstroemia macrocarpa</i>	33.33	0.53	3.3	0.0075	1.33	0.12	0.04	1.49	0.50
33	<i>Buchanania lanzan</i>	26.67	0.53	3.3	0.0208	1.06	0.12	0.10	1.29	0.43
34	<i>Flacourtia indica</i>	26.67	0.67	4.2	0.0092	1.06	0.15	0.05	1.26	0.42
35	<i>Semecarpus anacardium</i>	26.67	0.53	3.3	0.0147	1.06	0.12	0.07	1.26	0.42
36	<i>Vitex peduncularis</i>	26.67	0.47	2.9	0.0155	1.06	0.11	0.08	1.25	0.42
37	<i>Manilkara littoralis</i>	26.67	0.47	2.9	0.0033	1.06	0.11	0.02	1.19	0.40
38	<i>Semecarpus albescens</i>	20.00	0.33	2.1	0.0527	0.80	0.08	0.26	1.14	0.38
39	<i>Terminalia mucronata</i>	20.00	0.53	3.3	0.0257	0.80	0.12	0.13	1.05	0.35
40	<i>Colona flagrocarpa</i>	20.00	0.40	2.5	0.0036	0.80	0.09	0.02	0.91	0.30
41	<i>Syzygium cumini</i>	20.00	0.20	1.3	0.0065	0.80	0.05	0.03	0.87	0.29
42	<i>Memecylon plebejum</i>	13.33	0.60	3.8	0.0248	0.53	0.14	0.12	0.79	0.26
43	<i>Goniothalamus laoticus</i>	13.33	0.53	3.3	0.0150	0.53	0.12	0.07	0.73	0.24
44	<i>Dimocarpus longan</i>	13.33	0.33	2.1	0.0160	0.53	0.08	0.08	0.69	0.23
45	<i>Schleichera oleosa</i>	13.33	0.33	2.1	0.0076	0.53	0.08	0.04	0.65	0.22
46	<i>Craibiodendron stellatum</i>	13.33	0.13	0.8	0.0103	0.53	0.03	0.05	0.61	0.20
47	<i>Pterocarpus macrocarpus</i>	13.33	0.20	1.3	0.0046	0.53	0.05	0.02	0.60	0.20
48	<i>Dalbergia cana</i>	13.33	0.13	0.8	0.0058	0.53	0.03	0.03	0.59	0.20
49	<i>Spatholobus parviflorus</i>	13.33	0.20	1.3	0.0026	0.53	0.05	0.01	0.59	0.20
50	<i>Cratoxylum formosum</i>	13.33	0.20	1.3	0.0003	0.53	0.05	0.00	0.58	0.19

Table 2-2 (Continued)

No	Species	Frequency (%)	Density (trees/plot)	Density (trees/ha)	Basal area (m ² /ha)	Relative (%)			IVI	
						Frequency	Density	Dominance	300	%
51	<i>Smilax ovalifolia</i>	13.33	0.13	0.8	0.0010	0.53	0.03	0.01	0.57	0.19
52	<i>Litsea glutinosa</i>	6.67	0.13	0.8	0.0127	0.27	0.03	0.06	0.36	0.12
53	<i>Morinda coreia</i>	6.67	0.20	1.3	0.0058	0.27	0.05	0.03	0.34	0.11
54	<i>Schoepfia fragrans</i>	6.67	0.20	1.3	0.0024	0.27	0.05	0.01	0.32	0.11
55	<i>Walsura robusta</i>	6.67	0.20	1.3	0.0023	0.27	0.05	0.01	0.32	0.11
56	<i>Ochna integerrima</i>	6.67	0.07	0.4	0.0030	0.27	0.02	0.01	0.30	0.10
57	<i>Anneslea fragrans</i>	6.67	0.07	0.4	0.0023	0.27	0.02	0.01	0.29	0.10
58	<i>Antidesma acidum</i>	6.67	0.07	0.4	0.0004	0.27	0.02	0.00	0.28	0.09
59	<i>Vitex pinnata</i>	6.67	0.07	0.4	0.0002	0.27	0.02	0.00	0.28	0.09
60	<i>Garcinia merguensis</i>	6.67	0.07	0.4	0.0001	0.27	0.02	0.00	0.28	0.09
61	<i>Aganosma marginata</i>	6.67	0.07	0.4	0.0001	0.27	0.02	0.00	0.28	0.09
62	<i>Dalbergia velutina</i>	6.67	0.07	0.4	0.0001	0.27	0.02	0.00	0.28	0.09
63	Unidentified species	6.67	0.07	0.4	0.0002	0.27	0.02	0.00	0.28	0.09
Total		2,513	434	2,715	20.07	100	100	100	300	100

Table 2-3 Tree densities in fifteen temporary plots in the dry dipterocarp forest

No	Species	Density (trees/plot)															
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Average
1	<i>Shorea obtusa</i>	177	218	77	47	115	112	60	78	133	205	164	167	159	58	47	121
2	<i>Dipterocarpus tuberculatus</i>	62	81	91	102	143	11	66	2	76	47	1	48	138	124	16	67
3	<i>Dipterocarpus obtusifolius</i>	25	30	25	72	43	68	102	139	29	54	89	65	33	69	161	67
4	<i>Aporosa villosa</i>	21	19	32	134	41	35	67	85	28	56	21	59	36	38	40	47
5	<i>Millettia extensa</i>	29	25	20	24	15	23	26	43	23	21	30	34	26	43	55	29
6	<i>Canarium subulatum</i>	10	25	11	20	22	15	17	16	5	17	12	23	19	15	25	17
7	<i>Memecylon scutellatum</i>	-	-	3	33	23	61	33	75	-	1	-	2	-	-	-	29
8	<i>Irvingia malayana</i>	4	2	4	7	14	6	20	15	5	5	-	8	6	7	18	9
9	<i>Gluta usitata</i>	1	1	8	12	18	6	6	6	22	9	5	9	8	1	-	8
10	<i>Strychnos nux-vomica</i>	10	10	10	9	14	-	3	-	-	1	-	1	6	23	9	9
11	<i>Xylia xylocarpa</i>	14	13	-	-	-	-	-	9	5	3	8	-	1	2	38	10
12	<i>Bridelia retusa</i>	4	2	5	4	5	4	1	1	-	2	5	4	1	10	8	4
13	<i>Dalbergia oliveri</i>	5	5	3	2	6	4	-	3	1	2	7	3	12	-	-	4
14	<i>Shorea siamensis</i>	2	-	-	-	-	1	-	-	4	1	14	-	2	10	12	6
15	<i>Mitragyna rotundifolia</i>	-	1	-	5	12	3	9	6	-	-	-	-	-	-	-	6
16	<i>Catunaregam tomentosa</i>	-	1	7	3	6	1	3	1	-	1	-	1	1	2	6	3
17	<i>Dalbergia cultrata</i>	-	2	-	3	12	-	-	-	2	-	4	1	-	1	6	4
18	<i>Terminalia alata</i>	1	3	1	-	1	-	-	-	1	-	3	-	6	3	11	3
19	<i>Wendlandia tinctoria</i>	-	-	4	2	8	6	2	2	-	-	1	-	1	-	3	3
20	<i>Gardenia sootepensis</i>	1	-	1	-	-	7	-	10	1	2	2	2	-	1	-	3
21	<i>Terminalia chebula</i>	2	-	1	3	1	2	1	-	1	-	6	-	1	2	6	2
22	<i>Dioecrescis erythroclada</i>	1	1	4	-	-	1	2	-	-	-	-	1	-	8	3	3
23	<i>Garcinia cowa</i>	1	-	-	13	2	-	1	-	-	-	-	-	2	-	-	4
24	<i>Dillenia obovata</i>	1	-	-	1	1	2	3	2	1	1	-	1	4	-	-	2
25	<i>Stereospermum neuranthum</i>	-	-	1	-	-	-	-	-	-	-	2	1	2	2	5	2

Table 2-3 (Continued)

No	Species	Density (trees/plot)															
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Average
26	<i>Symplocos racemosa</i>	1	-	-	3	-	1	7	-	-	1	-	-	-	-	-	3
27	<i>Gardenia obtusifolia</i>	-	2	1	1	-	2	1	3	2	-	-	-	-	-	-	2
28	<i>Ulmus lancaefolia</i>	1	1	-	1	5	-	1	1	-	1	-	-	-	-	-	2
29	<i>Quercus kerrii</i>	3	3	1	-	-	1	-	-	-	-	-	-	-	-	2	2
30	<i>Flacourtia indica</i>	-	1	-	-	-	-	-	-	-	-	-	-	4	3	2	3
31	<i>Diospyros ehretioides</i>	-	1	-	-	-	-	-	2	-	-	1	-	3	3	-	2
32	<i>Antidesma ghaesembilla</i>	-	-	-	1	-	3	1	1	-	-	-	-	-	3	1	2
33	<i>Memecylon plebejum</i>	-	-	-	-	-	-	-	-	-	-	3	-	-	-	6	5
34	<i>Terminalia mucronata</i>	-	1	-	-	-	-	-	-	-	-	-	-	-	1	6	3
35	<i>Goniothalamus laoticus</i>	-	-	-	-	-	7	1	-	-	-	-	-	-	-	-	4
36	<i>Semecarpus anacardium</i>	-	3	-	2	-	2	1	-	-	-	-	-	-	-	-	2
37	<i>Lagerstroemia macrocarpa</i>	1	2	3	-	-	-	-	-	1	-	-	1	-	-	-	2
38	<i>Buchanania lanzan</i>	-	-	-	2	-	-	1	3	2	-	-	-	-	-	-	2
39	<i>Vitex peduncularis</i>	1	1	-	1	-	-	-	-	-	-	4	-	-	-	-	2
40	<i>Manilkara littoralis</i>	-	-	-	-	-	-	-	-	-	-	3	2	1	1	-	2
41	<i>Colona flagrocarpa</i>	1	-	-	-	-	3	2	-	-	-	-	-	-	-	-	2
42	<i>Schleichera oleosa</i>	-	-	-	-	-	4	1	-	-	-	-	-	-	-	-	3
43	<i>Semecarpus albescens</i>	-	-	-	-	-	-	-	-	-	-	1	-	1	-	3	2
44	<i>Dimocarpus longan</i>	-	-	-	-	-	-	-	-	-	-	3	-	2	-	-	3
45	<i>Schoepfia fragrans</i>	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	3
46	<i>Walsura robusta</i>	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	3
47	<i>Spatholobus parviflorus</i>	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	2
48	<i>Cratoxylum formosum</i>	-	-	-	-	-	1	2	-	-	-	-	-	-	-	-	2
49	<i>Pterocarpus macrocarpus</i>	-	-	-	-	-	-	2	-	-	1	-	-	-	-	-	2
50	<i>Morinda coreia</i>	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	3

Table 2-3 (Continued)

No	Species	Density (trees/plot)															
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Average
51	<i>Syzygium cumini</i>	1	-	-	-	-	-	-	-	-	-	1	-	1	-	-	1
52	<i>Smilax ovalifolia</i>	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1	1
53	<i>Craibiodendron stellatum</i>	-	-	-	-	-	-	-	-	-	1	-	1	-	-	-	1
54	<i>Dalbergia cana</i>	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	1
55	<i>Litsea glutinosa</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	2
56	<i>Garcinia merguensis</i>	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1
57	<i>Ochna integerrima</i>	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1
58	<i>Vitex pinnata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1
59	<i>Dalbergia velutina</i>	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	1
60	<i>Antidesma acidum</i>	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1
61	Unidentified species	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	1
62	<i>Aganosma marginata</i>	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1
63	<i>Anneslea fragrans</i>	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1
Total		381	457	314	509	509	397	445	506	342	432	391	434	477	430	493	434

Table 2-4 Stem basal areas of tree species in fifteen temporary plots in DDF

No	Species	Basal areas (m ² /plot)															
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
1	<i>Dipterocarpus obtusifolius</i>	0.444	0.586	0.810	1.185	0.602	1.421	1.137	1.589	0.686	1.120	1.922	1.218	0.656	1.165	2.406	1.130
2	<i>Dipterocarpus tuberculatus</i>	1.434	1.298	1.223	1.157	1.465	0.089	0.495	0.008	0.918	0.485	0.002	0.621	1.337	1.202	0.147	0.792
3	<i>Shorea obtusa</i>	0.980	1.134	0.333	0.359	0.651	0.326	0.163	0.240	0.387	0.547	0.565	0.609	0.745	0.174	0.138	0.490
4	<i>Aporosa villosa</i>	0.130	0.129	0.185	0.377	0.120	0.078	0.193	0.176	0.156	0.256	0.112	0.231	0.187	0.343	0.214	0.192
5	<i>Canarium subulatum</i>	0.129	0.113	0.208	0.086	0.081	0.064	0.071	0.070	0.036	0.081	0.069	0.101	0.123	0.395	0.152	0.119
6	<i>Millettia extensa</i>	0.104	0.084	0.056	0.137	0.077	0.023	0.053	0.035	0.074	0.045	0.097	0.110	0.131	0.111	0.109	0.083
7	<i>Gluta usitata</i>	0.008	0.036	0.176	0.068	0.135	0.125	0.035	0.046	0.229	0.072	0.080	0.051	0.104	0.002	-	0.083
8	<i>Irvingia malayana</i>	0.030	0.006	0.039	0.019	0.086	0.069	0.093	0.040	0.019	0.017	-	0.031	0.035	0.361	0.108	0.068
9	<i>Memecylon scutellatum</i>	-	-	0.004	0.316	0.024	0.046	0.023	0.052	-	0.001	-	0.003	-	-	-	0.059
10	<i>Xylia xylocarpa</i>	0.029	0.025	-	-	-	-	-	0.020	0.039	0.034	0.076	-	0.017	0.005	0.192	0.049
11	<i>Dalbergia oliveri</i>	0.030	0.020	0.029	0.008	0.016	0.030	-	0.001	0.001	0.048	0.068	0.020	0.101	-	-	0.031
12	<i>Shorea siamensis</i>	0.060	-	-	-	-	0.001	-	-	0.012	0.000	0.110	-	0.008	0.077	0.050	0.040
13	<i>Strychnos nux-vomica</i>	0.024	0.020	0.030	0.013	0.063	-	0.007	-	-	0.001	-	0.001	0.010	0.034	0.026	0.021
14	<i>Bridelia retusa</i>	0.026	0.006	0.008	0.027	0.012	0.008	0.001	0.003	-	0.012	0.018	0.012	0.000	0.021	0.056	0.015
15	<i>Terminalia alata</i>	0.015	0.010	0.004	-	0.002	-	-	-	0.001	-	0.006	-	0.030	0.017	0.054	0.015
16	<i>Quercus kerrii</i>	0.071	0.031	0.003	-	-	0.010	-	-	-	-	-	-	-	-	0.023	0.028
17	<i>Semecarpus albescens</i>	-	-	-	-	-	-	-	-	-	-	0.015	-	0.001	-	0.110	0.042
18	<i>Dillenia obovata</i>	0.007	-	-	0.000	0.001	0.010	0.013	0.007	0.005	0.033	-	0.010	0.031	-	-	0.012
19	<i>Stereospermum neuranthum</i>	-	-	0.000	-	-	-	-	-	-	-	0.014	0.006	0.039	0.025	0.019	0.017
20	<i>Gardenia sootepensis</i>	0.000	-	0.000	-	-	0.011	-	0.024	0.001	0.008	0.045	0.003	-	0.007	-	0.011
21	<i>Dalbergia cultrata</i>	-	0.005	-	0.001	0.024	-	-	-	0.007	-	0.022	0.005	-	0.006	0.029	0.012
22	<i>Catunaregam tomentosa</i>	-	0.001	0.006	0.044	0.005	0.000	0.001	0.000	-	0.004	-	0.003	0.000	0.006	0.007	0.006
23	<i>Terminalia chebula</i>	0.001	-	0.003	0.005	0.000	0.001	0.003	-	0.002	-	0.024	-	0.003	0.009	0.016	0.006
24	<i>Symplocos racemosa</i>	0.009	-	-	0.012	-	0.009	0.028	-	-	0.008	-	-	-	-	-	0.013
25	<i>Garcinia cowa</i>	0.024	-	-	0.033	0.004	-	0.001	-	-	-	-	-	0.004	-	-	0.013

Table 2-4 (Continued)

No	Species	Basal areas (m ² /plot)															
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
26	<i>Mitragyna rotundifolia</i>	-	0.010	-	0.010	0.022	0.006	0.011	0.006	-	-	-	-	-	-	-	0.011
27	<i>Terminalia mucronata</i>	-	0.019	-	-	-	-	-	-	-	-	-	-	-	0.027	0.016	0.021
28	<i>Memecylon plebejum</i>	-	-	-	-	-	-	-	-	-	-	0.007	-	-	-	0.052	0.030
29	<i>Diospyros ehretioides</i>	-	0.018	-	-	-	-	-	0.007	-	-	0.005	-	0.004	0.022	-	0.011
30	<i>Wendlandia tinctoria</i>	-	-	0.016	0.008	0.004	0.006	0.001	0.002	-	-	0.004	-	0.001	-	0.014	0.006
31	<i>Buchanania lanzan</i>	-	-	-	0.002	-	-	0.040	0.006	0.002	-	-	-	-	-	-	0.012
32	<i>Dimocarpus longan</i>	-	-	-	-	-	-	-	-	-	-	0.030	-	0.008	-	-	0.019
33	<i>Vitex peduncularis</i>	0.006	0.003	-	0.006	-	-	-	-	-	-	0.023	-	-	-	-	0.009
34	<i>Ulmus lancaefolia</i>	0.022	0.003	-	0.000	0.007	-	0.001	0.002	-	0.003	-	-	-	-	-	0.005
35	<i>Goniothalamus laoticus</i>	-	-	-	-	-	0.003	0.033	-	-	-	-	-	-	-	-	0.018
36	<i>Semecarpus anacardium</i>	-	0.025	-	0.004	-	0.004	0.003	-	-	-	-	-	-	-	-	0.009
37	<i>Dioecrescis erythroclada</i>	0.000	0.003	0.004	-	-	0.002	0.003	-	-	-	-	0.001	-	0.014	0.006	0.004
38	<i>Litsea glutinosa</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.031	0.031
39	<i>Craibiodendron stellatum</i>	-	-	-	-	-	-	-	-	-	0.016	-	0.009	-	-	-	0.012
40	<i>Flacourtia indica</i>	-	0.002	-	-	-	-	-	-	-	-	-	-	0.014	0.005	0.002	0.005
41	<i>Schleichera oleosa</i>	-	-	-	-	-	0.006	0.013	-	-	-	-	-	-	-	-	0.009
42	<i>Lagerstroemia macrocarpa</i>	0.000	0.008	0.006	-	-	-	-	-	0.001	-	-	0.002	-	-	-	0.004
43	<i>Gardenia obtusifolia</i>	-	0.001	0.001	0.001	-	0.002	0.000	0.007	0.005	-	-	-	-	-	-	0.002
44	<i>Syzygium cumini</i>	0.002	-	-	-	-	-	-	-	-	-	0.004	-	0.010	-	-	0.005
45	<i>Dalbergia cana</i>	-	-	0.012	0.002	-	-	-	-	-	-	-	-	-	-	-	0.007
46	<i>Morinda coreia</i>	-	-	-	-	-	0.014	-	-	-	-	-	-	-	-	-	0.014
47	<i>Antidesma ghaesembilla</i>	-	-	-	0.000	-	0.003	0.001	0.003	-	-	-	-	-	0.005	0.000	0.002
48	<i>Pterocarpus macrocarpus</i>	-	-	-	-	-	-	0.006	-	-	0.005	-	-	-	-	-	0.006
49	<i>Colona flagrocarpa</i>	0.000	-	-	-	-	0.007	0.002	-	-	-	-	-	-	-	-	0.003
50	<i>Manilkara littoralis</i>	-	-	-	-	-	-	-	-	-	-	0.004	0.001	0.002	0.000	-	0.002

Table 2-4 (Continued)

No	Species	Basal areas (m ² /plot)															
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
51	<i>Ochna integerrima</i>	-	-	-	-	-	-	-	-	-	-	-	-	0.007	-	-	0.007
52	<i>Spatholobus parviflorus</i>	0.002	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	0.003
53	<i>Schoepfia fragrans</i>	-	-	-	-	-	-	-	0.006	-	-	-	-	-	-	-	0.006
54	<i>Walsura robusta</i>	-	-	-	-	-	-	0.006	-	-	-	-	-	-	-	-	0.006
55	<i>Anneslea fragrans</i>	-	-	-	-	-	0.006	-	-	-	-	-	-	-	-	-	0.006
56	<i>Smilax ovalifolia</i>	-	-	-	-	-	-	-	-	-	-	0.002	-	-	-	0.000	0.001
57	<i>Antidesma acidum</i>	-	0.001	-	-	-	-	-	-	-	-	-	-	-	-	-	0.001
58	<i>Cratoxylum formosum</i>	-	-	-	-	-	0.000	0.001	-	-	-	-	-	-	-	-	0.000
59	<i>Vitex pinnata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.001	0.001
60	Unidentified species	-	-	-	-	0.000	-	-	-	-	-	-	-	-	-	-	0.000
61	<i>Garcinia merguensis</i>	-	-	-	0.000	-	-	-	-	-	-	-	-	-	-	-	0.000
62	<i>Aganosma marginata</i>	-	-	-	-	-	0.000	-	-	-	-	-	-	-	-	-	0.000
63	<i>Dalbergia velutina</i>	-	-	-	-	0.000	-	-	-	-	-	-	-	-	-	-	0.000
Total		3.58	3.60	3.16	3.88	3.40	2.38	2.44	2.35	2.58	2.80	3.33	3.05	3.61	4.03	3.98	3.211

