

## CHAPTER 3

### Carbon and Nutrient Allocation in Tree Biomass of Fire and Non-fire Dry Dipterocarp Forest

#### Abstract

Biomass and stored carbon-nutrients of tree species in the fire and non-fire dry dipterocarp forests (DDF) were investigated. The biomass allocation was calculated using allometric equations of some researchers; above-ground biomass by Ogino *et al.* (1967), root biomass by Ogawa *et al.* (1965) and carbon stocks by Tsutsumi *et al.* (1983).

Total tree biomass in DDF with annual fire was 106.6 Mg.ha<sup>-1</sup>, separated into stem, branch, leaf, and root components of 68.6, 22.9, 1.9 and 13.1 Mg.ha<sup>-1</sup>, respectively. The biomass carbon was calculated as 52.6 Mg.ha<sup>-1</sup> including amounts in stem, branch, leaf, and root of 34.3, 11.1, 0.9 and 6.3 Mg.ha<sup>-1</sup>, respectively.

The total tree biomass in non-fire DDF was higher than DDF with annual fire, 128.3 Mg.ha<sup>-1</sup>. The amounts allocated in stem, branch, leaf, and root were in the order of 82.1, 29.3, 2.0 and 15.0 Mg.ha<sup>-1</sup>, respectively. The stored carbon in biomass was 63.4 Mg.ha<sup>-1</sup> which accumulated in stem, branch, leaf, and root for 41.0, 14.2, 1.0 and 7.2 Mg.ha<sup>-1</sup>, respectively. The tree growths are thought to be reduced in DDF with annual fire. As a result, biomass and carbon storage in DDF without fire were higher than DDF with annual fire. Thus, forest fire control could be increased carbon stocks in DDF.

#### 3.1 Introduction

Carbon is important as the basis for the food and fiber that sustain and shelter human populations, as the primary energy source that fuels economies, and as a major contributor to the planetary greenhouse effect and potential climate change. Since 1750, CO<sub>2</sub> concentrations in the atmosphere have increased by 30% and CH<sub>4</sub> concentrations in the atmosphere have increased by 150% (IPCC, 2001).

The forests absorb carbon dioxide and converts to organic compounds of carbohydrate which are accumulated in various parts of the plant. This process is very effective in reducing carbon dioxide in the atmosphere. Increasing the amount of carbon sequestered is directly related to the increase in forest biomass (Creedy and Wurzbacher, 2001). The carbon accumulations can be very effective in the young stage and will be reduced in the older stage (Ciesla, 1995). Different forest types have variable potentials of carbon storages in biomass. Aboveground biomass carbon stocks at Kaeng Krachan National Park, Petchaburi province in evergreen, mixed deciduous and dry evergreen forests were in the order of 129, 93.2 and 37.1 Mg.ha<sup>-1</sup>. However, forest condition is an important factor (Champanil, 2004).

The objectives of this study were carried out plant biomass and nutrient accumulations in dry dipterocarp forest with and without fire at Intakin Silvicultural Research Station.

## 3.2 Materials and Methods

### 3.2.1 Vegetation Sampling

Two sampling plots (replications) of one hectare (100 x 100 m<sup>2</sup>, dividing into 100, 10 x 10 m<sup>2</sup> subplots) were used to study plant biomass and nutrient accumulations in fire and non-fire dry dipterocarp forests. All trees with height  $\geq 1.5$  m are measured for stem girth at breast height (gbh) and tree height. The data are calculated for biomass and nutrient accumulation including, carbon, nitrogen, phosphorus, potassium, calcium and magnesium.

### 3.2.2 Calculation of Plant Biomass and Nutrient Accumulation

The aboveground biomass of tree species including, stem, branch and leaf in DDF with and without fire were obtained using the allometric equation of Ogino *et al.* (1967).

$$W_S = 189 (D^2H)^{0.902}$$

$$W_B = 0.125 W_S^{1.204}$$

$$1/W_L = (11.4/W_S^{0.9}) + 0.172$$

Where,  $W_S$  = biomass of stem (kg)  
 $W_B$  = biomass of branch (kg)  
 $W_L$  = biomass of leaf (kg)  
 $W_R$  = biomass of root (kg)  
 D = diameter (cm)  
 H = height (m)

Root biomass was obtained using the allometric equation of Ogawa *et al.* (1965).