Table 2-5 Relative dominance of tree species in fifteen temporary plots in DDF

No	Species	Relative dominance (%)														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	<i>Dipterocarpus obtusifolius</i>	12.38	16.26	25.65	30.54	17.69	59.72	46.68	67.60	26.60	40.04	57.80	39.95	18.17	28.88	60.51
2	<i>Dipterocarpus tuberculatus</i>	40.01	36.03	38.74	29.82	43.07	3.76	20.33	0.35	35.59	17.35	0.06	20.37	37.06	29.78	3.69
3	<i>Shorea obtusa</i>	27.33	31.47	10.56	9.25	19.13	13.71	6.71	10.23	15.01	19.55	16.99	19.98	20.65	4.32	3.48
4	<i>Aporosa villosa</i>	3.61	3.57	5.86	9.71	3.53	3.26	7.94	7.47	6.06	9.15	3.36	7.58	5.18	8.51	5.37
5	<i>Canarium subulatum</i>	3.60	3.13	6.58	2.23	2.37	2.71	2.90	2.99	1.41	2.91	2.09	3.33	3.41	9.78	3.81
6	<i>Millettia extensa</i>	2.89	2.33	1.76	3.54	2.27	0.96	2.17	1.49	2.87	1.62	2.91	3.60	3.62	2.75	2.74
7	<i>Gluta usitata</i>	0.21	0.99	5.57	1.76	3.98	5.24	1.43	1.95	8.87	2.57	2.41	1.67	2.89	0.05	0.00
8	<i>Irvingia malayana</i>	0.83	0.17	1.24	0.49	2.53	2.92	3.80	1.69	0.72	0.61	0.00	1.01	0.98	8.96	2.71
9	<i>Memecylon scutellatum</i>	0.00	0.00	0.14	8.15	0.71	1.94	0.94	2.20	0.00	0.02	0.00	0.10	0.00	0.00	0.00
10	<i>Xylia xylocarpa</i>	0.80	0.70	0.00	0.00	0.00	0.00	0.00	0.86	1.51	1.23	2.29	0.00	0.46	0.12	4.82
11	<i>Dalbergia oliveri</i>	0.83	0.55	0.93	0.21	0.47	1.27	0.00	0.05	0.03	1.70	2.04	0.67	2.81	0.00	0.00
12	<i>Shorea siamensis</i>	1.66	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.47	0.00	3.30	0.00	0.22	1.91	1.27
13	<i>Strychnos nux-vomica</i>	0.66	0.55	0.96	0.33	1.84	0.00	0.31	0.00	0.00	0.03	0.00	0.03	0.28	0.85	0.64
14	<i>Bridelia retusa</i>	0.72	0.18	0.25	0.69	0.35	0.33	0.05	0.13	0.00	0.44	0.55	0.39	0.01	0.52	1.40
15	<i>Terminalia alata</i>	0.41	0.28	0.13	0.00	0.07	0.00	0.00	0.00	0.02	0.00	0.17	0.00	0.82	0.43	1.36
16	<i>Quercus kerrii</i>	1.98	0.87	0.09	0.00	0.00	0.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.58
17	<i>Semecarpus albescens</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.46	0.00	0.03	0.00	2.77
18	<i>Dillenia obovata</i>	0.21	0.00	0.00	0.01	0.03	0.40	0.52	0.32	0.18	1.16	0.00	0.34	0.86	0.00	0.00
19	<i>Stereospermum neuranthum</i>	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.41	0.19	1.08	0.63	0.48
20	<i>Gardenia sootepensis</i>	0.01	0.00	0.01	0.00	0.00	0.48	0.00	1.04	0.04	0.29	1.36	0.09	0.00	0.16	0.00
21	<i>Dalbergia cultrata</i>	0.00	0.14	0.00	0.04	0.71	0.00	0.00	0.00	0.25	0.00	0.65	0.17	0.00	0.15	0.74
22	<i>Catunaregam tomentosa</i>	0.00	0.03	0.20	1.13	0.13	0.01	0.03	0.02	0.00	0.15	0.00	0.11	0.01	0.16	0.16
23	<i>Terminalia chebula</i>	0.03	0.00	0.11	0.12	0.01	0.05	0.10	0.00	0.08	0.00	0.73	0.00	0.09	0.22	0.41
24	<i>Symplocos racemosa</i>	0.24	0.00	0.00	0.31	0.00	0.39	1.15	0.00	0.00	0.29	0.00	0.00	0.00	0.00	0.00
25	<i>Garcinia cowa</i>	0.67	0.00	0.00	0.84	0.12	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.12	0.00	0.00

Table 2-5 (Continued)

No	Species	Relative dominance (%)														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
26	<i>Mitragyna rotundifolia</i>	0.00	0.29	0.00	0.25	0.65	0.27	0.43	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00
27	<i>Terminalia mucronata</i>	0.00	0.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.67	0.40
28	<i>Memecylon plebejum</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.21	0.00	0.00	0.00	1.32
29	<i>Diospyros ehretioides</i>	0.00	0.51	0.00	0.00	0.00	0.00	0.00	0.30	0.00	0.00	0.16	0.00	0.11	0.56	0.00
30	<i>Wendlandia tinctoria</i>	0.00	0.00	0.51	0.21	0.11	0.24	0.04	0.07	0.00	0.00	0.13	0.00	0.03	0.00	0.35
31	<i>Buchanania lanzan</i>	0.00	0.00	0.00	0.05	0.00	0.00	1.63	0.27	0.07	0.00	0.00	0.00	0.00	0.00	0.00
32	<i>Dimocarpus longan</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.91	0.00	0.23	0.00	0.00
33	<i>Vitex peduncularis</i>	0.16	0.09	0.00	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.68	0.00	0.00	0.00	0.00
34	<i>Ulmus lancaefolia</i>	0.60	0.08	0.00	0.00	0.22	0.00	0.04	0.06	0.00	0.10	0.00	0.00	0.00	0.00	0.00
35	<i>Goniothalamus laoticus</i>	0.00	0.00	0.00	0.00	0.00	0.11	1.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
36	<i>Semecarpus anacardium</i>	0.00	0.70	0.00	0.10	0.00	0.15	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
37	<i>Dioecrescis erythroclada</i>	0.01	0.08	0.11	0.00	0.00	0.07	0.13	0.00	0.00	0.00	0.00	0.04	0.00	0.34	0.14
38	<i>Litsea glutinosa</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.77
39	<i>Craibiodendron stellatum</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.58	0.00	0.28	0.00	0.00	0.00
40	<i>Flacourtia indica</i>	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.38	0.11	0.04
41	<i>Schleichera oleosa</i>	0.00	0.00	0.00	0.00	0.00	0.23	0.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
42	<i>Lagerstroemia macrocarpa</i>	0.01	0.23	0.20	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.06	0.00	0.00	0.00
43	<i>Gardenia obtusifolia</i>	0.00	0.04	0.03	0.03	0.00	0.07	0.02	0.28	0.18	0.00	0.00	0.00	0.00	0.00	0.00
44	<i>Syzygium cumini</i>	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.00	0.26	0.00	0.00
45	<i>Dalbergia cana</i>	0.00	0.00	0.39	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
46	<i>Morinda coreia</i>	0.00	0.00	0.00	0.00	0.00	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
47	<i>Antidesma ghaesembilla</i>	0.00	0.00	0.00	0.01	0.00	0.14	0.04	0.12	0.00	0.00	0.00	0.00	0.00	0.12	0.01
48	<i>Pterocarpus macrocarpus</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.24	0.00	0.00	0.19	0.00	0.00	0.00	0.00	0.00
49	<i>Colona flagrocarpa</i>	0.01	0.00	0.00	0.00	0.00	0.28	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
50	<i>Manilkara littoralis</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.05	0.04	0.01	0.00

Table 2-5 (Continued)

No	Species	Relative dominance (%)														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
51	<i>Ochna integririma</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.00	0.00
52	<i>Spatholobus parviflorus</i>	0.05	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
53	<i>Schoepfia fragrans</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00
54	<i>Walsura robusta</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
55	<i>Anneslea fragrans</i>	0.00	0.00	0.00	0.00	0.00	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
56	<i>Smilax ovalifolia</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.01
57	<i>Antidesma acidum</i>	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
58	<i>Cratoxylum formosum</i>	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
59	<i>Vitex pinnata</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
60	Unidentified species	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
61	<i>Garcinia merguensis</i>	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
62	<i>Aganosma marginata</i>	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
63	<i>Dalbergia velutina</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total		100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

2.4.1.3 Species diversity

Species diversity is considered from species diversity index of Shannon-Wiener Index (SWI). It is different from the species richness since it involves the relative abundance of all species in the forest. The species diversity index by the Shannon-Wiener function in DDF was 3.50 (Table 2-6). The species diversity index in DDF is usually lower than other forest types such as mixed deciduous forest, dry evergreen forest, montane forest, etc.

2.4.1.4 Forest condition

The forest condition index (FCI) is proposed in this research to identify the condition of forest communities in the forest, and the overall forest. In Table 2-7, the number of tree individuals in different stem girth classes was used for calculating the index in fifteen temporary plots. The FCI values varied among the plots, 34.66-66.13. The DDF in this research station had the average value of 50.86.

The average index values of trees with <25, 25-50, 50-75, 75-100, 100-125, 125-150, 150-175 and 175-200 cm were 2.81, 11.71, 26.91, 7.50, 2.54, 1.0, 1.0 and 1.0, respectively. Therefore, the young trees with 50-75 cm stem girth had the highest contribution to FCI.

Table 2-6 Species diversity index (SWI) of tree species in the dry dipterocarp forest based on fifteen sampling plots

No.	Species	p_i	$\log_2 p_i$	$p_i * \log_2 p_i$
1	<i>Shorea obtusa</i>	0.2788	-1.8426	-0.5137
2	<i>Dipterocarpus tuberculatus</i>	0.1547	-2.6927	-0.4165
3	<i>Dipterocarpus obtusifolius</i>	0.1541	-2.6984	-0.4157
4	<i>Aporosa villosa</i>	0.1092	-3.1943	-0.3490
5	<i>Millettia extensa</i>	0.0671	-3.8985	-0.2614
6	<i>Canarium subulatum</i>	0.0387	-4.6927	-0.1815
7	<i>Memecylon scutellatum</i>	0.0354	-4.8182	-0.1708
8	<i>Irvingia malayana</i>	0.0186	-5.7515	-0.1068
9	<i>Gluta usitata</i>	0.0172	-5.8626	-0.1008
10	<i>Strychnos nux-vomica</i>	0.0147	-6.0850	-0.0896
11	<i>Xylia xylocarpa</i>	0.0143	-6.1308	-0.0875
12	<i>Bridelia retusa</i>	0.0086	-6.8626	-0.0590
13	<i>Dalbergia oliveri</i>	0.0081	-6.9420	-0.0565
14	<i>Shorea siamensis</i>	0.0071	-7.1467	-0.0504
15	<i>Mitragyna rotundifolia</i>	0.0055	-7.5000	-0.0414
16	<i>Catunaregam tomentosa</i>	0.0051	-7.6256	-0.0386
17	<i>Dalbergia cultrata</i>	0.0048	-7.7158	-0.0367
18	<i>Terminalia alata</i>	0.0046	-7.7631	-0.0357
19	<i>Wendlandia tinctoria</i>	0.0044	-7.8120	-0.0348
20	<i>Gardenia sootepensis</i>	0.0041	-7.9151	-0.0328
21	<i>Terminalia chebula</i>	0.0040	-7.9695	-0.0318
22	<i>Dioecrescis erythroclada</i>	0.0032	-8.2777	-0.0267
23	<i>Garcinia cowa</i>	0.0029	-8.4220	-0.0246
24	<i>Dillenia obovata</i>	0.0026	-8.5825	-0.0224
25	<i>Stereospermum neuranthum</i>	0.0020	-8.9695	-0.0179
26	<i>Symplocos racemosa</i>	0.0020	-8.9695	-0.0179
27	<i>Gardenia obtusifolia</i>	0.0018	-9.0850	-0.0167
28	<i>Ulmus lancaefolia</i>	0.0017	-9.2105	-0.0155
29	<i>Quercus kerrii</i>	0.0015	-9.3480	-0.0143
30	<i>Flacourtia indica</i>	0.0015	-9.3480	-0.0143
31	<i>Diospyros ehretioides</i>	0.0015	-9.3480	-0.0143
32	<i>Antidesma ghaesembilla</i>	0.0015	-9.3480	-0.0143
33	<i>Memecylon plebejum</i>	0.0014	-9.5000	-0.0131
34	<i>Terminalia mucronata</i>	0.0012	-9.6700	-0.0119
35	<i>Goniothalamus laoticus</i>	0.0012	-9.6700	-0.0119
36	<i>Semecarpus anacardium</i>	0.0012	-9.6700	-0.0119
37	<i>Lagerstroemia macrocarpa</i>	0.0012	-9.6700	-0.0119
38	<i>Buchanania lanzan</i>	0.0012	-9.6718	-0.0119
39	<i>Vitex peduncularis</i>	0.0011	-9.8626	-0.0106
40	<i>Manilkara littoralis</i>	0.0011	-9.8626	-0.0106
41	<i>Colona flagrocarpa</i>	0.0009	-10.0850	-0.0093
42	<i>Schleichera oleosa</i>	0.0008	-10.3480	-0.0079

Table 2-6 (Continued)

No.	Species	p_i	$\log_2 p_i$	$p_i * \log_2 p_i$
43	<i>Semecarpus albescens</i>	0.0008	-10.3480	-0.0079
44	<i>Dimocarpus longan</i>	0.0008	-10.3480	-0.0079
45	<i>Schoepfia fragrans</i>	0.0005	-11.0850	-0.0051
46	<i>Walsura robusta</i>	0.0005	-11.0850	-0.0051
47	<i>Spatholobus parviflorus</i>	0.0005	-11.0850	-0.0051
48	<i>Cratoxylum formosum</i>	0.0005	-11.0850	-0.0051
49	<i>Pterocarpus macrocarpus</i>	0.0005	-11.0850	-0.0051
50	<i>Morinda coreia</i>	0.0005	-11.0850	-0.0051
51	<i>Syzygium cumini</i>	0.0005	-11.0850	-0.0051
52	<i>Smilax ovalifolia</i>	0.0003	-11.6700	-0.0036
53	<i>Craibiodendron stellatum</i>	0.0003	-11.6700	-0.0036
54	<i>Dalbergia cana</i>	0.0003	-11.6700	-0.0036
55	<i>Litsea glutinosa</i>	0.0003	-11.6700	-0.0036
56	<i>Garcinia merguensis</i>	0.0002	-12.6700	-0.0019
57	<i>Ochna integerrima</i>	0.0002	-12.6700	-0.0019
58	<i>Vitex pinnata</i>	0.0002	-12.6700	-0.0019
59	<i>Dalbergia velutina</i>	0.0002	-12.6700	-0.0019
60	<i>Antidesma acidum</i>	0.0002	-12.6700	-0.0019
61	Unidentified species	0.0002	-12.6700	-0.0019
62	<i>Aganosma marginata</i>	0.0002	-12.6700	-0.0019
63	<i>Anneslea fragrans</i>	0.0002	-12.6700	-0.0019
Total		1.00	-566.17	-3.50
Shannon-Wiener Index (H)				3.50

Table 2-7 Forest condition indexes of fifteen temporary plots in DDF

Plot	Index of forest conditions with different stem-girth classes (cm)								FCI
	<25	25-50	50-75	75-100	100-125	125-150	150-175	175-200	
1	1.95	14.60	28	7	5	0	0	0	56.38
2	2.44	18.20	18	11	2	0	0	0	51.64
3	1.77	9.93	27	9	2	0	0	0	49.70
4	3.26	13.70	38	6	0	0	1	1	62.96
5	3.48	12.30	32	5	0	0	0	1	53.78
6	3.16	5.50	17	7	2	1	0	0	34.66
7	3.29	8.80	27	0	1	0	0	0	39.92
8	4.16	5.80	23	7	3	0	0	0	42.46
9	2.19	9.30	22	7	1	0	0	0	41.49
10	3.25	7.20	24	11	1	0	0	0	45.45
11	2.36	12.10	16	16	2	0	0	0	48.46
12	2.71	12.30	36	4	0	0	0	0	55.01
13	2.58	18.20	33	3	1	0	0	0	57.78
14	2.63	12.50	25	8	8	0	0	1	57.13
15	2.93	15.20	39	5	3	0	1	0	66.13
Average	2.81	11.71	26.91	7.50	2.54	1.00	1.00	1.00	50.86

2.4.2 Effect of Fire on Plant Diversity in DDF

The effect of fire on plant diversity was studied in permanent plots of dry dipterocarp forest with annual fire and without fire.

2.4.2.1 Species richness

Species richness of tree species in DDF with annual fire was 42 species, 36 genera, 22 families (Table 2-8). The number of tree species were different among the common families; Rubiaceae (6 species), Leguminosae (5), Dipterocarpaceae (4) and Euphorbiaceae (3).

In DDF without fire the species richness was 45 species, 38 genera, 26 families (Table 2-9). The number of species was the highest for Leguminosae (6 species) followed by Euphorbiaceae (5), Rubiaceae (5) and Dipterocarpaceae (4) (Figure 2-3).

There was no significant difference of species richness between fire and non-fire forests.

Table 2-8 Species list and growth forms of tree species in permanent plots of DDF with fire

	Thai name		Scientific name	Growth form*
1	Anacardiaceae			
	1 รักใหญ่	Rak yai	<i>Gluta usitata</i> (Wall.) Ding Hou	T
	2 รักขี้หมู	Rak khi mu	<i>Semecarpus albescens</i> Kurz	T
2	Bignoniaceae			
	3 แคฝอย	Khae foi	<i>Stereospermum neuranthum</i> Kurz	T
3	Burseraceae			
	4 มะเกิ้ม	Ma koem	<i>Canarium subulatum</i> Guill.	T
4	Combretaceae			
	5 รกฟ้า	Rok fa	<i>Terminalia alata</i> Heyne ex Roth	T
	6 สมอไทย	Samo thai	<i>Terminalia chebula</i> Retz. var. <i>chebula</i>	T
5	Dilleniaceae			
	7 ส้าน	San	<i>Dillenia obovata</i> (Blume) Hooglaud	ST
6	Dipterocarpaceae			
	8 เหียง	Hiang	<i>Dipterocarpus obtusifolius</i> Teijsm. ex. Miq.	T
	9 พลวง	Phluang	<i>Dipterocarpus tuberculatus</i> Roxb.	T
	10 เต็ง	Teng	<i>Shorea obtusa</i> Wall.	T
	11 รัง	Rang	<i>Shorea siamensis</i> Miq.	T
7	Ebenaceae			
	12 ตับเต่าตัน	Taptao ton	<i>Diospyros ehretioides</i> Wall. ex G. Don	T
8	Euphorbiaceae			
	13 เหมือนดหลวง	Mueat luang	<i>Aporosa villosa</i> (Wall. ex Lindl.) Baill.	ST
	14 เต็งหนาม	Teng nam	<i>Bridelia pierrei</i> Gagnep.	T
	15 มะขามป้อม	Ma kham pom	<i>Phyllanthus emblica</i> Linn.	ST
9	Fagaceae			
	16 ก่อแพะ	Ko phae	<i>Quercus kerrii</i> Craib	T
10	Guttiferae			
	17 ชะมวง	Cha muang	<i>Garcinia cowa</i> Roxb. ex DC.	T
11	Irvingiaceae			
	18 กระบก	Krabok	<i>Irvingia malayana</i> Oliv. Ex A. Benn.	T
12	Labiatae			
	19 ดินนก	Tin nok	<i>Vitex pinnata</i> Linn.	T
13	Leguminosae			
	20 กางขี้มอด	Kang khi mot	<i>Albizia odoratissima</i> (L.f.) Benth.	T
	21 กระพี้เขาควาย	Kra phi khao khwai	<i>Millettia leucantha</i> Kurz var. <i>leucantha</i>	T
	22 ประดู่	Pra du	<i>Pterocarpus macrocarpus</i> Kurz	T
	23 แดง	Daeng	<i>Xylia xylocarpa</i> (Roxb.) Taub. var. <i>Kerrii</i>	T
	24 เครือกวาว	Kwao khrua	<i>Millettia extensa</i> Benth.	C
	25 เครือขี้	Khruea pi	<i>Dalbergia velutina</i> Benth.	ST
14	Melastomataceae			
	26 เหมือนดฟอง	Mueat fong	<i>Memecylon plebejum</i> Kurz. var.	ST
	27 เหมือนดจี	Mueat chi	<i>Memecylon scutellatum</i> Naudin.	ST
15	Myrtaceae			
	28 มะห้า	Ma ha	<i>Syzygium oblatum</i> (Roxb.) Wall. ex A.M.	T
16	Rhizophoraceae			
	29 เฌียงพรานางแ	Chiang phra nang ae	<i>Carallia brachiata</i> Merr.	T
17	Rubiaceae			
	30 หนามแท่ง	Nam taeng	<i>Catunaregam spathulifolia</i> Tirveng.	ST
	31 มะเค็ด	Ma khet	<i>Catunaregam tomentosa</i> (Blume ex DC)	ST
	32 มะคังแดง	Ma khang	<i>Dioecrescis erythroclada</i> (Kurz) Tirveng.	ST
	33 คำมอกน้อย	Khammok noi	<i>Gardenia obtusifolia</i> Roxb. ex Kurz	ST
	34 คำมอกหลวง	Khammok	<i>Gardenia sootepensis</i> Hutch.	ST
	35 แข็งกวาง	Khaeng kwang	<i>Wendlandia tinctoria</i> A. DC.	ST