$$W_R = 0.0313 (D^2H)^{0.805}$$

Where,  $W_R$  = biomass of root (kg)  
 D = diameter (cm)  
 H = height (m)

Nutrient contents in various organs of tree species followed the data of Tsutsumi *et al.* (1983). The mean carbon contents in stem, branch, leaf and root were reported as 49.9, 48.7, 48.3 and 48.2%; nitrogen as 0.53, 0.53, 1.59 and 0.53%; phosphorus as 0.08, 0.10, 0.13 and 0.02%; potassium as 0.37, 0.40, 1.10 and 0.27%; calcium as 0.76, 0.80, 1.50 and 0.88%; and magnesium as 0.17, 0.20, 0.90 and 0.10%, respectively.

### 3.3 Results

#### 3.3.1 Tree Biomass in Fire and Non-fire DDF

Biomass of tree species in fire and non-fire DDF was estimated by using equations of Ogino *et al.* (1967) and Ogawa *et al.* (1965).

##### DDF with Annual Fire:

The total biomass of 42 plant species in DDF with annual fire was 106.6 Mg.ha<sup>-1</sup>. The amount was separated to be stem, branch, leaf and root components of 68.6, 22.9, 1.9 and 13.1 Mg.ha<sup>-1</sup>, respectively. The dominant species, *Dipterocarpus tuberculatus* had the highest biomass storage, 51.7% of the total (55.1 Mg.ha<sup>-1</sup>). They were followed by *Shorea obtusa* (16.2 Mg.ha<sup>-1</sup>), *Gluta usitata* (11.7 Mg.ha<sup>-1</sup>), *Canarium subulatum* (11.2 Mg.ha<sup>-1</sup>), *D. obtusifolius* (3.2 Mg.ha<sup>-1</sup>), and *Aporosa villosa* (3.2 Mg.ha<sup>-1</sup>) (Table 3-1).

##### DDF without Fire:

The total biomass of 45 plant species in DDF without fire was higher than DDF with fire, 128.3 Mg.ha<sup>-1</sup>, and divided into stem, branch, leaf and root biomass of 82.1, 29.3, 2.0 and 15.0 Mg.ha<sup>-1</sup>, respectively. *D. tuberculatus* was also the dominant tree species having the highest biomass, 67.4% (86.5 Mg.ha<sup>-1</sup>). They were followed by *Shorea obtusa* (14.2 Mg.ha<sup>-1</sup>), *Gluta usitata* (12.0 Mg.ha<sup>-1</sup>), *Canarium subulatum* (4.4 Mg.ha<sup>-1</sup>), *D. obtusifolius* (3.4 Mg.ha<sup>-1</sup>), and *Aporosa villosa* (2.6 Mg.ha<sup>-1</sup>). (Table 3-2 and Figure 3-1).

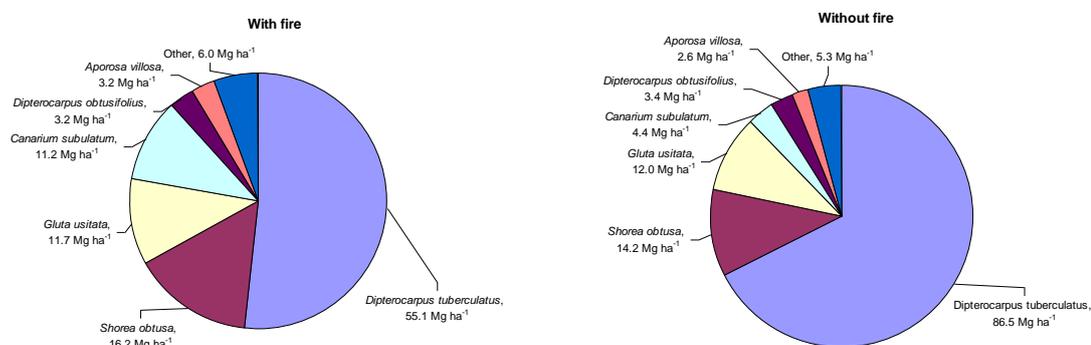


Figure 3-1 Biomass of tree species in DDF with and without fire

#### 3.3.2 Stored Carbon-Nutrients in Fire and Non-fire DDF

##### DDF with Annual Fire:

The stored carbon amount in 42 plant biomass in DDF with annual fire was calculated as 52.6 Mg.ha<sup>-1</sup>, divided into stem, branch, leaf and root components of 34.3, 11.1, 0.9 and 6.3 Mg.ha<sup>-1</sup>. *D. tuberculatus* had the highest biomass carbon (27.2 Mg.ha<sup>-1</sup>), and followed by *Shorea obtusa* (8.0 Mg.ha<sup>-1</sup>), *Gluta usitata* (5.8 Mg.ha<sup>-1</sup>),