Table 2-8 (Continued)

	Thai name		Scientific name	Growth form*
18	Sapindaceae			
	36 ลำไยป่า	Lamyai pa	<i>Dimocarpus longan</i> Lour. subsp. <i>longan</i>	T
	37 ตะคร้อ	Ta khro	<i>Schleichera oleosa</i> (Lour.) Oken.	T
19	Sapotaceae			
	38 ละมุดป่า	Lamut pa	<i>Manilkara littoralis</i> (Kurz) Dubard	T
20	Strychnaceae			
	39 แสลงใจ	Salaeng chai	<i>Strychnos nux-vomica</i> L.	ST
21	Theaceae			
	40 สารภีป่า	Saraphi pa	<i>Anneslea fragrans</i> Wall.	ST
22	Tiliaceae			
	41 ปอมีน	Po muen	<i>Colona floribunda</i> (Kurz) Craib	ST
23	Ulmaceae			
	42 ลูกลีบ	Lup lip	<i>Ulmus lancaefolia</i> Roxb. ex Wall.	ST

Note: * T = Tree, ST = Shrubby Tree, C = Climber

Table 2-9 Species list and growth forms of tree species in permanent plots of DDF without fire

	Thai name		Scientific name	Growth form*
1	Alangiaceae			
	1 ฝี่เสื่อป่า	Phi suea pa	<i>Alangium chinense</i> Rehder	ST
2	Anacardiaceae			
	2 รักใหญ่	Rak yai	<i>Gluta usitata</i> (Wall.) Ding Hou	T
	3 รักขี้หมู	Rak khi mu	<i>Semecarpus albescens</i> Kurz	T
3	Arareaceae			
	4 อ้อยช้าง	Oi chang	<i>Heteropanax fragraus</i> (Roxb.ex DC.) Seem.	T
4	Bignoniaceae			
	5 แคฝอย	Khae foi	<i>Stereospermum neuranthum</i> Kurz	T
5	Burseraceae			
	6 มะกั้ม	Ma koem	<i>Canarium subulatum</i> Guill.	T
6	Combretaceae			
	7 รกฟ้า	Rok fa	<i>Terminalia alata</i> Heyne ex Roth	T
	8 สมอไทย	Samo thai	<i>Terminalia chebula</i> Retz. var. <i>chebula</i>	T
7	Dilleniaceae			
	9 ส้าน	San	<i>Dillenia obovata</i> (Blume) Hoogland	ST
8	Dipterocarpaceae			
	10 เหียง	Hiang	<i>Dipterocarpus obtusifolius</i> Teijsm. ex. Miq.	T
	11 พลวง	Phluang	<i>Dipterocarpus tuberculatus</i> Roxb.	T
	12 เต็ง	Teng	<i>Shorea obtusa</i> Wall.	T
	13 รัง	Rang	<i>Shorea siamensis</i> Miq.	T
9	Ebenaceae			
	14 ดับเต้าตัน	Taptao ton	<i>Diospyros ehretioides</i> Wall. ex G. Don	T
10	Euphorbiaceae			
	15 เม่าขาว	Moa khao	<i>Antidesma acidum</i> Retz.	ST
	16 เหมือดหลวง	Mueat luang	<i>Aporosa villosa</i> (Wall. ex Lindl.) Baill.	ST
	17 เป้าหนาม	Teng nam	<i>Bridelia pierrei</i> Gagnep.	T
	18 อั้น	An	<i>Glochidion velutinum</i> Wight	ST
	19 มะขามป้อม	Ma kham pom	<i>Phyllanthus emblica</i> Linn.	ST
11	Fagaceae			
	20 ก่อแพะ	Ko phae	<i>Quercus kerrii</i> Craib	T

Table 2-9 (Continued)

	Thai name		Scientific name	Growth form*
12	Flacourtiaceae			
21	ตะขบป่า	Ta khop pa	<i>Flacourtia indica</i> (Burm.f.) Merr.	ST
13	Guttiferae			
22	ชะมวง	Cha muang	<i>Garcinia cowa</i> Roxb. ex DC.	T
14	Irvingiaceae			
23	กระบก	Krabok	<i>Irvingia malayana</i> Oliv. Ex A. Benn.	T
15	Leguminosae			
24	กางขีมอด	Kang khi mot	<i>Albizia odoratissima</i> (L.f.) Benth.	T
25	ปีพง	Pi phong	<i>Dalbergia cana</i> Graham ex Kurz	T
26	พะยุง	Pha yung	<i>Dalbergia cochinchinensis</i> Pierre	T
27	ชิงชัน	Chingchan	<i>Dalbergia oliveri</i> Gamble	T
28	กระพีเขาควาย	Kra phi khao khwai	<i>Millettia leucantha</i> Kurz var. <i>leucantha</i>	T
29	ประดู่	Pra du	<i>Pterocarpus macrocarpus</i> Kurz	T
16	Lythraceae			
30	อินทนิลบก	Inthanin bok	<i>Lagerstroemia macrocarpa</i> Wall.	T
31	อินทนิลน้ำ	Inthanin nam	<i>Lagerstroemia speciosa</i> (L.) Pers.	T
17	Melastomataceae			
32	เหมือดฟอง	Mueat fong	<i>Memecylon plebejum</i> Kurz. var. <i>ellipsoideum</i>	ST
18	Myrtaceae			
33	มะห่า	Ma ha	<i>Syzygium oblatum</i> (Roxb.) Wall. ex A.M.	T
19	Rhizophoraceae			
34	เฉียงพร้านางแอ	Chiang phra	<i>Carallia brachiata</i> Merr.	T
20	Rubiaceae			
35	หนามแท่ง	Nam taeng	<i>Catunaregam spathulifolia</i> Tirveng.	ST
36	มะเค็ด	Ma khet	<i>Catunaregam tomentosa</i> (Blume ex DC)	ST
37	มะคิงแดง	Ma khang	<i>Dioecrescis erythroclada</i> (Kurz) Tirveng.	ST
38	กว่าว	Tum kwao	<i>Mitragyna rotundifolia</i> (Roxb.) Kuntze	T
39	ขังกวาง	Khaeng kwang	<i>Wendlandia tinctoria</i> A. DC.	ST
21	Sapindaceae			
40	ตะคร้อ	Ta khro	<i>Schleichera oleosa</i> (Lour.) Oken.	T
22	Sapotaceae			
41	ละมุดป่า	Lamut pa	<i>Manilkara littoralis</i> (Kurz) Dubard	T
23	Strychnaceae			
42	แสลงใจ	Salaeng chai	<i>Strychnos nux-vomica</i> L.	ST
24	Theaceae			
43	สารภีป่า	Saraphi pa	<i>Anneslea fragrans</i> Wall.	ST
25	Tiliaceae			
44	ปอมีน	Po muen	<i>Colona floribunda</i> (Kurz) Craib	ST
26	Ulmaceae			
45	ลูกลีบ	Lup lip	<i>Ulmus lancaefolia</i> Roxb. ex Wall.	ST

Note: * T = Tree, ST = Shrubby Tree, C = Climber

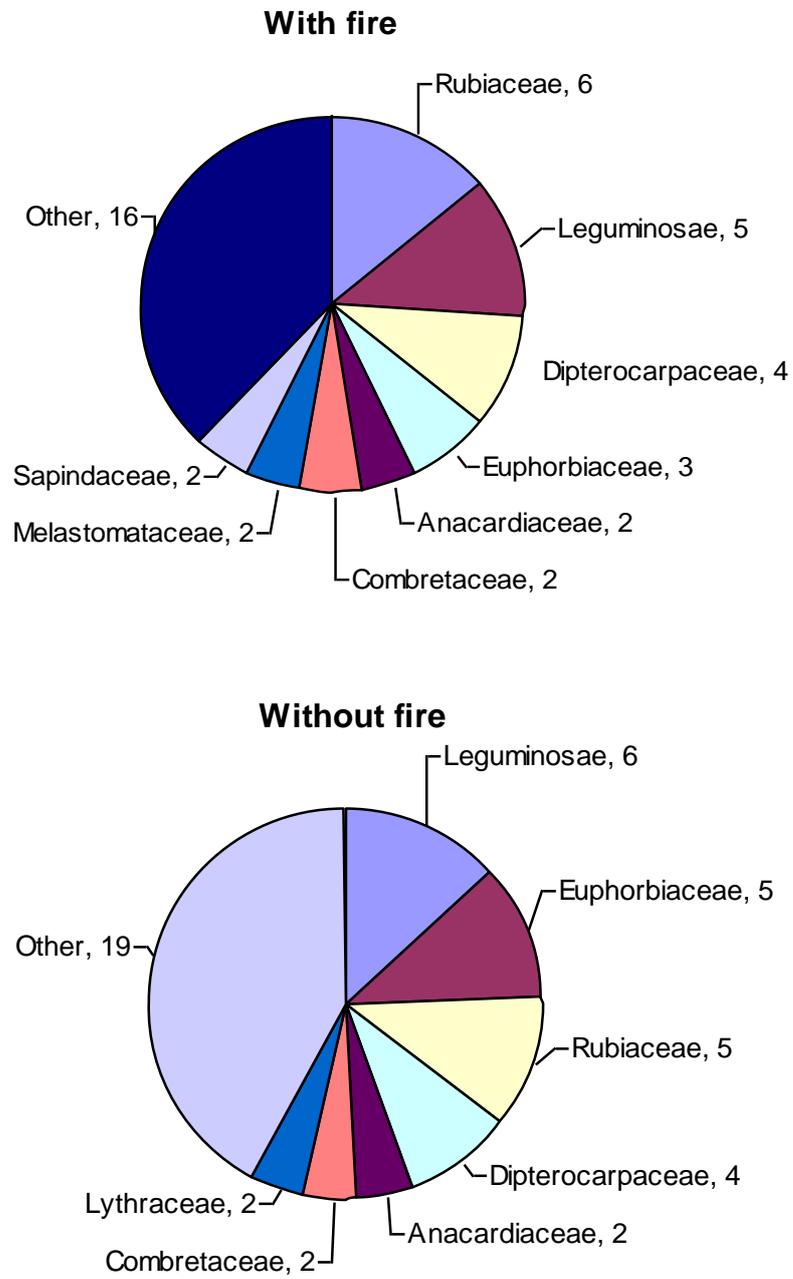


Figure 2-3 Plant species richness in DDF with and without fire



Figure 2-4 Over view of plant community in DDF with annual fire



Figure 2-5 Over view of plant community in DDF without fire

2.4.2.2 Quantitative Characteristics

The quantitative characteristics of dry dipterocarp forests with and without fire were shown in Table 2-10 to 2-13.

(1) Tree frequency

The tree frequency was calculated using 100, 10 x 10 m² subplots within the 1-ha plot. The data implied to spatial distribution of each tree species in the 100 x 100 m² plot.

DDF with annual fire:

D. tuberculatus had the highest frequency of 100%. This tree distributed over the plot. The lower frequencies were observed for *S. obtusa* (89%), *G. usitata* (85%), *Aporosa villosa* (72%), and *Canarium subulatum* (63%). The remainder had lower frequencies, less than 41%.

DDF without fire:

D. tuberculatus had the highest frequency of 99%. It distributed nearly over the plot. The lower frequencies were found for *C. subulatum* (82%), *G. usitata* (73%), *Aporosa villosa* (68%), and *S. obtusa* (60%). The remainder had lower frequencies, less than 42%.

The spatial distribution of some common tree species in fire and non-fire forests was a little difference.

(2) Tree density

DDF with annual fire:

Average tree density in the forest was 1,827 trees/ha. *D. tuberculatus* had the highest density (510 trees/ha), followed by *S. obtusa* (394), *A. villosa* (235), *G. usitata* (197), *D. obtusifolius* (110), *Strychnos nux-vomica* (68) and *C. subulatum* (67).

DDF without fire:

The average tree density was 1,809 trees/ha. *D. tuberculatus* had also the highest density (573 trees/ha), followed by *S. obtusa* (414), *A. villosa* (191), *C. subulatum* (153) and *G. usitata* (127). Other tree species had intermediate to low densities (Figure 2-6).

The fire and non-fire forest consisted of nearly the same tree density.

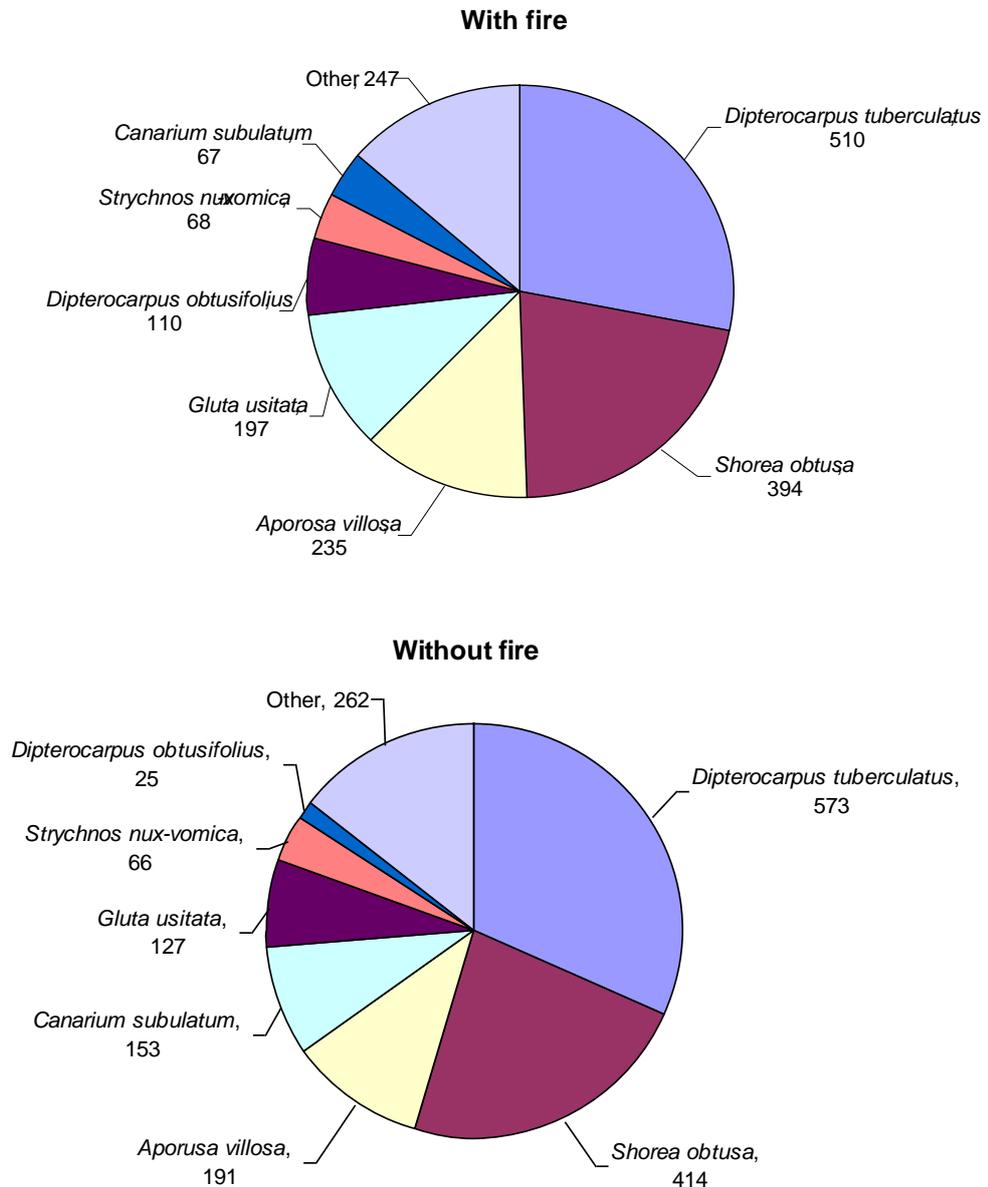


Figure 2-6 Densities of tree species in DDF with and without fire

(3) Tree dominance

DDF with annual fire:

D. tuberculatus had the highest dominance (44.95% of all species), followed by, *D. obtusifolius* (13.58%), *S. obtusa* (13.19%), *G. usitata* (12.48%), *A. villosa* (5.45%) and *C. subulatum* 3.43%). The remained species had the values below 3%.

DDF without fire:

D. tuberculatus had the highest dominance (58.64% of all species), followed by, *S. obtusa* (13.82%), *G. usitata* (10.72%), *C. subulatum* (4.50%) and *A. villosa* (4.21%). The remained species had the values below 4% (Figure 2-7).

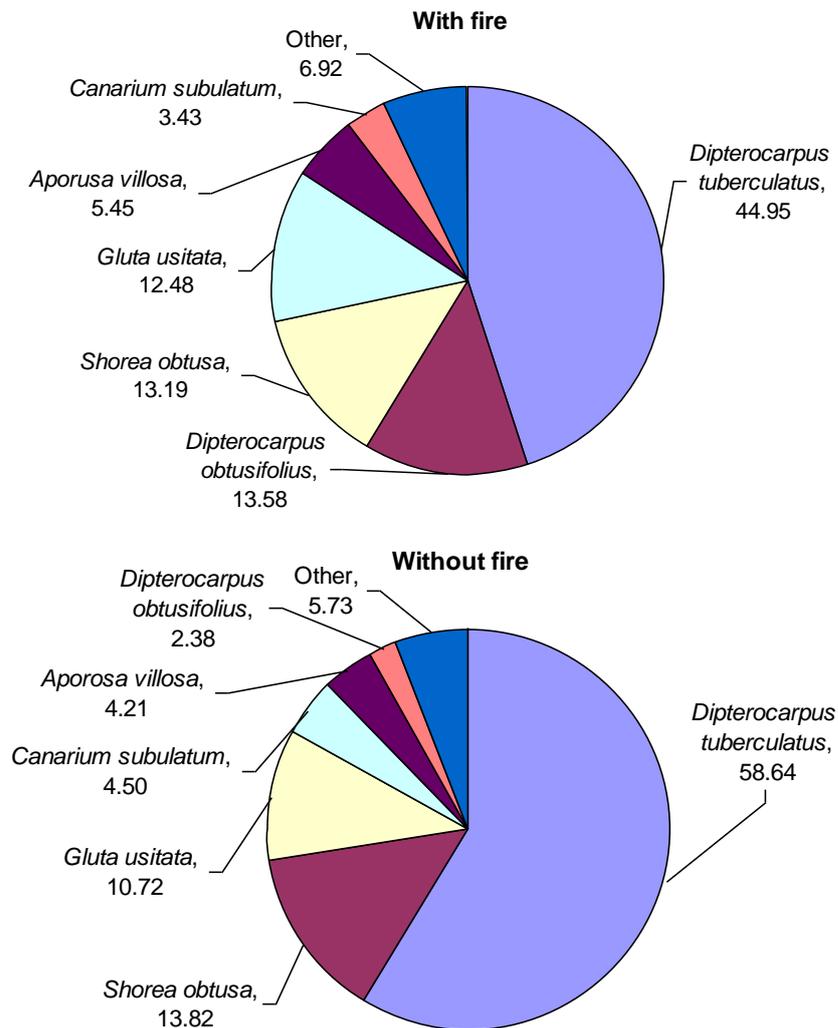


Figure 2-7 Relative dominance of tree species in DDF with and without fire

(4) Important value index (IVI)

DDF with annual fire:

D. tuberculatus had the high frequency, density and a large number of big trees in the forest. Therefore, this tree species had the highest IVI (36.44% of all species), and followed by *S. obtusa*, *G. usitata*, *D. obtusifolius*, *A. villosa* and *C. subulatum*. The total relative IVI of these six tree species was high as 87.91% (Figure 2-8).

DDF without fire:

D. tuberculatus had also the highest relative IVI (45.15%) in the non-fire forest, and followed by *S. obtusa*, *G. usitata*, *A. villosa* and *Canarium subulatum*. The total IVI of these five tree species was high as 86.20% (Figure 2-8).

Though the value of IVI of each dominant tree species was different between fire and non-fire forest, their total relative IVI was nearly the same.

2.4.2.3 Species diversity

Species diversity is different from the species richness since it involves the relative abundance of all tree species in the forest.

DDF with annual fire:

The species diversity indexes by the Shannon-Wiener function (SWI) in DDF with fire were calculated as 3.22 and 3.02 for Plot 1 and Plot 2, respectively, and 3.24 in average (Table 2-14).

DDF without fire:

The SWI values in DDF without fire were calculated as 3.42 and 2.77 for Plot 1 and Plot 2, respectively, and 3.20 in average (Table 2-15).

The species diversity indexes in DDF with and without fire were nearly the same.

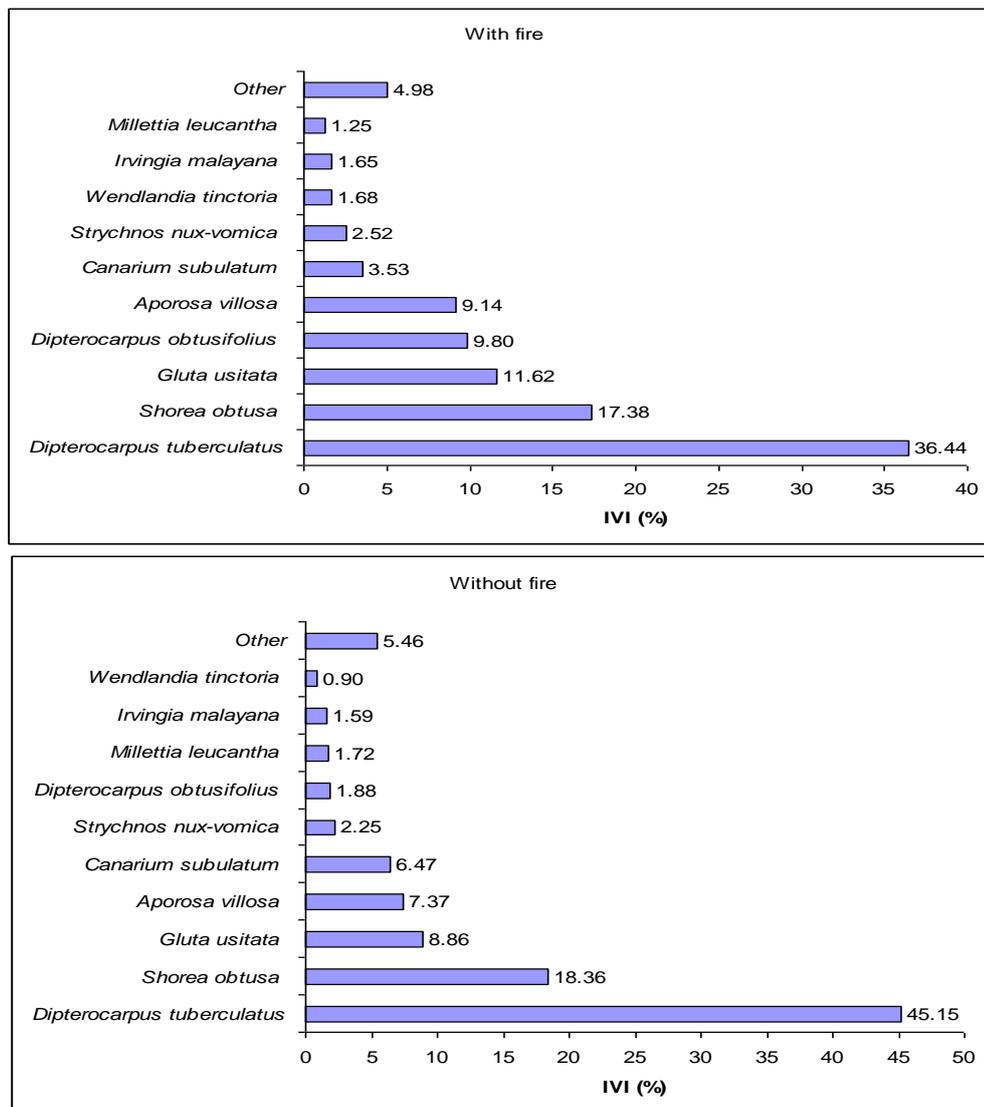


Figure 2-8 Important value indexes of tree species in DDF with and without fire

Table 2-10 Quantitative characteristics of tree species in two plots of DDF with fire

Plot	No	Species	Frequency (%)	Density (trees/ha)	Basal (m ² /ha)	Relative (%)			IVI	
						Frequency	Density	Dominance	300	%
1	1	<i>Dipterocarpus tuberculatus</i>	100	565	11.781	14.58	30.09	52.77	97.43	32.48
	2	<i>Shorea obtusa</i>	89	383	3.773	12.97	20.39	16.90	50.27	16.76
	3	<i>Gluta usitata</i>	85	245	3.004	12.39	13.05	13.45	38.89	12.96
	4	<i>Aporosa villosa</i>	72	191	1.082	10.50	10.17	4.84	25.51	8.50
	5	<i>Canarium subulatum</i>	63	102	1.056	9.18	5.43	4.73	19.34	6.45
	6	<i>Strychnos nux-vomica</i>	41	71	0.322	5.98	3.78	1.44	11.20	3.73
	7	<i>Wendlandia tinctoria</i>	41	82	0.092	5.98	4.37	0.41	10.76	3.59
	8	<i>Millettia leucantha</i>	22	27	0.233	3.21	1.44	1.04	5.69	1.90
	9	<i>Irvingia malayanann.</i>	20	27	0.195	2.92	1.44	0.87	5.23	1.74
	10	<i>Manilkara littoralis</i>	21	28	0.027	3.06	1.49	0.12	4.67	1.56
	11	<i>Catunaregam spathulifolia</i>	16	25	0.047	2.33	1.33	0.21	3.88	1.29
	12	<i>Terminalia alata</i>	12	18	0.102	1.75	0.96	0.46	3.17	1.06
	13	<i>Anneslea fragrans</i>	12	13	0.061	1.75	0.69	0.27	2.71	0.90
	14	<i>Garcinia cowa</i>	11	12	0.053	1.60	0.64	0.24	2.48	0.83
	15	<i>Terminalia chebula</i>	10	11	0.034	1.46	0.59	0.15	2.20	0.73
	16	<i>Memecylon plebejum</i>	9	10	0.036	1.31	0.53	0.16	2.00	0.67
	17	<i>Bridelia pierrei</i>	8	10	0.052	1.17	0.53	0.23	1.93	0.64
	18	<i>Memecylon scutellatum</i>	7	7	0.064	1.02	0.37	0.29	1.68	0.56
	19	<i>Dioecrescis erythroclada</i>	7	10	0.024	1.02	0.53	0.11	1.66	0.55
	20	<i>Semecarpus albescens</i>	7	7	0.022	1.02	0.37	0.10	1.49	0.50
	21	<i>Catunaregam tomentosa</i>	5	6	0.044	0.73	0.32	0.20	1.25	0.42
	22	<i>Stereospermum colais</i>	4	4	0.033	0.58	0.21	0.15	0.94	0.31
	23	<i>Dillenia oborata</i>	4	4	0.028	0.58	0.21	0.12	0.92	0.31
	24	<i>Dipterocarpus obtusifolius</i>	2	2	0.095	0.29	0.11	0.43	0.82	0.27
	25	<i>Pterocarpus macrocarpus</i>	3	3	0.002	0.44	0.16	0.01	0.60	0.20

Table 2-10 (Continued)

Plot	No	Species	Frequency (%)	Density (trees/ha)	Basal (m ² /ha)	Relative (%)			IVI	
						Frequency	Density	Dominance	300	%
1	26	<i>Diospyros ehretioides</i>	2	2	0.026	0.29	0.11	0.12	0.52	0.17
	27	<i>Dimocarpus longan</i>	2	2	0.016	0.29	0.11	0.07	0.47	0.16
	28	<i>Ulmus lancaefolia</i>	2	2	0.007	0.29	0.11	0.03	0.43	0.14
	29	<i>Gardenia sootepensis</i>	2	2	0.004	0.29	0.11	0.02	0.42	0.14
	30	<i>Albizia odoratissima</i>	2	2	0.002	0.29	0.11	0.01	0.41	0.14
	31	<i>Schleichera oleosa</i>	1	1	0.003	0.15	0.05	0.01	0.21	0.07
	32	<i>Millettia extensa</i>	1	1	0.003	0.15	0.05	0.01	0.21	0.07
	33	<i>Dalbergia velutina</i>	1	1	0.002	0.15	0.05	0.01	0.21	0.07
	34	<i>Colona floribunda</i>	1	1	0.001	0.15	0.05	0.01	0.20	0.07
	35	<i>Phyllanthus emblica</i>	1	1	0.000	0.15	0.05	0.00	0.20	0.07
Total			686	1,878	22.32	100	100	100	300	100
2	1	<i>Dipterocarpus tuberculatus</i>	97	455	6.946	16.25	25.63	35.93	77.81	25.94
	2	<i>Dipterocarpus obtusifolius</i>	64	218	5.564	10.72	12.28	28.78	51.78	17.26
	3	<i>Shorea obtusa</i>	84	405	1.720	14.07	22.82	8.90	45.78	15.26
	4	<i>Aporosa villosa</i>	84	278	1.188	14.07	15.66	6.14	35.88	11.96
	5	<i>Gluta usitata</i>	74	148	2.196	12.40	8.34	11.36	32.09	10.70
	6	<i>Strychnos nux-vomica</i>	35	65	0.228	5.86	3.66	1.18	10.70	3.57
	7	<i>Irvingia malayana</i>	29	46	0.349	4.86	2.59	1.80	9.25	3.08
	8	<i>Canarium subulatum</i>	26	31	0.372	4.36	1.75	1.92	8.03	2.68
	9	<i>Manilkara littoralis</i>	22	28	0.045	3.69	1.58	0.23	5.49	1.83
	10	<i>Millettia leucantha</i>	15	17	0.306	2.51	0.96	1.58	5.05	1.68
	11	<i>Wendlandia tinctoria</i>	19	26	0.078	3.18	1.46	0.41	5.05	1.68
	12	<i>Shorea siamensis</i>	10	11	0.046	1.68	0.62	0.24	2.53	0.84
	13	<i>Carallia brachiata</i>	8	13	0.052	1.34	0.73	0.27	2.34	0.78
	14	<i>Catunaregam spathulifolia</i>	7	7	0.015	1.17	0.39	0.08	1.64	0.55

Table 2-10 (Continued)

Plot	No	Species	Frequency (%)	Density (trees/ha)	Basal (m ² /ha)	Relative (%)			IVI	
						Frequency	Density	Dominance	300	%
2	15	<i>Gardenia obtusifolia</i>	4	4	0.013	0.67	0.23	0.07	0.96	0.32
	16	<i>Quercus kerrii</i>	2	3	0.064	0.34	0.17	0.33	0.83	0.28
	17	<i>Dillenia obovata</i>	3	3	0.031	0.50	0.17	0.16	0.83	0.28
	18	<i>Xylocarpus xylocarpa</i>	2	2	0.044	0.34	0.11	0.23	0.68	0.23
	19	<i>Ulmus lancaefolia</i>	2	2	0.005	0.34	0.11	0.03	0.47	0.16
	20	<i>Stereospermum colais</i>	1	3	0.020	0.17	0.17	0.10	0.44	0.15
	21	<i>Pterocarpus macrocarpus</i>	1	1	0.019	0.17	0.06	0.10	0.32	0.11
	22	<i>Millettia extensa</i>	1	2	0.003	0.17	0.11	0.01	0.29	0.10
	23	<i>Syzygium oblatum</i>	1	1	0.013	0.17	0.06	0.07	0.29	0.10
	24	<i>Vitex pinnata</i>	1	1	0.006	0.17	0.06	0.03	0.26	0.09
	25	<i>Dioecrescis erythroclada</i>	1	1	0.004	0.17	0.06	0.02	0.24	0.08
	26	<i>Dimocarpus longan</i>	1	1	0.004	0.17	0.06	0.02	0.24	0.08
	27	<i>Anneslea fragrans</i>	1	1	0.004	0.17	0.06	0.02	0.24	0.08
	28	<i>Diospyros ehretioides</i>	1	1	0.000	0.17	0.06	0.00	0.23	0.08
29	<i>Albizia odoratissima</i>	1	1	0.000	0.17	0.06	0.00	0.22	0.07	
Total			597	1,775	19.34	100	100	100	300	100

Table 2-11 Quantitative characteristics of tree species in two plots of DDF without fire

Plot	No	Species	Frequency (%)	Density (trees/ha)	Basal area (m ² /ha)	Relative (%)			IVI	
						Frequency	Density	Dominance	300	(%)
1	1	<i>Dipterocarpus tuberculatus</i>	99	603	14.500	13.81	34.90	63.45	112.16	37.39
	2	<i>Shorea obtusa</i>	60	199	2.228	8.37	11.52	9.75	29.64	9.88
	3	<i>Gluta usitata</i>	73	141	2.336	10.18	8.16	10.22	28.56	9.52
	4	<i>Canarium subulatum</i>	82	170	1.246	11.44	9.84	5.45	26.73	8.91
	5	<i>Aporosa villosa</i>	68	150	0.699	9.48	8.68	3.06	21.22	7.07
	6	<i>Strychnos nux-vomica</i>	42	80	0.221	5.86	4.63	0.97	11.45	3.82
	7	<i>Millettia leucantha</i>	36	57	0.260	5.02	3.30	1.14	9.46	3.15
	8	<i>Irvingia malayana</i>	31	49	0.418	4.32	2.84	1.83	8.99	3.00
	9	<i>Wendlandia tinctoria</i>	28	47	0.046	3.91	2.72	0.20	6.83	2.28
	10	<i>Semecarpus albescens</i>	27	32	0.175	3.77	1.85	0.76	6.38	2.13
	11	<i>Terminalia alata</i>	22	28	0.064	3.07	1.62	0.28	4.97	1.66
	12	<i>Terminalia chebula</i>	18	20	0.070	2.51	1.16	0.31	3.97	1.32
	13	<i>Bridelia pierrei</i>	17	19	0.024	2.37	1.10	0.10	3.57	1.19
	14	<i>Garcinia cowa</i>	11	14	0.164	1.53	0.81	0.72	3.06	1.02
	15	<i>Anneslea fragrans</i>	12	14	0.124	1.67	0.81	0.54	3.03	1.01
	16	<i>Flacourtia indica</i>	10	14	0.079	1.39	0.81	0.34	2.55	0.85
	17	<i>Colona floribunda</i>	12	14	0.011	1.67	0.81	0.05	2.53	0.84
	18	<i>Catunaregam spathulifolia</i>	11	13	0.009	1.53	0.75	0.04	2.33	0.78
	19	<i>Dioecrescis erythroclada</i>	8	9	0.032	1.12	0.52	0.14	1.77	0.59
	20	<i>Stereospermum colais</i>	7	8	0.037	0.98	0.46	0.16	1.60	0.53
	21	<i>Albizia odoratissima</i>	7	7	0.007	0.98	0.41	0.03	1.41	0.47
	22	<i>Glochidion velutinum</i>	6	7	0.011	0.84	0.41	0.05	1.29	0.43
	23	<i>Lagerstroemia macrocarpa</i>	5	5	0.008	0.70	0.29	0.04	1.02	0.34
	24	<i>Quercus kerrii</i>	4	4	0.047	0.56	0.23	0.21	0.99	0.33
	25	<i>Memecylon plebejum</i>	3	3	0.010	0.42	0.17	0.04	0.63	0.21

Table 2-11 (Continued)

Plot	No	Species	Frequency (%)	Density (trees/ha)	Basal area (m ² /ha)	Relative (%)			IVI	
						Frequency	Density	Dominance	300	(%)
1	26	<i>Dillenia oborata</i>	3	3	0.002	0.42	0.17	0.01	0.60	0.20
	27	<i>Shorea siamensis</i>	2	3	0.003	0.28	0.17	0.01	0.46	0.15
	28	<i>Lagerstroemia speciosa</i>	2	3	0.002	0.28	0.17	0.01	0.46	0.15
	29	<i>Diospyros ehretioides</i>	2	2	0.007	0.28	0.12	0.03	0.42	0.14
	30	<i>Dalbergia dongnaiensis</i>	2	2	0.002	0.28	0.12	0.01	0.40	0.13
	31	<i>Antidesma acidum</i>	2	2	0.001	0.28	0.12	0.00	0.40	0.13
	32	<i>Dalbergia cochinchinensis</i>	1	2	0.004	0.14	0.12	0.02	0.27	0.09
	33	<i>Pterocarpus macrocarpus</i>	1	1	0.002	0.14	0.06	0.01	0.21	0.07
	34	<i>Ulmus lancaefolia</i>	1	1	0.002	0.14	0.06	0.01	0.20	0.07
	35	<i>Manilkara littoralis</i>	1	1	0.001	0.14	0.06	0.01	0.20	0.07
	37	<i>Syzygium oblatum</i>	1	1	0.000	0.14	0.06	0.00	0.20	0.07
Total			717	1728	22.85	100	100	100	300	100
2	1	<i>Dipterocarpus tuberculatus</i>	99	542	12.878	17.34	28.71	54.03	100.08	33.36
	2	<i>Shorea obtusa</i>	97	629	4.224	16.99	33.32	17.72	68.02	22.67
	3	<i>Aporosa villosa</i>	84	231	1.268	14.71	12.24	5.32	32.27	10.76
	4	<i>Gluta usitata</i>	66	112	2.670	11.56	5.93	11.20	28.69	9.56
	5	<i>Canarium subulatum</i>	70	135	0.856	12.26	7.15	3.59	23.00	7.67
	6	<i>Dipterocarpus obtusifolius</i>	22	50	1.109	3.85	2.65	4.65	11.15	3.72
	7	<i>Strychnos nux-vomica</i>	30	51	0.185	5.25	2.70	0.78	8.73	2.91
	8	<i>Millettia leucantha</i>	23	34	0.168	4.03	1.80	0.70	6.53	2.18
	9	<i>Irvingia malayana</i>	16	21	0.165	2.80	1.11	0.69	4.61	1.54
	10	<i>Wendlandia tinctoria</i>	7	13	0.023	1.23	0.69	0.10	2.01	0.67
	11	<i>Shorea siamensis</i>	8	8	0.012	1.40	0.42	0.05	1.88	0.63
	12	<i>Terminalia chebula</i>	7	7	0.037	1.23	0.37	0.16	1.75	0.58
	13	<i>Mitragyna rotundifolia</i>	5	5	0.032	0.88	0.26	0.14	1.28	0.43

Table 2-11 (Continued)

Plot	No	Species	Frequency (%)	Density (trees/ha)	Basal area (m ² /ha)	Relative (%)			IVI		
						Frequency	Density	Dominance	300	(%)	
2	14	<i>Dillenia oborata</i>	4	4	0.031	0.70	0.21	0.13	1.04	0.35	
	15	<i>Dioecrescis erythroclada</i>	3	5	0.048	0.53	0.26	0.20	0.99	0.33	
	16	<i>Schleichera oleosa</i>	2	7	0.033	0.35	0.37	0.14	0.86	0.29	
	17	<i>Terminalia alata</i>	3	3	0.014	0.53	0.16	0.06	0.74	0.25	
	18	<i>Catunaregam spathulifolia</i>	3	3	0.005	0.53	0.16	0.02	0.71	0.24	
	19	<i>Carallia brachiata</i>	2	4	0.008	0.35	0.21	0.03	0.60	0.20	
	20	<i>Colona floribunda</i>	2	3	0.002	0.35	0.16	0.01	0.52	0.17	
	21	<i>Bridelia pierrei</i>	2	2	0.009	0.35	0.11	0.04	0.50	0.17	
	22	<i>Ulmus lancaefolia</i>	2	2	0.001	0.35	0.11	0.01	0.46	0.15	
	23	<i>Quercus kerrii</i>	1	2	0.018	0.18	0.11	0.07	0.36	0.12	
	24	<i>Dalbergia oliveri</i>	1	2	0.006	0.18	0.11	0.02	0.31	0.10	
	25	<i>Lagerstroemia macrocarpa</i>	1	2	0.001	0.18	0.11	0.00	0.28	0.09	
	26	<i>Stereospermum colais</i>	1	1	0.012	0.18	0.05	0.05	0.28	0.09	
	27	<i>Catunaregam tomentosa</i>	1	1	0.010	0.18	0.05	0.04	0.27	0.09	
	28	<i>Flacourtia indica</i>	1	1	0.003	0.18	0.05	0.01	0.24	0.08	
	29	<i>Anneslea fragrans</i>	1	1	0.002	0.18	0.05	0.01	0.24	0.08	
	30	<i>Dalbergia cana</i>	1	1	0.002	0.18	0.05	0.01	0.24	0.08	
	31	<i>Syzygium oblatum</i>	1	1	0.001	0.18	0.05	0.01	0.23	0.08	
	32	<i>Albizia odoratissima</i>	1	1	0.001	0.18	0.05	0.00	0.23	0.08	
	33	<i>Heteropanax fragraus</i>	1	1	0.001	0.18	0.05	0.00	0.23	0.08	
	34	<i>Phyllanthus emblica</i>	1	1	0.000	0.18	0.05	0.00	0.23	0.08	
	35	<i>Pterocarpus macrocarpus</i>	1	1	0.000	0.18	0.05	0.00	0.23	0.08	
	36	<i>Alangium chinense</i>	1	1	0.000	0.18	0.05	0.00	0.23	0.08	
	Total			571	1888	23.84	100	100	100	300	100

Table 2-12 Quantitative characteristics of tree species in DDF with fire

No	Species	Density (trees/ha)	Basal area (m ² /ha)	Relative (%)		IVI	
				Density	Dominance	(200)	(%)
1	<i>Dipterocarpus tuberculatus</i>	510	9.3638	27.92	44.95	72.88	36.44
2	<i>Shorea obtusa</i>	394	2.7469	21.57	13.19	34.76	17.38
3	<i>Gluta usitata</i>	197	2.5999	10.76	12.48	23.24	11.62
4	<i>Dipterocarpus obtusifolius</i>	110	2.8297	6.02	13.58	19.61	9.80
5	<i>Aporosa villosa</i>	235	1.1347	12.84	5.45	18.29	9.14
6	<i>Canarium subulatum</i>	67	0.7139	3.64	3.43	7.07	3.53
7	<i>Strychnos nux-vomica</i>	68	0.2748	3.72	1.32	5.04	2.52
8	<i>Wendlandia tinctoria</i>	54	0.0853	2.96	0.41	3.37	1.68
9	<i>Irvingia malayana</i>	37	0.2718	2.00	1.30	3.30	1.65
10	<i>Millettia leucantha</i>	22	0.2695	1.20	1.29	2.50	1.25
11	<i>Manilkara littoralis</i>	28	0.0360	1.53	0.17	1.71	0.85
12	<i>Catunaregam spathulifolia</i>	16	0.0311	0.88	0.15	1.03	0.51
13	<i>Terminalia alata</i>	9	0.0512	0.49	0.25	0.74	0.37
14	<i>Anneslea fragrans</i>	7	0.0322	0.38	0.15	0.54	0.27
15	<i>Carallia brachiata</i>	7	0.0259	0.36	0.12	0.48	0.24
16	<i>Garcinia cowa</i>	6	0.0263	0.33	0.13	0.45	0.23
17	<i>Shorea siamensis</i>	6	0.0228	0.30	0.11	0.41	0.21
18	<i>Bridelia pierrei</i>	5	0.0261	0.27	0.13	0.40	0.20
19	<i>Terminalia chebula</i>	6	0.0170	0.30	0.08	0.38	0.19
20	<i>Dioecrescis erythroclada</i>	6	0.0137	0.30	0.07	0.37	0.18
21	<i>Memecylon plebejum</i>	5	0.0178	0.27	0.09	0.36	0.18
22	<i>Memecylon scutellatum</i>	4	0.0320	0.19	0.15	0.35	0.17
23	<i>Dillenia obovata</i>	4	0.0294	0.19	0.14	0.33	0.17
24	<i>Stereospermum neuranthum</i>	4	0.0264	0.19	0.13	0.32	0.16
25	<i>Catunaregam tomentosa</i>	3	0.0220	0.16	0.11	0.27	0.14
26	<i>Semecarpus albescens</i>	4	0.0110	0.19	0.05	0.24	0.12
27	<i>Quercus kerrii</i>	2	0.0319	0.08	0.15	0.24	0.12
28	<i>Xylia xylocarpa</i>	1	0.0220	0.05	0.11	0.16	0.08
29	<i>Pterocarpus macrocarpus</i>	2	0.0103	0.11	0.05	0.16	0.08
30	<i>Diospyros ehretioides</i>	2	0.0133	0.08	0.06	0.15	0.07
31	<i>Gardenia obtusifolia</i>	2	0.0067	0.11	0.03	0.14	0.07
32	<i>Ulmus lancaefolia</i>	2	0.0060	0.11	0.03	0.14	0.07
33	<i>Dimocarpus longan</i>	2	0.0098	0.08	0.05	0.13	0.06
34	<i>Millettia extensa</i>	2	0.0026	0.08	0.012	0.09	0.05
35	<i>Albizia odoratissima</i>	2	0.0009	0.08	0.004	0.09	0.04
36	<i>Gardenia sootepensis</i>	1	0.0022	0.05	0.011	0.07	0.03
37	<i>Syzygium oblatum</i>	1	0.0064	0.03	0.031	0.06	0.03
38	<i>Vitex pinnata</i>	1	0.0032	0.03	0.015	0.04	0.02
39	<i>Schleichera oleosa</i>	1	0.0016	0.03	0.008	0.04	0.02
40	<i>Dalbergia velutina</i>	1	0.0010	0.03	0.005	0.03	0.02
41	<i>Colona floribunda</i>	1	0.0006	0.03	0.003	0.03	0.02
42	<i>Phyllanthus emblica</i>	1	0.0001	0.03	0.001	0.03	0.01
Total		1,827	20.83	100	100	200	100

Table 2-13 Quantitative characteristics of tree species in DDF without fire

No	Species	Density (trees/ha)	Basal area (m ² /ha)	Relative (%)		IVI	
				Density	Dominance	(200)	(%)
1	<i>Dipterocarpus tuberculatus</i>	572.5	13.6891	31.66	58.641	90.31	45.15
2	<i>Shorea obtusa</i>	414.0	3.2259	22.90	13.819	36.72	18.36
3	<i>Gluta usitata</i>	126.5	2.5029	7.00	10.722	17.72	8.86
4	<i>Aporosa villosa</i>	190.5	0.9838	10.54	4.214	14.75	7.38
5	<i>Canarium subulatum</i>	152.5	1.0508	8.43	4.501	12.94	6.47
6	<i>Strychnos nux-vomica</i>	65.5	0.2029	3.62	0.869	4.49	2.25
7	<i>Dipterocarpus obtusifolius</i>	25.0	0.5545	1.38	2.375	3.76	1.88
8	<i>Millettia leucantha</i>	46	0.2136	2.52	0.915	3.43	1.72
9	<i>Irvingia malayana</i>	35	0.2919	1.94	1.250	3.19	1.59
10	<i>Wendlandia tinctoria</i>	30	0.0346	1.66	0.148	1.81	0.90
11	<i>Terminalia alata</i>	16	0.0873	0.88	0.374	1.26	0.63
12	<i>Terminalia chebula</i>	16	0.0389	0.86	0.167	1.02	0.51
13	<i>Anneslea fragrans</i>	14	0.0537	0.75	0.230	0.98	0.49
14	<i>Bridelia pierrei</i>	7	0.0821	0.39	0.352	0.74	0.37
15	<i>Flacourtia indica</i>	8	0.0632	0.41	0.271	0.69	0.34
16	<i>Dioecrescis erythroclada</i>	11	0.0165	0.58	0.071	0.65	0.33
17	<i>Colona floribunda</i>	8	0.0409	0.41	0.175	0.59	0.29
18	<i>Catunaregam spathulifolia</i>	7	0.0398	0.39	0.170	0.56	0.28
19	<i>Stereospermum neuranthum</i>	9	0.0062	0.47	0.027	0.50	0.25
20	<i>Shorea siamensis</i>	8	0.0072	0.44	0.031	0.47	0.24
21	<i>Quercus kerrii</i>	5	0.0244	0.25	0.105	0.35	0.18
22	<i>Dillenia oborata</i>	6	0.0075	0.30	0.032	0.34	0.17
23	<i>Schleichera oleosa</i>	3	0.0323	0.17	0.138	0.30	0.15
24	<i>Albizia odoratissima</i>	4	0.0166	0.19	0.071	0.26	0.13
25	<i>Lagerstroemia macrocarpa</i>	4	0.0163	0.19	0.070	0.26	0.13
26	<i>Mitragyna rotundifolia</i>	4	0.0042	0.22	0.018	0.24	0.12
27	<i>Carallia brachiata</i>	4	0.0056	0.19	0.024	0.22	0.11
28	<i>Dalbergia oliveri</i>	4	0.0043	0.19	0.019	0.21	0.11
29	<i>Ulmus lancaefolia</i>	3	0.0161	0.14	0.069	0.21	0.10
30	<i>Pterocarpus macrocarpus</i>	2	0.0041	0.11	0.017	0.13	0.06
31	<i>Syzygium oblatum</i>	2	0.0037	0.11	0.016	0.13	0.06
32	<i>Catunaregam tomentosa</i>	2	0.0049	0.08	0.021	0.10	0.05
33	<i>Semecarpus albescens</i>	2	0.0015	0.08	0.006	0.09	0.04
34	<i>Dalbergia cana</i>	2	0.0010	0.08	0.004	0.09	0.04
35	<i>Heteropanax fragraus</i>	1	0.0034	0.06	0.015	0.07	0.04
36	<i>Phyllanthus emblica</i>	1	0.0020	0.06	0.009	0.06	0.03
37	<i>Alangium chinense</i>	1	0.0013	0.06	0.006	0.06	0.03
38	<i>Garcinia cowa</i>	1	0.0008	0.06	0.003	0.06	0.03
39	<i>Glochidion velutinum</i>	1	0.0005	0.06	0.002	0.06	0.03
40	<i>Memecylon plebejum</i>	1	0.0050	0.03	0.021	0.05	0.02
41	<i>Lagerstroemia speciosa</i>	1	0.0010	0.03	0.004	0.03	0.02
42	<i>Diospyros ehretioides</i>	1	0.0006	0.03	0.003	0.03	0.02
43	<i>Dalbergia cochinchinensis</i>	1	0.0004	0.03	0.002	0.03	0.01
44	<i>Antidesma acidum</i>	1	0.0002	0.03	0.001	0.03	0.01
45	<i>Manilkara littoralis</i>	1	0.0001	0.03	0.001	0.03	0.01
Total		1,808	23.34	100	100	200	100

Table 2-14 Shannon-Wiener Index (SWI) of tree species in two plots of DDF with annual fire

Plot	No	Species	pi	log2pi	pi*log2pi
1	1	<i>Dipterocarpus tuberculatus</i>	0.3009	-1.7329	-0.5213
	2	<i>Shorea obtusa</i>	0.2039	-2.2938	-0.4678
	3	<i>Gluta usitata</i>	0.1305	-2.9383	-0.3833
	4	<i>Aporosa villosa</i>	0.1017	-3.2976	-0.3354
	5	<i>Canarium subulatum</i>	0.0543	-4.2026	-0.2283
	6	<i>Wendlandia tinctoria</i>	0.0437	-4.5174	-0.1972
	7	<i>Strychnos nux-vomica</i>	0.0378	-4.7252	-0.1786
	8	<i>Manilkara littoralis</i>	0.0149	-6.0676	-0.0905
	9	<i>Millettia leucantha</i>	0.0144	-6.1201	-0.0880
	10	<i>Irvingia malayanann.</i>	0.0144	-6.1201	-0.0880
	11	<i>Catunaregam spathulifolia</i>	0.0133	-6.2311	-0.0829
	12	<i>Terminalia alata</i>	0.0096	-6.7051	-0.0643
	13	<i>Anneslea fragrans</i>	0.0069	-7.1745	-0.0497
	14	<i>Garcinia cowa</i>	0.0064	-7.2900	-0.0466
	15	<i>Terminalia chebula</i>	0.0059	-7.4155	-0.0434
	16	<i>Memecylon plebejum</i>	0.0053	-7.5531	-0.0402
	17	<i>Bridelia pierrei</i>	0.0053	-7.5531	-0.0402
	18	<i>Dioecrescis erythroclada</i>	0.0053	-7.5531	-0.0402
	19	<i>Memecylon scutellatum</i>	0.0037	-8.0676	-0.0301
	20	<i>Semecarpus albescens</i>	0.0037	-8.0676	-0.0301
	21	<i>Catunaregam tomentosa</i>	0.0032	-8.2900	-0.0265
	22	<i>Stereospermum colais</i>	0.0021	-8.8750	-0.0189
	23	<i>Dillenia oborata</i>	0.0021	-8.8750	-0.0189
	24	<i>Pterocarpus macrocarpus</i>	0.0016	-9.2900	-0.0148
	25	<i>Dipterocarpus obtusifolius</i>	0.0011	-9.8750	-0.0105
	26	<i>Diospyros ehretioides</i>	0.0011	-9.8750	-0.0105
	27	<i>Dimocarpus longan</i>	0.0011	-9.8750	-0.0105
	28	<i>Ulmus lancaefolia</i>	0.0011	-9.8750	-0.0105
	29	<i>Gardenia sootepensis</i>	0.0011	-9.8750	-0.0105
	30	<i>Albizia odoratissima</i>	0.0011	-9.8750	-0.0105
	31	<i>Schleichera oleosa</i>	0.0005	-10.8750	-0.0058
	32	<i>Millettia extensa</i>	0.0005	-10.8750	-0.0058
	33	<i>Dalbergia velutina</i>	0.0005	-10.8750	-0.0058
	34	<i>Colona floribunda</i>	0.0005	-10.8750	-0.0058
	35	<i>Phyllanthus emblica</i>	0.0005	-10.8750	-0.0058
Total			1.00	-264.58	-3.22
Shannon-Wiener Index					3.22

Table 2-14 (Continued)

Plot	No	Species	pi	log2pi	pi*log2pi
2	1	<i>Dipterocarpus tuberculatus</i>	0.2563	-1.9639	-0.5034
	2	<i>Dipterocarpus obtusifolius</i>	0.1228	-3.0254	-0.3716
	3	<i>Shorea obtusa</i>	0.2282	-2.1318	-0.4864
	4	<i>Aporosa villosa</i>	0.1566	-2.6747	-0.4189
	5	<i>Gluta usitata</i>	0.0834	-3.5841	-0.2988
	6	<i>Strychnos nux-vomica</i>	0.0366	-4.7712	-0.1747
	7	<i>Irvingia malayana</i>	0.0259	-5.2700	-0.1366
	8	<i>Canarium subulatum</i>	0.0175	-5.8394	-0.1020
	9	<i>Manilkara littoralis</i>	0.0158	-5.9862	-0.0944
	10	<i>Millettia leucantha</i>	0.0096	-6.7061	-0.0642
	11	<i>Wendlandia tinctoria</i>	0.0146	-6.0932	-0.0893
	12	<i>Shorea siamensis</i>	0.0062	-7.3342	-0.0455
	13	<i>Carallia brachiata</i>	0.0073	-7.0932	-0.0519
	14	<i>Catunaregam spathulifolia</i>	0.0039	-7.9862	-0.0315
	15	<i>Gardenia obtusifolia</i>	0.0023	-8.7936	-0.0198
	16	<i>Quercus kerrii</i>	0.0017	-9.2086	-0.0156
	17	<i>Dillenia obovata</i>	0.0017	-9.2086	-0.0156
	18	<i>Xylia xylocarpa</i>	0.0011	-9.7936	-0.0110
	19	<i>Ulmus lancaefolia</i>	0.0011	-9.7936	-0.0110
	20	<i>Stereospermum colais</i>	0.0017	-9.2086	-0.0156
	21	<i>Pterocarpus macrocarpus</i>	0.0006	-10.7936	-0.0061
	22	<i>Millettia extensa</i>	0.0011	-9.7936	-0.0110
	23	<i>Syzygium oblatum</i>	0.0006	-10.7936	-0.0061
	24	<i>Vitex pinnata</i>	0.0006	-10.7936	-0.0061
	25	<i>Dioecrescis erythroclada</i>	0.0006	-10.7936	-0.0061
	26	<i>Dimocarpus longan</i>	0.0006	-10.7936	-0.0061
	27	<i>Anneslea fragrans</i>	0.0006	-10.7936	-0.0061
	28	<i>Diospyros ehretioides</i>	0.0006	-10.7936	-0.0061
	29	<i>Albizia odoratissima</i>	0.0006	-10.7936	-0.0061
Total			1.00	-222.61	-3.02
Shannon-Wiener Index					3.02

Table 2-14 (Continued)

Plot	No	Species	pi	log2pi	pi*log2pi
(1+2) Total	1	<i>Dipterocarpus tuberculatus</i>	0.2792	-1.8405	-0.5139
	2	<i>Shorea obtusa</i>	0.2157	-2.2128	-0.4773
	3	<i>Aporosa villosa</i>	0.1284	-2.9614	-0.3802
	4	<i>Gluta usitata</i>	0.1076	-3.2165	-0.3460
	5	<i>Dipterocarpus obtusifolius</i>	0.0602	-4.0535	-0.2441
	6	<i>Strychnos nux-vomica</i>	0.0372	-4.7474	-0.1767
	7	<i>Canarium subulatum</i>	0.0364	-4.7796	-0.1740
	8	<i>Wendlandia tinctoria</i>	0.0296	-5.0800	-0.1502
	9	<i>Irvingia malayana</i>	0.0200	-5.6450	-0.1128
	10	<i>Manilkara littoralis</i>	0.0153	-6.0275	-0.0924
	11	<i>Millettia leucantha</i>	0.0120	-6.3754	-0.0768
	12	<i>Catunaregam spathulifolia</i>	0.0088	-6.8349	-0.0599
	13	<i>Terminalia alata</i>	0.0049	-7.6649	-0.0378
	14	<i>Anneslea fragrans</i>	0.0038	-8.0275	-0.0308
	15	<i>Carallia brachiata</i>	0.0036	-8.1344	-0.0289
	16	<i>Garcinia cowa</i>	0.0033	-8.2499	-0.0271
	17	<i>Shorea siamensis</i>	0.0030	-8.3754	-0.0252
	18	<i>Terminalia chebula</i>	0.0030	-8.3754	-0.0252
	19	<i>Dioecrescis erythroclada</i>	0.0030	-8.3754	-0.0252
	20	<i>Bridelia pierrei</i>	0.0027	-8.5129	-0.0233
	21	<i>Memecylon plebejum</i>	0.0027	-8.5129	-0.0233
	22	<i>Memecylon scutellatum</i>	0.0019	-9.0275	-0.0173
	23	<i>Dillenia oborata</i>	0.0019	-9.0275	-0.0173
	24	<i>Stereospermum neuranthum</i>	0.0019	-9.0275	-0.0173
	25	<i>Semecarpus albescens</i>	0.0019	-9.0275	-0.0173
	26	<i>Catunaregam tomentosa</i>	0.0016	-9.2499	-0.0152
	27	<i>Pterocarpus macrocarpus</i>	0.0011	-9.8349	-0.0108
	28	<i>Gardenia obtusifolia</i>	0.0011	-9.8349	-0.0108
	29	<i>Ulmus lancaefolia</i>	0.0011	-9.8349	-0.0108
	30	<i>Quercus kerrii</i>	0.0008	-10.2499	-0.0084
	31	<i>Diospyros ehretioides</i>	0.0008	-10.2499	-0.0084
	32	<i>Dimocarpus longan</i>	0.0008	-10.2499	-0.0084
	33	<i>Millettia extensa</i>	0.0008	-10.2499	-0.0084
	34	<i>Albizia odoratissima</i>	0.0008	-10.2499	-0.0084
	35	<i>Xylia xylocarpa</i>	0.0005	-10.8349	-0.0059
	36	<i>Gardenia sootepensis</i>	0.0005	-10.8349	-0.0059
	37	<i>Syzygium oblatum</i>	0.0003	-11.8349	-0.0032
	38	<i>Vitex pinnata</i>	0.0003	-11.8349	-0.0032
	39	<i>Schleichera oleosa</i>	0.0003	-11.8349	-0.0032
	40	<i>Dalbergia velutina</i>	0.0003	-11.8349	-0.0032
	41	<i>Colona floribunda</i>	0.0003	-11.8349	-0.0032
	42	<i>Phyllanthus emblica</i>	0.0003	-11.8349	-0.0032
Total			1.00	-346.80	-3.2414
Shannon-Wiener Index (H)					3.24

Table 2-15 Shannon-Wiener Index (SWI) of tree species in two plots of DDF without fire

Plot	No	Species	pi	log2pi	pi*log2pi
1	1	<i>Dipterocarpus tuberculatus</i>	0.3490	-1.5189	-0.5300
	2	<i>Shorea obtusa</i>	0.1152	-3.1183	-0.3591
	3	<i>Canarium subulatum</i>	0.0984	-3.3455	-0.3291
	4	<i>Aporosa villosa</i>	0.0868	-3.5261	-0.3061
	5	<i>Gluta usitata</i>	0.0816	-3.6153	-0.2950
	6	<i>Strychnos nux-vomica</i>	0.0463	-4.4330	-0.2052
	7	<i>Millettia leucantha</i>	0.0330	-4.9220	-0.1624
	8	<i>Irvingia malayana</i>	0.0284	-5.1402	-0.1458
	9	<i>Wendlandia tinctoria</i>	0.0272	-5.2003	-0.1414
	10	<i>Semecarpus albescens</i>	0.0185	-5.7549	-0.1066
	11	<i>Terminalia alata</i>	0.0162	-5.9475	-0.0964
	12	<i>Terminalia chebula</i>	0.0116	-6.4330	-0.0745
	13	<i>Bridelia pierrei</i>	0.0110	-6.5070	-0.0715
	14	<i>Garcinia cowa</i>	0.0081	-6.9475	-0.0563
	15	<i>Anneslea fragrans</i>	0.0081	-6.9475	-0.0563
	16	<i>Flacourtia indica</i>	0.0081	-6.9475	-0.0563
	17	<i>Colona floribunda</i>	0.0081	-6.9475	-0.0563
	18	<i>Catunaregam spathulifolia</i>	0.0075	-7.0544	-0.0531
	19	<i>Dioecrescis erythroclada</i>	0.0052	-7.5850	-0.0395
	20	<i>Stereospermum colais</i>	0.0046	-7.7549	-0.0359
	21	<i>Albizia odoratissima</i>	0.0041	-7.9475	-0.0322
	22	<i>Glochidion velutinum</i>	0.0041	-7.9475	-0.0322
	23	<i>Lagerstroemia macrocarpa</i>	0.0029	-8.4330	-0.0244
	24	<i>Quercus kerrii</i>	0.0023	-8.7549	-0.0203
	25	<i>Memecylon plebejum</i>	0.0017	-9.1699	-0.0159
	26	<i>Dillenia oborata</i>	0.0017	-9.1699	-0.0159
	27	<i>Shorea siamensis</i>	0.0017	-9.1699	-0.0159
	28	<i>Lagerstroemia speciosa</i>	0.0017	-9.1699	-0.0159
	29	<i>Diospyros ehretioides</i>	0.0012	-9.7549	-0.0113
	30	<i>Dalbergia oliveri</i>	0.0012	-9.7549	-0.0113
	31	<i>Antidesma acidum</i>	0.0012	-9.7549	-0.0113
	32	<i>Dalbergia cochinchinensis</i>	0.0012	-9.7549	-0.0113
	33	<i>Pterocarpus macrocarpus</i>	0.0006	-10.7549	-0.0062
	34	<i>Ulmus lancaefolia</i>	0.0006	-10.7549	-0.0062
	35	<i>Manilkara littoralis</i>	0.0006	-10.7549	-0.0062
	37	<i>Syzygium oblatum</i>	0.0006	-10.7549	-0.0062
	Total			1.00	-261.45
Shannon-Wiener Index (H)					3.42

Table 2-15 (Continued)

Plot	No	Species	pi	log2pi	pi*log2pi
2	1	<i>Shorea obtusa</i>	0.3332	-1.5857	-0.5283
	2	<i>Dipterocarpus tuberculatus</i>	0.2871	-1.8005	-0.5169
	3	<i>Aporosa villosa</i>	0.1224	-3.0309	-0.3708
	4	<i>Canarium subulatum</i>	0.0715	-3.8058	-0.2721
	5	<i>Gluta usitata</i>	0.0593	-4.0753	-0.2418
	6	<i>Strychnos nux-vomica</i>	0.0270	-5.2102	-0.1407
	7	<i>Dipterocarpus obtusifolius</i>	0.0265	-5.2388	-0.1387
	8	<i>Millettia leucantha</i>	0.0180	-5.7952	-0.1044
	9	<i>Irvingia malayana</i>	0.0111	-6.4903	-0.0722
	10	<i>Wendlandia tinctoria</i>	0.0069	-7.1822	-0.0495
	11	<i>Shorea siamensis</i>	0.0042	-7.8826	-0.0334
	12	<i>Terminalia chebula</i>	0.0037	-8.0753	-0.0299
	13	<i>Schleichera oleosa</i>	0.0037	-8.0753	-0.0299
	14	<i>Mitragyna rotundifolia</i>	0.0026	-8.5607	-0.0227
	15	<i>Dioecrescis erythroclada</i>	0.0026	-8.5607	-0.0227
	16	<i>Dillenia oborata</i>	0.0021	-8.8826	-0.0188
	17	<i>Carallia brachiata</i>	0.0021	-8.8826	-0.0188
	18	<i>Terminalia alata</i>	0.0016	-9.2977	-0.0148
	19	<i>Catunaregam spathulifolia</i>	0.0016	-9.2977	-0.0148
	20	<i>Colona floribunda</i>	0.0016	-9.2977	-0.0148
	21	<i>Bridelia pierrei</i>	0.0011	-9.8826	-0.0105
	22	<i>Ulmus lancaefolia</i>	0.0011	-9.8826	-0.0105
	23	<i>Quercus kerrii</i>	0.0011	-9.8826	-0.0105
	24	<i>Dalbergia oliveri</i>	0.0011	-9.8826	-0.0105
	25	<i>Lagerstroemia macrocarpa</i>	0.0011	-9.8826	-0.0105
	26	<i>Stereospermum colais</i>	0.0005	-10.8826	-0.0058
	27	<i>Catunaregam tomentosa</i>	0.0005	-10.8826	-0.0058
	28	<i>Flacourtia indica</i>	0.0005	-10.8826	-0.0058
	29	<i>Anneslea fragrans</i>	0.0005	-10.8826	-0.0058
	30	<i>Dalbergia cana</i>	0.0005	-10.8826	-0.0058
	31	<i>Syzygium oblatum</i>	0.0005	-10.8826	-0.0058
	32	<i>Albizia odoratissima</i>	0.0005	-10.8826	-0.0058
	33	<i>Heteropanax fragraus</i>	0.0005	-10.8826	-0.0058
	34	<i>Phyllanthus emblica</i>	0.0005	-10.8826	-0.0058
	35	<i>Pterocarpus macrocarpus</i>	0.0005	-10.8826	-0.0058
	36	<i>Alangium chinense</i>	0.0005	-10.8826	-0.0058
Total			1.00	-300.15	-2.77
Shannon-Wiener Index (H)					2.77

Table 2-15 (Continued)

Plot	No	Species	pi	log2pi	pi*log2pi
(1+2) Total	1	<i>Dipterocarpus tuberculatus</i>	0.3166	-1.6590	-0.5253
	2	<i>Shorea obtusa</i>	0.2290	-2.1267	-0.4870
	3	<i>Aporosa villosa</i>	0.1054	-3.2465	-0.3421
	4	<i>Canarium subulatum</i>	0.0843	-3.5675	-0.3009
	5	<i>Gluta usitata</i>	0.0700	-3.8372	-0.2685
	6	<i>Strychnos nux-vomica</i>	0.0362	-4.7868	-0.1734
	7	<i>Millettia leucantha</i>	0.0252	-5.3124	-0.1337
	8	<i>Irvingia malayana</i>	0.0194	-5.6909	-0.1102
	9	<i>Wendlandia tinctoria</i>	0.0166	-5.9133	-0.0981
	10	<i>Dipterocarpus obtusifolius</i>	0.0138	-6.1763	-0.0854
	11	<i>Semecarpus albescens</i>	0.0088	-6.8202	-0.0604
	12	<i>Terminalia alata</i>	0.0086	-6.8660	-0.0589
	13	<i>Terminalia chebula</i>	0.0075	-7.0653	-0.0528
	14	<i>Bridelia pierrei</i>	0.0058	-7.4279	-0.0431
	15	<i>Colona floribunda</i>	0.0047	-7.7327	-0.0364
	16	<i>Catunaregam spathulifolia</i>	0.0044	-7.8202	-0.0346
	17	<i>Anneslea fragrans</i>	0.0041	-7.9133	-0.0328
	18	<i>Flacourtia indica</i>	0.0041	-7.9133	-0.0328
	19	<i>Dioecrescis erythroclada</i>	0.0039	-8.0128	-0.0310
	20	<i>Garcinia cowa</i>	0.0039	-8.0128	-0.0310
	21	<i>Shorea siamensis</i>	0.0030	-8.3607	-0.0254
	22	<i>Stereospermum neuranthum</i>	0.0025	-8.6503	-0.0215
	23	<i>Albizia odoratissima</i>	0.0022	-8.8202	-0.0195
	24	<i>Dillenia oborata</i>	0.0019	-9.0128	-0.0174
	25	<i>Schleichera oleosa</i>	0.0019	-9.0128	-0.0174
	26	<i>Lagerstroemia macrocarpa</i>	0.0019	-9.0128	-0.0174
	27	<i>Glochidion velutinum</i>	0.0019	-9.0128	-0.0174
	28	<i>Quercus kerrii</i>	0.0017	-9.2352	-0.0153
	29	<i>Mitragyna rotundifolia</i>	0.0014	-9.4983	-0.0131
	30	<i>Carallia brachiata</i>	0.0011	-9.8202	-0.0109
	31	<i>Dalbergia oliveri</i>	0.0011	-9.8202	-0.0109
	32	<i>Ulmus lancaefolia</i>	0.0008	-10.2352	-0.0085
	33	<i>Memecylon plebejum</i>	0.0008	-10.2352	-0.0085
	34	<i>Lagerstroemia speciosa</i>	0.0008	-10.2352	-0.0085
	35	<i>Pterocarpus macrocarpus</i>	0.0006	-10.8202	-0.0060
	36	<i>Syzygium oblatum</i>	0.0006	-10.8202	-0.0060
	37	<i>Diospyros ehretioides</i>	0.0006	-10.8202	-0.0060
	38	<i>Dalbergia cochinchinensis</i>	0.0006	-10.8202	-0.0060
	39	<i>Antidesma acidum</i>	0.0006	-10.8202	-0.0060
	40	<i>Catunaregam tomentosa</i>	0.0003	-11.8202	-0.0033
	41	<i>Dalbergia cana</i>	0.0003	-11.8202	-0.0033
	42	<i>Heteropanax fragraus</i>	0.0003	-11.8202	-0.0033
	43	<i>Phyllanthus emblica</i>	0.0003	-11.8202	-0.0033
	44	<i>Alangium chinense</i>	0.0003	-11.8202	-0.0033
	45	<i>Manilkara littoralis</i>	0.0003	-11.8202	-0.0033
Total			1.0000	-373.88	-3.20
Shannon-Wiener Index (H)					3.20

2.4.2.4 Forest Condition Index (FCI)

DDF with annual fire:

The indexes of forest conditions in annual fire DDF were 52.48 and 47.55 for Plot 1 and Plot 2, and 50.01 in average.

DDF without fire:

The indexes were 62.25 and 49.20 for the two plots, and 55.72 in average. It was the higher for DDF without fire since it consisted of more big trees. However, the difference might be not the effect of fire, but according to the previous conditions. The forest in this area had been logged by forest concession and illegal cutting. During ten years of no forest fire, growth rates of tree species may be more rapid than the forest with annual fire, and may give some small contribution to the value of forest condition index. The average value of DDF with and without fire was 52.87 (Table 2-16).

For other forest type, Seeloy-ounkeaw (2011) calculated FCI of two lower montane community forests at Nong Tao villages, Mae Wang district, Chiang Mai province. The values were in ranges of 27.13-93.99 (average: 50.16) for utilization forest and 23.89-84.74 (average: 54.45) for conservation forest.

Table 2-16 Forest condition index (FCI) in DDF with and without fire

DDF	Plot	Forest condition indexes with different stem-girth classes (cm) for 1-ha plot									FCI
		<25	25-50	50-75	75-100	100-125	125-150	150-175	175-200	220-225	
With fire	1	8.67	71.70	184.00	85.00	19.00	3.00	3.00	0.00	0.00	52.48
	2	9.27	54.70	204.00	82.00	13.00	2.00	0.00	0.00	0.00	47.55
	Average	8.97	63.20	194.00	83.50	16.00	2.50	1.50	0.00	0.00	50.01
40 x 40 m² plot											
Without fire	3	9.00	52.70	146.00	117.00	28.00	5.00	4.00	0.00	1.00	62.25
	4	9.05	66.80	176.00	101.00	29.00	4.00	5.00	0.00	0.00	49.20
	Average	9.03	59.75	161.00	109.00	28.50	4.50	4.50	0.00	0.50	55.72
40 x 40 m² plot											
Average		9.00	61.48	177.50	96.25	22.25	3.50	3.00	0.00	0.25	52.87

2.4.3 Growth and Size Class Distribution

The number of tree individuals of different height and stem-girth classes in DDF with and without fire were presented in Table 2-17 to 2-20. The relationship between stem diameter at breast height (dbh) and tree height (H) showed in semi-log curve (Figure 2-9), which was approximated by the relation,

$$\text{DDF with fire: } y = 0.609x + 1.3079 \quad (R^2 = 0.7529)$$

$$\text{DDF without fire: } y = 0.5843x + 1.619 \quad (R^2 = 0.7675)$$

Most trees in DDF with and without fire followed the reverse-J-shaped distribution with plenty of individuals in the smaller size classes that indicated a good regeneration (Figure 2-10). The big tree species such as *D. tuberculatus*, *S. obtusa* and *G. usitata* were common in DDF, whereas *A. villosa* and *C. subulatum* were the common small trees.

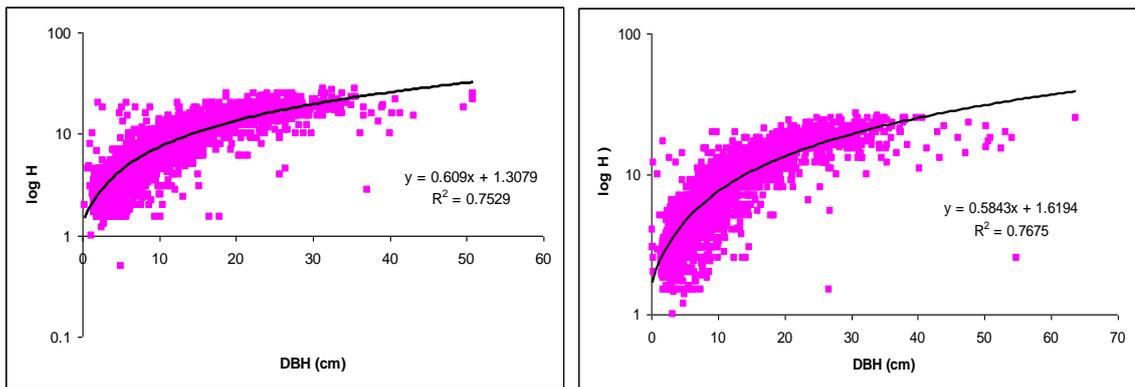


Figure 2-9 Relation between stem dbh and tree height in DDF with and without fire

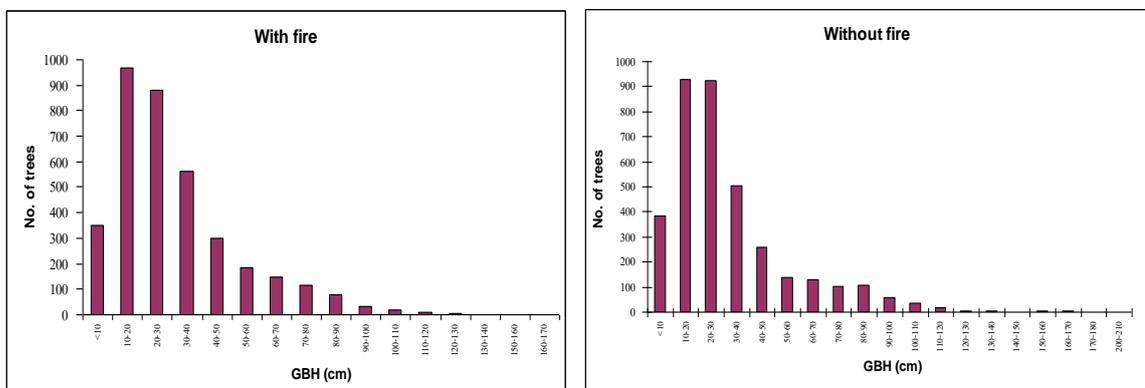


Figure 2-10 Stem size-class distribution of tree species in DDF with and without fire

Table 2-17 Number of tree individuals of tree species with different height classes in DDF with fire

Plot	No	Species	Number of tree individuals with different height classes (m)						
			<5	5-10	10-15	15-20	20-25	25-30	Total
1	1	<i>Dipterocarpus tuberculatus</i>	100	161	133	100	56	15	565
	2	<i>Shorea obtusa</i>	150	135	83	13	1	1	383
	3	<i>Gluta usitata</i>	24	120	90	11	-	-	245
	4	<i>Aporosa villosa</i>	107	79	4	1	-	-	191
	5	<i>Canarium subulatum</i>	29	29	39	4	1	-	102
	6	<i>Wendlandia tinctoria</i>	68	13	1	-	-	-	82
	7	<i>Strychnos nux-vomica</i>	47	21	1	2	-	-	71
	8	<i>Manilkara littoralis</i>	27	1	-	-	-	-	28
	9	<i>Irvingia malayanann.</i>	15	3	6	3	-	-	27
	10	<i>Millettia leucantha</i>	4	12	8	1	1	1	27
	11	<i>Catunaregam spathulifolia</i>	17	6	2	-	-	-	25
	12	<i>Terminalia alata</i>	10	3	5	-	-	-	18
	13	<i>Anneslea fragrans</i>	7	5	1	-	-	-	13
	14	<i>Garcinia cowa</i>	9	2	1	-	-	-	12
	15	<i>Terminalia chebula</i>	6	2	3	-	-	-	11
	16	<i>Bridelia pierrei</i>	5	5	-	-	-	-	10
	17	<i>Dioecrescis erythroclada</i>	5	4	1	-	-	-	10
	18	<i>Memecylon plebejum</i>	7	3	-	-	-	-	10
	19	<i>Semecarpus albescens</i>	3	3	1	-	-	-	7
	20	<i>Memecylon scutellatum</i>	1	5	1	-	-	-	7
	21	<i>Catunaregam tomentosa</i>	-	5	1	-	-	-	6
	22	<i>Stereospermum colais</i>	-	-	4	-	-	-	4
	23	<i>Dillenia oborata</i>	1	2	1	-	-	-	4
	24	<i>Pterocarpus macrocarpus</i>	3	-	-	-	-	-	3
	25	<i>Albizia odoratissima</i>	2	-	-	-	-	-	2
	26	<i>Gardenia sootepensis</i>	1	1	-	-	-	-	2
	27	<i>Diospyros ehretioides</i>	-	-	2	-	-	-	2
	28	<i>Ulmus lancaefolia</i>	1	1	-	-	-	-	2
	29	<i>Dimocarpus longan</i>	1	-	-	1	-	-	2
	30	<i>Dipterocarpus obtusifolius</i>	-	-	1	1	-	-	2
	31	<i>Millettia extensa</i>	-	1	-	-	-	-	1
	32	<i>Schleichera oleosa</i>	-	1	-	-	-	-	1
	33	<i>Dalbergia velutina</i>	-	1	-	-	-	-	1
	34	<i>Colona floribunda</i>	1	-	-	-	-	-	1
	35	<i>Phyllanthus emblica</i>	1	-	-	-	-	-	1
Total			652	624	389	137	59	17	1,878

Table 2-17 (Continued)

Plot	No	Species	Number of tree individuals with different height classes (m)						
			<5	5-10	10-15	15-20	20-25	25-30	Total
2	1	<i>Dipterocarpus tuberculatus</i>	112	167	81	81	14	-	455
	2	<i>Shorea obtusa</i>	239	150	14	2	-	-	405
	3	<i>Aporosa villosa</i>	157	120	1	-	-	-	278
	4	<i>Dipterocarpus obtusifolius</i>	29	72	42	61	14	-	218
	5	<i>Gluta usitata</i>	15	92	36	5	-	-	148
	6	<i>Strychnos nux-vomica</i>	51	14	-	-	-	-	65
	7	<i>Irvingia malayana</i>	6	27	12	1	-	-	46
	8	<i>Canarium subulatum</i>	6	16	8	1	-	-	31
	9	<i>Manilkara littoralis</i>	24	4	-	-	-	-	28
	10	<i>Wendlandia tinctoria</i>	14	11	1	-	-	-	26
	11	<i>Millettia leucantha</i>	-	4	6	5	2	-	17
	12	<i>Carallia brachiata</i>	6	6	1	-	-	-	13
	13	<i>Shorea siamensis</i>	8	2	1	-	-	-	11
	14	<i>Catunaregam spathulifolia</i>	5	1	1	-	-	-	7
	15	<i>Gardenia obtusifolia</i>	2	2	-	-	-	-	4
	16	<i>Quercus kerrii</i>	-	3	-	-	-	-	3
	17	<i>Stereospermum colais</i>	-	2	1	-	-	-	3
	18	<i>Dillenia obovata</i>	1	1	1	-	-	-	3
	19	<i>Millettia extensa</i>	-	2	-	-	-	-	2
	20	<i>Xylocarpus xylocarpa</i>	-	-	-	2	-	-	2
	21	<i>Ulmus lancaefolia</i>	2	-	-	-	-	-	2
	22	<i>Albizia odoratissima</i>	1	-	-	-	-	-	1
	23	<i>Diospyros ehretioides</i>	1	-	-	-	-	-	1
	24	<i>Vitex pinnata</i>	-	1	-	-	-	-	1
	25	<i>Pterocarpus macrocarpus</i>	-	-	1	-	-	-	1
	26	<i>Dioecrescis erythroclada</i>	-	1	-	-	-	-	1
	27	<i>Syzygium oblatum</i>	-	1	-	-	-	-	1
	28	<i>Dimocarpus longan</i>	-	1	-	-	-	-	1
	29	<i>Anneslea fragrans</i>	-	1	-	-	-	-	1
Total			679	701	207	158	30	-	1,775

Table 2-17 (Continued)

Plot	No	Species	Number of tree individuals with different height classes (m)						
			<5	5-10	10-15	15-20	20-25	25-30	Total
(1+2) Total	1	<i>Dipterocarpus tuberculatus</i>	212	328	214	181	70	15	1,020
	2	<i>Shorea obtusa</i>	389	285	97	15	1	1	788
	3	<i>Aporosa villosa</i>	264	199	5	1	-	-	469
	4	<i>Gluta usitata</i>	39	212	126	16	-	-	393
	5	<i>Dipterocarpus obtusifolius</i>	29	72	43	62	14	-	220
	6	<i>Strychnos nux-vomica</i>	98	35	1	2	-	-	136
	7	<i>Canarium subulatum</i>	35	45	47	5	1	-	133
	8	<i>Wendlandia tinctoria</i>	82	24	2	-	-	-	108
	9	<i>Iringia malayana</i>	21	30	18	4	-	-	73
	10	<i>Manilkara littoralis</i>	51	5	-	-	-	-	56
	11	<i>Millettia leucantha</i>	4	16	14	6	3	1	44
	12	<i>Catunaregam spathulifolia</i>	22	7	3	-	-	-	32
	13	<i>Terminalia alata</i>	10	3	5	-	-	-	18
	14	<i>Anneslea fragrans</i>	7	6	1	-	-	-	14
	15	<i>Carallia brachiata</i>	6	6	1	-	-	-	13
	16	<i>Garcinia cowa</i>	9	2	1	-	-	-	12
	17	<i>Dioecrescis erythroclada</i>	5	5	1	-	-	-	11
	18	<i>Shorea siamensis</i>	8	2	1	-	-	-	11
	19	<i>Terminalia chebula</i>	6	2	3	-	-	-	11
	20	<i>Bridelia pierrei</i>	5	5	-	-	-	-	10
	21	<i>Memecylon plebejum</i>	7	3	-	-	-	-	10
	22	<i>Stereospermum neuranthum</i>	-	2	5	-	-	-	7
	23	<i>Semecarpus albescens</i>	3	3	1	-	-	-	7
	24	<i>Dillenia oborata</i>	2	3	2	-	-	-	7
	25	<i>Memecylon scutellatum</i>	1	5	1	-	-	-	7
	26	<i>Catunaregam tomentosa</i>	-	5	1	-	-	-	6
	27	<i>Gardenia obtusifolia</i>	2	2	-	-	-	-	4
	28	<i>Ulmus lancaefolia</i>	3	1	-	-	-	-	4
	29	<i>Pterocarpus macrocarpus</i>	3	-	1	-	-	-	4
	30	<i>Quercus kerrii</i>	-	3	-	-	-	-	3
	31	<i>Albizia odoratissima</i>	3	-	-	-	-	-	3
	32	<i>Millettia extensa</i>	-	3	-	-	-	-	3
	33	<i>Diospyros ehretioides</i>	1	-	2	-	-	-	3
	34	<i>Dimocarpus longan</i>	1	1	-	1	-	-	3
	35	<i>Gardenia sootepensis</i>	1	1	-	-	-	-	2
	36	<i>Xylia xylocarpa</i>	-	-	-	2	-	-	2
	37	<i>Schleichera oleosa</i>	-	1	-	-	-	-	1
	38	<i>Vitex pinnata</i>	-	1	-	-	-	-	1
	39	<i>Dalbergia velutina</i>	-	1	-	-	-	-	1
	40	<i>Colona floribunda</i>	1	-	-	-	-	-	1
	41	<i>Phyllanthus emblica</i>	1	-	-	-	-	-	1
	42	<i>Syzygium oblatum</i>	-	1	-	-	-	-	1
Total 2 plots			1,331	1,325	596	295	89	17	3,653
trees/ha			666	663	298	148	45	9	1,827
(%)			36.4	36.3	16.3	8.1	2.4	0.5	100

Table 2-18 Number of tree individuals of tree species with different stem-girth classes in DDF with fire

Plot	No	Species	Number of tree individuals with different stem-girth classes (cm)				
			<50	50-100	100-150	150-200	Total
1	1	<i>Dipterocarpus tuberculatus</i>	371	177	17	-	565
	2	<i>Shorea obtusa</i>	359	17	4	3	383
	3	<i>Gluta usitata</i>	209	35	1	-	245
	4	<i>Aporosa villosa</i>	184	7	-	-	191
	5	<i>Canarium subulatum</i>	84	18	-	-	102
	6	<i>Wendlandia tinctoria</i>	82	-	-	-	82
	7	<i>Strychnos nux-vomica</i>	68	3	-	-	71
	8	<i>Manilkara littoralis</i>	28	-	-	-	28
	9	<i>Irvingia malayanann.</i>	24	3	-	-	27
	10	<i>Millettia leucantha</i>	24	3	-	-	27
	11	<i>Catunaregam spathulifolia</i>	25	-	-	-	25
	12	<i>Terminalia alata</i>	16	2	-	-	18
	13	<i>Anneslea fragrans</i>	12	1	-	-	13
	14	<i>Garcinia cowa</i>	11	1	-	-	12
	15	<i>Terminalia chebula</i>	11	-	-	-	11
	16	<i>Bridelia pierrei</i>	10	-	-	-	10
	17	<i>Dioecrescis erythroclada</i>	10	-	-	-	10
	18	<i>Memecylon plebejum</i>	10	-	-	-	10
	19	<i>Semecarpus albescens</i>	7	-	-	-	7
	20	<i>Memecylon scutellatum</i>	7	-	-	-	7
	21	<i>Catunaregam tomentosa</i>	6	-	-	-	6
	22	<i>Stereospermum colais</i>	4	-	-	-	4
	23	<i>Dillenia oborata</i>	4	-	-	-	4
	24	<i>Pterocarpus macrocarpus</i>	3	-	-	-	3
	25	<i>Albizia odoratissima</i>	2	-	-	-	2
	26	<i>Gardenia sootepensis</i>	2	-	-	-	2
	27	<i>Diospyros ehretioides</i>	2	-	-	-	2
	28	<i>Ulmus lancaefolia</i>	2	-	-	-	2
	29	<i>Dimocarpus longan</i>	2	-	-	-	2
	30	<i>Dipterocarpus obtusifolius</i>	0	2	-	-	2
	31	<i>Millettia extensa</i>	1	-	-	-	1
	32	<i>Schleichera oleosa</i>	1	-	-	-	1
	33	<i>Dalbergia velutina</i>	1	-	-	-	1
	34	<i>Colona floribunda</i>	1	-	-	-	1
	35	<i>Phyllanthus emblica</i>	1	-	-	-	1
Total			1584	269	22	3	1,878

Table 2-18 (Continued)

Plot	No	Species	Number of tree individuals with different stem-girth classes (cm)				
			<50	50-100	100-150	150-200	Total
2	1	<i>Dipterocarpus tuberculatus</i>	318	135	2	-	455
	2	<i>Shorea obtusa</i>	396	9	-	-	405
	3	<i>Aporosa villosa</i>	277	1	-	-	278
	4	<i>Dipterocarpus obtusifolius</i>	117	91	10	-	218
	5	<i>Gluta usitata</i>	114	31	3	-	148
	6	<i>Strychnos nux-vomica</i>	64	1	-	-	65
	7	<i>Irvingia malayana</i>	43	3	-	-	46
	8	<i>Canarium subulatum</i>	24	7	-	-	31
	9	<i>Manilkara littoralis</i>	28	-	-	-	28
	10	<i>Wendlandia tinctoria</i>	26	-	-	-	26
	11	<i>Millettia leucantha</i>	11	6	-	-	17
	12	<i>Carallia brachiata</i>	13	-	-	-	13
	13	<i>Shorea siamensis</i>	11	-	-	-	11
	14	<i>Catunaregam spathulifolia</i>	7	-	-	-	7
	15	<i>Gardenia obtusifolia</i>	4	-	-	-	4
	16	<i>Quercus kerrii</i>	2	1	-	-	3
	17	<i>Stereospermum colais</i>	3	-	-	-	3
	18	<i>Dillenia obovata</i>	3	-	-	-	3
	19	<i>Millettia extensa</i>	2	-	-	-	2
	20	<i>Xylocarpus xylocarpa</i>	1	1	-	-	2
	21	<i>Ulmus lancaefolia</i>	2	-	-	-	2
	22	<i>Albizia odoratissima</i>	1	-	-	-	1
	23	<i>Diospyros ehretioides</i>	1	-	-	-	1
	24	<i>Vitex pinnata</i>	1	-	-	-	1
	25	<i>Pterocarpus macrocarpus</i>	1	-	-	-	1
	26	<i>Dioecrescis erythroclada</i>	1	-	-	-	1
	27	<i>Syzygium oblatum</i>	1	-	-	-	1
	28	<i>Dimocarpus longan</i>	1	-	-	-	1
	29	<i>Anneslea fragrans</i>	1	-	-	-	1
Total			1474	286	15	-	1,775

Table 2-18 (Continued)

Plot	No	Species	Number of tree individuals with different stem-girth classes (cm)				
			<50	50-100	100-150	150-200	Total
(1+2) Total	1	<i>Dipterocarpus tuberculatus</i>	689	312	19	-	1,020
	2	<i>Shorea obtusa</i>	755	26	4	3	788
	3	<i>Aporosa villosa</i>	461	8	0	-	469
	4	<i>Gluta usitata</i>	323	66	4	-	393
	5	<i>Dipterocarpus obtusifolius</i>	117	93	10	-	220
	6	<i>Strychnos nux-vomica</i>	132	4	-	-	136
	7	<i>Canarium subulatum</i>	108	25	-	-	133
	8	<i>Wendlandia tinctoria</i>	108	-	-	-	108
	9	<i>Iringia malayana</i>	67	6	-	-	73
	10	<i>Manilkara littoralis</i>	56	-	-	-	56
	11	<i>Millettia leucantha</i>	35	9	-	-	44
	12	<i>Catunaregam spathulifolia</i>	32	-	-	-	32
	13	<i>Terminalia alata</i>	16	2	-	-	18
	14	<i>Anneslea fragrans</i>	13	1	-	-	14
	15	<i>Carallia brachiata</i>	13	-	-	-	13
	16	<i>Garcinia cowa</i>	11	1	-	-	12
	17	<i>Dioecrescis erythroclada</i>	11	-	-	-	11
	18	<i>Shorea siamensis</i>	11	-	-	-	11
	19	<i>Terminalia chebula</i>	11	-	-	-	11
	20	<i>Bridelia pierrei</i>	10	-	-	-	10
	21	<i>Memecylon plebejum</i>	10	-	-	-	10
	22	<i>Stereospermum neuranthum</i>	7	-	-	-	7
	23	<i>Semecarpus albescens</i>	7	-	-	-	7
	24	<i>Dillenia obovata</i>	7	-	-	-	7
	25	<i>Memecylon scutellatum</i>	7	-	-	-	7
	26	<i>Catunaregam tomentosa</i>	6	-	-	-	6
	27	<i>Gardenia obtusifolia</i>	4	-	-	-	4
	28	<i>Ulmus lancaefolia</i>	4	-	-	-	4
	29	<i>Pterocarpus macrocarpus</i>	4	-	-	-	4
	30	<i>Quercus kerrii</i>	2	1	-	-	3
	31	<i>Albizia odoratissima</i>	3	-	-	-	3
	33	<i>Diospyros ehretioides</i>	3	-	-	-	3
	34	<i>Dimocarpus longan</i>	3	-	-	-	3
	32	<i>Millettia extensa</i>	3	-	-	-	3
	36	<i>Xylia xylocarpa</i>	1	1	-	-	3
	35	<i>Gardenia sootepensis</i>	2	-	-	-	2
	37	<i>Schleichera oleosa</i>	1	-	-	-	1
	38	<i>Vitex pinnata</i>	1	-	-	-	1
	39	<i>Dalbergia velutina</i>	1	-	-	-	1
	40	<i>Colona floribunda</i>	1	-	-	-	1
	41	<i>Phyllanthus emblica</i>	1	-	-	-	1
	42	<i>Syzygium oblatum</i>	1	-	-	-	1
Total 2 plots			3058	555	37	3	3,653
trees/ha			1,529	278	19	2	1,827
(%)			83.7	15.2	1.0	0.1	100

Table 2-19 Number of tree individuals of tree species with different height classes in DDF without fire

Plot	No	Species	Number of tree individuals with different height classes (m)						Total
			<5	5-10	10-15	15-20	20-25	25-30	
1	1	<i>Dipterocarpus tuberculatus</i>	109	149	135	123	74	13	603
	2	<i>Shorea obtusa</i>	90	80	22	6	-	1	199
	3	<i>Canarium subulatum</i>	63	71	30	6	-	-	170
	4	<i>Aporosa villosa</i>	94	53	3	-	-	-	150
	5	<i>Gluta usitata</i>	43	44	44	10	-	-	141
	6	<i>Strychnos nux-vomica</i>	56	23	-	1	-	-	80
	7	<i>Millettia leucantha</i>	25	19	11	2	-	-	57
	8	<i>Irvingia malayana</i>	18	20	8	3	-	-	49
	9	<i>Wendlandia tinctoria</i>	39	8	-	-	-	-	47
	10	<i>Semecarpus albescens</i>	13	15	4	-	-	-	32
	11	<i>Terminalia alata</i>	23	2	2	1	-	-	28
	12	<i>Terminalia chebula</i>	11	5	4	-	-	-	20
	13	<i>Bridelia pierrei</i>	13	6	-	-	-	-	19
	14	<i>Garcinia cowa</i>	8	-	5	1	-	-	14
	15	<i>Anneslea fragrans</i>	9	5	-	-	-	-	14
	16	<i>Flacourtia indica</i>	6	7	1	-	-	-	14
	17	<i>Colona floribunda</i>	7	6	1	-	-	-	14
	18	<i>Catunaregam spathulifolia</i>	13	-	-	-	-	-	13
	19	<i>Dioecrescis erythroclada</i>	5	3	-	-	1	-	9
	20	<i>Stereospermum colais</i>	3	4	1	-	-	-	8
	21	<i>Albizia odoratissima</i>	4	3	-	-	-	-	7
	22	<i>Glochidion velutinum</i>	6	-	1	-	-	-	7
	23	<i>Lagerstroemia macrocarpa</i>	3	2	-	-	-	-	5
	24	<i>Quercus kerrii</i>	-	3	1	-	-	-	4
	25	<i>Shorea siamensis</i>	3	-	-	-	-	-	3
	26	<i>Dillenia obovata</i>	3	-	-	-	-	-	3
	27	<i>Memecylon plebejum</i>	2	1	-	-	-	-	3
	28	<i>Lagerstroemia speciosa</i>	3	-	-	-	-	-	3
	29	<i>Dalbergia dongnaiensis</i>	2	-	-	-	-	-	2
	30	<i>Diospyros ehretioides</i>	1	-	1	-	-	-	2
	31	<i>Dalbergia cochinchinensis</i>	-	2	-	-	-	-	2
	32	<i>Antidesma acidum</i>	2	-	-	-	-	-	2
	33	<i>Ulmus lancaefolia</i>	1	-	-	-	-	-	1
	34	<i>Pterocarpus macrocarpus</i>	-	1	-	-	-	-	1
	35	<i>Manilkara littoralis</i>	1	-	-	-	-	-	1
	36	<i>Syzygium oblatum</i>	1	-	-	-	-	-	1
Total			680	532	274	153	75	14	1,728

Table 2-19 (Continued)

Plot	No	Species	Number of tree individuals with different height classes (m)						Total
			<5	5-10	10-15	15-20	20-25	25-30	
2	1	<i>Shorea obtusa</i>	242	344	30	11	2	-	629
	2	<i>Dipterocarpus tuberculatus</i>	102	154	93	110	80	3	542
	3	<i>Aporosa villosa</i>	126	104	1	-	-	-	231
	4	<i>Canarium subulatum</i>	41	74	19	1	-	-	135
	5	<i>Gluta usitata</i>	21	47	32	12	-	-	112
	6	<i>Strychnos nux-vomica</i>	32	19	-	-	-	-	51
	7	<i>Dipterocarpus obtusifolius</i>	8	25	4	6	7	-	50
	8	<i>Millettia leucantha</i>	16	13	3	2	-	-	34
	9	<i>Irvingia malayana</i>	5	9	7	-	-	-	21
	10	<i>Wendlandia tinctoria</i>	11	1	1	-	-	-	13
	11	<i>Shorea siamensis</i>	4	4	-	-	-	-	8
	12	<i>Terminalia chebula</i>	4	3	-	-	-	-	7
	13	<i>Schleichera oleosa</i>	2	4	1	-	-	-	7
	14	<i>Mitragyna rotundifolia</i>	2	2	1	-	-	-	5
	15	<i>Dioecrescis erythroclada</i>	2	2	1	-	-	-	5
	16	<i>Carallia brachiata</i>	3	1	-	-	-	-	4
	17	<i>Dillenia obovata</i>	-	3	1	-	-	-	4
	18	<i>Colona floribunda</i>	3	-	-	-	-	-	3
	19	<i>Terminalia alata</i>	2	-	-	1	-	-	3
	20	<i>Catunaregam spathulifolia</i>	2	1	-	-	-	-	3
	21	<i>Quercus kerrii</i>	-	2	-	-	-	-	2
	22	<i>Dalbergia oliveri</i>	2	-	-	-	-	-	2
	23	<i>Ulmus lancaefolia</i>	2	-	-	-	-	-	2
	24	<i>Bridelia pierrei</i>	1	1	-	-	-	-	2
	25	<i>Lagerstroemia macrocarpa</i>	2	-	-	-	-	-	2
	26	<i>Albizia odoratissima</i>	1	-	-	-	-	-	1
	27	<i>Stereospermum colais</i>	-	-	1	-	-	-	1
	28	<i>Pterocarpus macrocarpus</i>	1	-	-	-	-	-	1
	29	<i>Dalbergia cana</i>	1	-	-	-	-	-	1
	30	<i>Alangium chinense</i>	1	-	-	-	-	-	1
	31	<i>Flacourtia indica</i>	-	1	-	-	-	-	1
	32	<i>Phyllanthus emblica</i>	1	-	-	-	-	-	1
	33	<i>Catunaregam tomentosa</i>	-	1	-	-	-	-	1
	34	<i>Syzygium obovatum</i>	1	-	-	-	-	-	1
	35	<i>Anneslea fragrans</i>	1	-	-	-	-	-	1
	36	<i>Heteropanax fragraus</i>	1	-	-	-	-	-	1
Total			643	815	195	143	89	3	1,888

Table 2-19 (Continued)

Plot	No	Species	Number of tree individuals with different height classes (m)						Total
			<5	5-10	10-15	15-20	20-25	25-30	
(1+2) Total	1	<i>Dipterocarpus tuberculatus</i>	211	303	228	233	154	16	1,145
	2	<i>Shorea obtusa</i>	332	424	52	17	2	1	828
	3	<i>Aporosa villosa</i>	220	157	4	-	-	-	381
	4	<i>Canarium subulatum</i>	104	145	49	7	-	-	305
	5	<i>Gluta usitata</i>	64	91	76	22	-	-	253
	6	<i>Strychnos nux-vomica</i>	88	42	-	1	-	-	131
	7	<i>Millettia leucantha</i>	41	32	14	4	-	-	91
	8	<i>Irvingia malayana</i>	23	29	15	3	-	-	70
	9	<i>Wendlandia tinctoria</i>	50	9	1	-	-	-	60
	10	<i>Dipterocarpus obtusifolius</i>	8	25	4	6	7	-	50
	11	<i>Semecarpus albescens</i>	13	15	4	-	-	-	32
	12	<i>Terminalia alata</i>	25	2	2	2	-	-	31
	13	<i>Terminalia chebula</i>	13	9	5	-	-	-	27
	14	<i>Bridelia pierrei</i>	14	7	-	-	-	-	21
	15	<i>Colona floribunda</i>	12	5	-	-	-	-	17
	16	<i>Catunaregam spathulifolia</i>	15	1	-	-	-	-	16
	17	<i>Flacourtia indica</i>	6	8	1	-	-	-	15
	18	<i>Anneslea fragrans</i>	8	6	1	-	-	-	15
	19	<i>Garcinia cowa</i>	8	-	5	1	-	-	14
	20	<i>Dioecrescis erythroclada</i>	7	5	1	-	1	-	14
	21	<i>Shorea siamensis</i>	7	4	-	-	-	-	11
	22	<i>Stereospermum neuranthum</i>	3	4	2	-	-	-	9
	23	<i>Albizia odoratissima</i>	5	3	-	-	-	-	8
	24	<i>Schleichera oleosa</i>	4	3	-	-	-	-	7
	25	<i>Dillenia oborata</i>	3	3	1	-	-	-	7
	26	<i>Glochidion velutinum</i>	6	-	1	-	-	-	7
	27	<i>Lagerstroemia macrocarpa</i>	5	2	-	-	-	-	7
	28	<i>Quercus kerrii</i>	-	5	1	-	-	-	6
	29	<i>Mitragyna rotundifolia</i>	2	2	1	-	-	-	5
	30	<i>Dalbergia oliveri</i>	4	-	-	-	-	-	4
	31	<i>Carallia brachiata</i>	3	1	-	-	-	-	4
	32	<i>Ulmus lancaefolia</i>	3	-	-	-	-	-	3
	33	<i>Memecylon plebejum</i>	2	1	-	-	-	-	3
	34	<i>Lagerstroemia speciosa</i>	3	-	-	-	-	-	3
	35	<i>Diospyros ehretioides</i>	1	-	1	-	-	-	2
	36	<i>Pterocarpus macrocarpus</i>	1	1	-	-	-	-	2
	37	<i>Dalbergia cochinchinensis</i>	-	2	-	-	-	-	2
	38	<i>Antidesma acidum</i>	2	-	-	-	-	-	2
	39	<i>Syzygium oblatum</i>	2	-	-	-	-	-	2
	40	<i>Dalbergia cana</i>	1	-	-	-	-	-	1
	41	<i>Alangium chinense</i>	1	-	-	-	-	-	1
	42	<i>Phyllanthus emblica</i>	1	-	-	-	-	-	1
	43	<i>Catunaregam tomentosa</i>	-	1	-	-	-	-	1
	44	<i>Manilkara littoralis</i>	1	-	-	-	-	-	1
	45	<i>Heteropanax fragraus</i>	1	-	-	-	-	-	1
Total 2 plots			1,323	1,347	469	296	164	17	3,616
trees/ha			662	674	235	148	82	9	1,808
(%)			37	37	13	8	5	0	100

Table 2-20 Number of tree individuals of tree species with different stem-girth classes in DDF without fire

Plot	No	Species	Number of tree individuals with different stem-girth classes (cm)					Total
			<50	50-100	100-150	150-200	>200	
1	1	<i>Dipterocarpus tuberculatus</i>	376	199	27	1	-	603
	2	<i>Shorea obtusa</i>	187	7	1	3	1	199
	3	<i>Canarium subulatum</i>	157	13	-	-	-	170
	4	<i>Aporosa villosa</i>	148	2	-	-	-	150
	5	<i>Gluta usitata</i>	106	31	4	-	-	141
	6	<i>Strychnos nux-vomica</i>	80	-	-	-	-	80
	7	<i>Millettia leucantha</i>	55	2	-	-	-	57
	8	<i>Irvingia malayana</i>	45	3	1	-	-	49
	9	<i>Wendlandia tinctoria</i>	47	-	-	-	-	47
	10	<i>Semecarpus albescens</i>	31	1	-	-	-	32
	11	<i>Terminalia alata</i>	28	-	-	-	-	28
	12	<i>Terminalia chebula</i>	20	-	-	-	-	20
	13	<i>Bridelia pierrei</i>	19	-	-	-	-	19
	14	<i>Garcinia cowa</i>	11	3	-	-	-	14
	15	<i>Colona floribunda</i>	14	-	-	-	-	14
	16	<i>Flacourtia indica</i>	14	-	-	-	-	14
	17	<i>Anneslea fragrans</i>	12	2	-	-	-	14
	18	<i>Catunaregam spathulifolia</i>	13	-	-	-	-	13
	19	<i>Dioecrescis erythroclada</i>	9	-	-	-	-	9
	20	<i>Stereospermum colais</i>	8	-	-	-	-	8
	21	<i>Albizia odoratissima</i>	7	-	-	-	-	7
	22	<i>Glochidion velutinum</i>	7	-	-	-	-	7
	23	<i>Lagerstroemia macrocarpa</i>	5	-	-	-	-	5
	24	<i>Quercus kerrii</i>	4	-	-	-	-	4
	25	<i>Shorea siamensis</i>	3	-	-	-	-	3
	26	<i>Dillenia obovata</i>	3	-	-	-	-	3
	27	<i>Memecylon plebejum</i>	3	-	-	-	-	3
	28	<i>Lagerstroemia speciosa</i>	3	-	-	-	-	3
	29	<i>Dalbergia dongnaiensis</i>	2	-	-	-	-	2
	30	<i>Diospyros ehretioides</i>	2	-	-	-	-	2
	31	<i>Dalbergia cochinchinensis</i>	2	-	-	-	-	2
	32	<i>Antidesma acidum</i>	2	-	-	-	-	2
	33	<i>Ulmus lancaefolia</i>	1	-	-	-	-	1
	34	<i>Pterocarpus macrocarpus</i>	1	-	-	-	-	1
	35	<i>Syzygium oblatum</i>	1	-	-	-	-	1
	36	<i>Manilkara littoralis</i>	1	-	-	-	-	1
Total			1,427	263	33	4	1	1,728

Table 2-20 (Continued)

Plot	No	Species	Number of tree individuals with different stem-girth classes (cm)					Total
			<50	50-100	100-150	150-200	>200	
2	1	<i>Shorea obtusa</i>	608	15	4	2	-	629
	2	<i>Dipterocarpus tuberculatus</i>	314	209	18	1	-	542
	3	<i>Aporosa villosa</i>	228	3	-	-	-	231
	4	<i>Canarium subulatum</i>	131	4	-	-	-	135
	5	<i>Gluta usitata</i>	74	29	7	2	-	112
	6	<i>Strychnos nux-vomica</i>	51	-	-	-	-	51
	7	<i>Dipterocarpus obtusifolius</i>	34	12	4	-	-	50
	8	<i>Millettia leucantha</i>	31	3	-	-	-	34
	9	<i>Irvingia malayana</i>	19	2	-	-	-	21
	10	<i>Wendlandia tinctoria</i>	13	-	-	-	-	13
	11	<i>Shorea siamensis</i>	8	-	-	-	-	8
	12	<i>Schleichera oleosa</i>	7	-	-	-	-	7
	13	<i>Terminalia chebula</i>	7	-	-	-	-	7
	14	<i>Mitragyna rotundifolia</i>	5	-	-	-	-	5
	15	<i>Dioecrescis erythroclada</i>	5	-	-	-	-	5
	16	<i>Carallia brachiata</i>	4	-	-	-	-	4
	17	<i>Dillenia oborata</i>	4	-	-	-	-	4
	18	<i>Colona floribunda</i>	3	-	-	-	-	3
	19	<i>Terminalia alata</i>	3	-	-	-	-	3
	20	<i>Catunaregam spathulifolia</i>	3	-	-	-	-	3
	21	<i>Quercus kerrii</i>	2	-	-	-	-	2
	22	<i>Dalbergia oliveri</i>	2	-	-	-	-	2
	23	<i>Ulmus lancaefolia</i>	2	-	-	-	-	2
	24	<i>Bridelia pierrei</i>	2	-	-	-	-	2
	25	<i>Lagerstroemia macrocarpa</i>	2	-	-	-	-	2
	26	<i>Albizia odoratissima</i>	1	-	-	-	-	1
	27	<i>Stereospermum colais</i>	1	-	-	-	-	1
	28	<i>Pterocarpus macrocarpus</i>	1	-	-	-	-	1
	29	<i>Dalbergia cana</i>	1	-	-	-	-	1
	30	<i>Alangium chinense</i>	1	-	-	-	-	1
	31	<i>Flacourtia indica</i>	1	-	-	-	-	1
	32	<i>Phyllanthus emblica</i>	1	-	-	-	-	1
	33	<i>Catunaregam tomentosa</i>	1	-	-	-	-	1
	34	<i>Syzygium oblatum</i>	1	-	-	-	-	1
	35	<i>Anneslea fragrans</i>	1	-	-	-	-	1
	36	<i>Heteropanax fragraus</i>	1	-	-	-	-	1
Total			1,573	277	33	5	-	1,888

Table 2-20 (Continued)

Plot	No	Species	Number of tree individuals with different stem-girth classes (cm)					Total
			<50	50-100	100-150	150-200	>200	
(1+2) Total	1	<i>Dipterocarpus tuberculatus</i>	690	408	45	2	-	1,145
	2	<i>Shorea obtusa</i>	795	22	5	5	1	828
	3	<i>Aporosa villosa</i>	376	5	-	-	-	381
	4	<i>Canarium subulatum</i>	288	17	-	-	-	305
	5	<i>Gluta usitata</i>	180	60	11	2	-	253
	6	<i>Strychnos nux-vomica</i>	131	-	-	-	-	131
	7	<i>Millettia leucantha</i>	86	5	-	-	-	91
	8	<i>Irvingia malayana</i>	64	5	1	-	-	70
	9	<i>Wendlandia tinctoria</i>	60	-	-	-	-	60
	10	<i>Dipterocarpus obtusifolius</i>	34	12	4	-	-	50
	11	<i>Semecarpus albescens</i>	31	1	-	-	-	32
	12	<i>Terminalia alata</i>	31	-	-	-	-	31
	13	<i>Terminalia chebula</i>	27	-	-	-	-	27
	14	<i>Bridelia pierrei</i>	21	-	-	-	-	21
	15	<i>Colona floribunda</i>	17	-	-	-	-	17
	16	<i>Catunaregam spatulifolia</i>	16	-	-	-	-	16
	17	<i>Flacourtia indica</i>	15	-	-	-	-	15
	18	<i>Anneslea fragrans</i>	13	2	-	-	-	15
	19	<i>Garcinia cowa</i>	11	3	-	-	-	14
	20	<i>Dioecrescis erythroclada</i>	14	-	-	-	-	14
	21	<i>Shorea siamensis</i>	11	-	-	-	-	11
	22	<i>Stereospermum neuranthum</i>	9	-	-	-	-	9
	23	<i>Albizia odoratissima</i>	8	-	-	-	-	8
	24	<i>Schleichera oleosa</i>	7	-	-	-	-	7
	25	<i>Dillenia obovata</i>	7	-	-	-	-	7
	26	<i>Glochidion velutinum</i>	7	-	-	-	-	7
	27	<i>Lagerstroemia macrocarpa</i>	7	-	-	-	-	7
	28	<i>Quercus kerrii</i>	6	-	-	-	-	6
	29	<i>Mitragyna rotundifolia</i>	5	-	-	-	-	5
	30	<i>Dalbergia oliveri</i>	4	-	-	-	-	4
	31	<i>Carallia brachiata</i>	4	-	-	-	-	4
	32	<i>Ulmus lancaefolia</i>	3	-	-	-	-	3
	33	<i>Memecylon plebejum</i>	3	-	-	-	-	3
	34	<i>Lagerstroemia speciosa</i>	3	-	-	-	-	3
	35	<i>Diospyros ehretioides</i>	2	-	-	-	-	2
	36	<i>Pterocarpus macrocarpus</i>	2	-	-	-	-	2
	37	<i>Dalbergia cochinchinensis</i>	2	-	-	-	-	2
	38	<i>Antidesma acidum</i>	2	-	-	-	-	2
	39	<i>Syzygium oblatum</i>	2	-	-	-	-	2
	40	<i>Dalbergia cana</i>	1	-	-	-	-	1
	41	<i>Alangium chinense</i>	1	-	-	-	-	1
	42	<i>Phyllanthus emblica</i>	1	-	-	-	-	1
	43	<i>Catunaregam tomentosa</i>	1	-	-	-	-	1
	44	<i>Manilkara littoralis</i>	1	-	-	-	-	1
	45	<i>Heteropanax fragraus</i>	1	-	-	-	-	1
Total 2 plots			3,000	540	66	9	1	3,166
trees/ha			1,500	270	33	4.5	0.5	1,808
(%)			83.0	14.9	1.8	0.2	0.03	100

2.4.4 Natural Regeneration in DDF with and without Fire

The total number of seedling and ground-covered species existed in DDF with and without fire were 75 species which were separated to be 64 species of trees, 8 species of herbs and 3 species of climbers.

DDF with fire:

Totally 34,525 individuals/ha (5,524 individuals/rai) of seedling and ground-covered species were estimated in the forest. The average number of seedlings and climbers was 27,738 individuals/ha (4,438 individuals/rai), whereas the average number of herbs was 6,788 individuals/ha (1,086 individuals/rai).

DDF without fire:

Totally 35,688 individuals/ha (5,710 individuals/rai) of seedling and ground-covered species were estimated in the non-fire forest. The average number of seedlings and climbers was 29,188 individuals/ha (4,670 individuals/rai), whereas the average number of herbs was 6,500 individuals/ha (1,040 individuals/rai).

The number of seedlings and ground-covered species was the higher in non-fire forest. The common seedlings of woody species were *Shorea obtusa*, *Gluta usitata*, *Dipterocarpus tuberculatus*, *Aporosa villosa* and *Glochidion velutinum* (Table 2-21).

Table 2-21 Total number of seedling and ground-covered species in DDF with and without fire

No.	Species	Growth form*	Number of seedlings (individuals/ha)					
			Fire 1	Fire 2	Average	Without fire 1	Without fire 2	Average
1	<i>Shorea obtusa</i>	S	5,150	6,825	5,988	6,175	6,275	6,225
2	<i>Gluta usitata</i>	S	4,225	1,400	2,813	5,425	3,525	4,475
3	<i>Dipterocarpus tuberculatus</i>	S	2,550	500	1,525	2,375	1,900	2,138
4	<i>Aporosa villosa</i>	S	1,475	2,125	1,800	1,375	2,225	1,800
5	<i>Glochidion velutinum</i>	S	125	0	63	2,675	450	1,563
6	<i>Ochna integerrima</i>	S	1,600	775	1,188	1,725	850	1,288
7	<i>Tephrosia purpurea</i>	S	3,875	1,000	2,438	1,775	525	1,150
8	<i>Antidesma acidum</i>	S	1,575	0	788	1,375	675	1,025
9	<i>Cyathostemma micranthum</i>	S	1,675	1,350	1,513	1,175	625	900
10	<i>Garcinia cowa</i>	S	1,600	0	800	1,325	0	663
11	<i>Leea guineensis</i>	S	550	125	338	975	250	613
12	<i>Ailanthus triphysa</i>	S	900	0	450	575	500	538
13	<i>Catunaregam spathulifolia</i>	S	575	250	413	650	425	538
14	<i>Canarium subulatum</i>	S	650	125	388	650	275	463
15	<i>Strychnos nux-vomica</i>	S	575	175	375	750	0	375
16	<i>Irvingia malayana</i>	S	600	275	438	475	250	363
17	<i>Stereospermum neuranthum</i>	S	50	0	25	575	75	325
18	<i>Carallia brachiata</i>	S	0	2,475	1,238	0	600	300
19	<i>Dipterocarpus obtusifolius</i>	S	75	2,700	1,388	0	550	275
20	<i>Ulmus lancaefolia</i>	S	50	225	138	350	100	225
21	<i>Dillenia obovata</i>	S	325	300	313	250	200	225
22	<i>Phoenix acaulis</i>	S	100	50	75	75	300	188
23	<i>Crotalaria pallida</i>	S	575	0	288	275	75	175
24	<i>Pavetta indica</i>	S	0	0	0	325	0	163
25	<i>Memecylon scutellatum</i>	S	225	0	113	325	0	163
26	<i>Terminalia chebula</i>	S	50	25	38	300	0	150
27	<i>Wendlandia tinctoria</i>	S	125	300	213	125	150	138
28	ພູທະໂປ່ງ	S	0	0	0	275	0	138
29	<i>Terminalia alata</i>	S	200	0	100	125	150	138
30	<i>Mitragyna rotundifolia</i>	S	0	0	0	0	250	125
31	<i>Diospyros ehretioides</i>	S	100	50	75	175	75	125
32	<i>Strychnos minor</i>	S	0	0	0	0	250	125
33	<i>Flacourtia indica</i>	S	0	0	0	225	0	113
34	<i>Goniothalamus laotica</i>	S	100	0	50	200	0	100
35	<i>Dioecrescis erythroclada</i>	S	0	0	0	50	125	88
36	<i>Memecylon plebejum</i>	S	775	0	388	150	0	75
37	<i>Quercus kerrii</i>	S	0	0	0	75	50	63
38	<i>Flemingia lineata</i>	S	225	0	113	50	75	63
39	<i>Anneslea fragrans</i>	S	150	0	75	75	50	63
40	<i>Gardenia obtusifolia</i>	S	0	0	0	25	75	50
41	<i>Azadirachta indica</i>	S	0	0	0	0	100	50
42	<i>Millettia leucantha</i>	S	1,725	0	863	75	0	38
43	<i>Schleichera oleosa</i>	S	0	0	0	0	75	38
44	<i>Ficus scortechinii</i>	S	125	0	63	50	25	38

Table 2-21 (Continued)

No.	Species	Growth form*	Number of seedlings (individuals/ha)					
			Fire 1	Fire 2	Average	Without fire 1	Without fire 2	Average
45	<i>Colona floribunda</i>	S	0	0	0	50	0	25
46	<i>Croton argyratus</i>	S	0	0	0	50	0	25
47	<i>Bridelia retusa</i>	S	25	0	13	50	0	25
48	<i>Phyllanthus emblica</i>	S	50	25	38	50	0	25
49	<i>Diospyros winitii</i>	S	0	0	0	50	0	25
50	<i>Catunaregam tomentosa</i>	S	25	0	13	25	0	13
51	<i>Syzygium oblatum</i>	S	0	0	0	25	0	13
52	<i>Semecarpus albescens</i>	S	25	0	13	25	0	13
53	<i>Dimocarpus longan</i>	S	0	125	63	0	25	13
54	<i>Blumea balsamifera</i>	S	375	0	188	25	0	13
55	เหมือดม่อน	S	50	0	25	0	25	13
56	<i>Albizia odoratissima</i>	S	25	0	13	0	0	0
57	<i>Gardenia obtusifolia</i>	S	0	50	25	0	0	0
58	<i>Gardenia sootepensis</i>	S	125	0	63	0	0	0
59	<i>Pterocarpus macrocarpus</i>	S	200	25	113	0	0	0
60	<i>Roureopsis stenopetala</i>	S	0	275	138	0	0	0
61	<i>Zanthoxylum limonella</i>	S	100	0	50	0	0	0
62	ระเม็ด	S	0	25	13	0	0	0
63	<i>Manilkara littoralis</i>	S	125	75	100	0	0	0
64	<i>Heteropanax fragraus</i>	S	0	25	13	0	0	0
65	<i>Millettia extensa</i>	C	0	0	0	350	1,700	1,025
66	<i>Dalbergia velutina</i>	C	0	0	0	175	0	88
67	<i>Celastrus paniculata</i>	C	0	0	0	0	25	13
68	<i>Imperata cylindrica</i>	H	12,275	0	6,138	4,100	5,825	4,963
69	หญ้าดอกหนาม	H	175	25	100	1,275	50	663
70	<i>Chromolaena odoratum</i>	H	75	0	38	1,225	50	638
71	<i>Cynodon dactylon</i>	H	150	0	75	25	175	100
72	หญ้าอีงวาย	H	0	0	0	175	0	88
73	<i>Xyris tuberosa</i>	H	100	0	50	75	0	38
74	<i>Costus globosus</i>	H	0	0	0	25	0	13
75	หญ้าหัวม้อ	H	775	0	388	0	0	0
Total			47,350	21,700	34,525	41,400	29,975	35,688

Note: * S = seedlings, C = climber, H = herb

Table 2-22 Overall data of plant communities in DDF with and without fire

	With fire			Without fire			
	Plot 1	Plot 2	Total	Plot 1	Plot 2	Total	
1	Number of species	35	29	42	36	36	45
2	Number of genus	31	27	36	32	32	38
3	Number of families	18	18	22	22	22	26
		Plot 1	Plot 2	Average	Plot 1	Plot 2	Average
4	Basal area (m ² /ha)	22.32	19.34	20.83	22.85	23.84	23.34
5	Frequency (%)						
	(1) <i>Dipterocarpus tuberculatus</i>	100	97	-	99	99	-
	(2) <i>Shorea obtusa</i>	89	84	-	60	97	-
	(3) <i>Gluta usitata</i>	85	74	-	73	66	-
	(4) <i>Aporosa villosa</i>	72	84	-	68	84	-
	(5) <i>Canarium subulatum</i>	63	26	-	82	70	-
	(6) <i>Dipterocarpus obtusifolius</i>	2	64	-	-	22	-
6	Dominance (%)						
	(1) <i>Dipterocarpus tuberculatus</i>	52.77	35.93	44.95	63.45	54.03	58.64
	(2) <i>Shorea obtusa</i>	16.9	8.9	13.19	9.75	17.72	13.82
	(3) <i>Gluta usitata</i>	13.45	11.36	12.48	10.22	11.2	10.72
	(4) <i>Aporosa villosa</i>	4.84	6.14	5.45	3.06	5.32	4.21
	(5) <i>Canarium subulatum</i>	4.73	1.92	3.43	5.45	3.59	4.5
	(6) <i>Dipterocarpus obtusifolius</i>	0.43	28.78	13.58	-	4.65	2.38
7	Density (individuals/ha)	1,878	1,775	1,827	1,729	1,888	1,809
	(1) gbh < 50 cm	1,584	1,474	1,529	1,428	1,573	1,501
	(2) gbh 50-100 cm	269	286	277.5	263	277	270
	(3) gbh 100-150 cm	22	15	18.5	33	33	33
	(4) gbh 150-200 cm	3	0	1.5	4	5	4.5
	(5) gbh 200-250 cm	0	0	0	1	0	0.5
8	IVI (%)						
	(1) <i>Dipterocarpus tuberculatus</i>	32.48	25.94	36.44	37.37	33.36	45.15
	(2) <i>Shorea obtusa</i>	16.76	15.26	17.38	9.87	22.67	18.36
	(3) <i>Gluta usitata</i>	12.96	10.7	11.62	9.52	9.56	8.86
	(4) <i>Aporosa villosa</i>	8.5	11.96	9.14	7.07	10.76	7.37
	(5) <i>Canarium subulatum</i>	6.45	2.68	3.53	8.9	7.67	6.47
	(6) <i>Dipterocarpus obtusifolius</i>	0.27	17.26	9.8	-	3.72	1.88
9	Ground coves (individuals/ha)	47,350	21,700	34,525	41,400	29,975	35,688
	9.1 Seedlings	33,800	21,675	27,738	34,500	23,875	29,188
	9.2 Herbs	13,550	25	6,788	6,900	6,100	6,500
10	Shannon-Wiener index of species diversity	3.22	3.02	3.24	3.42	2.77	3.20

2.5 Discussion

The forest fire protection was done for about ten years so that changes of plant communities might be occurred slowly. The stem basal area and number of large trees with gbh over 100 cm. in non-fire DDF were greater than annual fire forest. This might be not the fire effect, but caused by different previously logging. However, it is thought that growths of tree species during ten years may be different that are higher for non-fire forest.

The DDF in this research station is a recovery forest, and still in relative good condition. The tree densities in DDF with and without fire were higher than DDF at Lum Nampong, the northeast of Thailand which had the density of 496 trees/ha and stem basal area of 2.52-15.78 m²/ha, whereas the forests in the north had densities between 410-603 trees/ha and basal area of 10.00-23.87 m²/ha (Klunklin, 2008).

Sukwong (1974) stated that the DDF usually has three vertical structure including upper, middle and lower canopy layers. The stem basal area of middle tree layer is normally higher than the upper and lower tree layers. In undisturbed forest, crown cover is about 70%, and light intensity at the forest floor is about 60-80% of full sun light. The stem size and height are varied with locations. Annual surface fire was common in DDF, and the trees in this forest usually had good ability of sprouting from stump. Thus, the numbers of small size-class trees in DDF with fire were higher than that without fire.

Sukwong (1980) was found that tree growths in annual fire areas were slow down. As with the study of Sutiwanich (1989) found that DDF which was protected from forest fire for four years, the mean annual increment of diameter at breast height was 0.44 cm/year, whereas the value was 0.24 cm/year in DDF with annual fire.

Annually forest fire led to decrease in species richness and densities of trees and seedlings (Sukwong and Dhamanitayakul, 1977; Sutiwanich, 1989). The DDF without fire (46 species) was higher than species richness in DDF with fire (42 species). The density of seedlings in DDF without fire (35,688 individuals/ha) was also higher than DDF with fire (34,525 individuals/ha). However, tree density in DDF with fire (1,827 individuals/ha) was higher than DDF without fire (1,809 individuals/ha) because of the increase in sprouting from stumps in the fire area. Thus, the tree density of small trees (gbh <100 cm) in DDF with fire (1,807 trees/ha) was higher than that in DDF without fire (1,771 trees/ha). Fire protection is therefore important for management in the DDF, and a tool for changing phonologies of tree species to the more favorable conditions (Kafle, 1996).