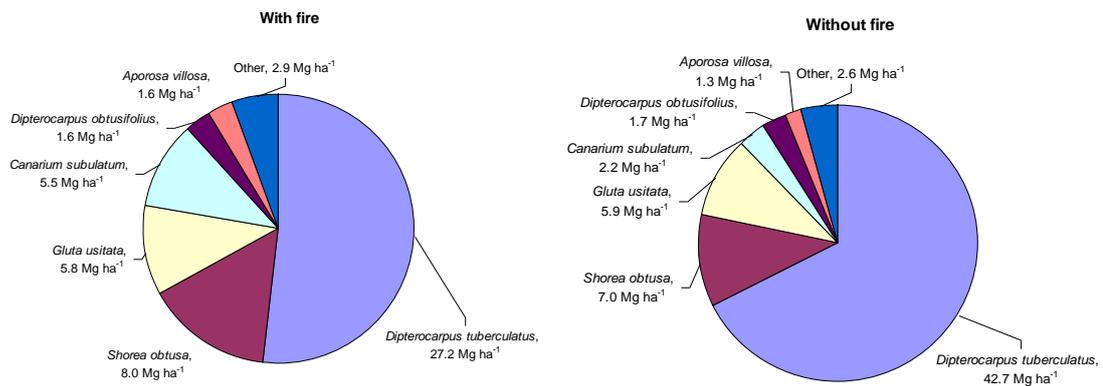
*Canarium subulatum* ( $5.5 \text{ Mg}\cdot\text{ha}^{-1}$ ), *D. obtusifolius* ( $1.6 \text{ Mg}\cdot\text{ha}^{-1}$ ), and *Aporosa villosa* ( $1.6 \text{ Mg}\cdot\text{ha}^{-1}$ ) (Table 3-3).

Stored nutrients in tree biomass in DDF with annual fire were different for each nutrient: nitrogen;  $585.39 \text{ kg}\cdot\text{ha}^{-1}$ , phosphorus;  $82.95 \text{ kg}\cdot\text{ha}^{-1}$ , potassium;  $402.26 \text{ kg}\cdot\text{ha}^{-1}$ , calcium;  $849.09 \text{ kg}\cdot\text{ha}^{-1}$  and magnesium;  $193.08 \text{ kg}\cdot\text{ha}^{-1}$  (Table 3-4 to 3-8).

#### DDF without Fire:

The biomass carbon amount in DDF without fire was  $63.4 \text{ Mg}\cdot\text{ha}^{-1}$ , divided into stem, branch, leaf and root components of  $41.0$ ,  $14.2$ ,  $1.0$  and  $7.2 \text{ Mg}\cdot\text{ha}^{-1}$ , respectively. *D. tuberculatus* had the highest biomass carbon ( $42.7 \text{ Mg}\cdot\text{ha}^{-1}$ ), and followed by *Shorea obtusa* ( $7.0 \text{ Mg}\cdot\text{ha}^{-1}$ ), *Gluta usitata* ( $5.9 \text{ Mg}\cdot\text{ha}^{-1}$ ), *Canarium subulatum* ( $2.2 \text{ Mg}\cdot\text{ha}^{-1}$ ), *D. obtusifolius* ( $1.7 \text{ Mg}\cdot\text{ha}^{-1}$ ), and *Aporosa villosa* ( $1.3 \text{ Mg}\cdot\text{ha}^{-1}$ ) (Table 3-9 and Figure 3-2).

The amounts of stored nutrients of tree biomass in DDF without fire were different for each nutrient: nitrogen;  $896.62 \text{ kg}\cdot\text{ha}^{-1}$ , phosphorus;  $123.45 \text{ kg}\cdot\text{ha}^{-1}$ , potassium;  $610.75 \text{ kg}\cdot\text{ha}^{-1}$ , calcium;  $1,301.62 \text{ kg}\cdot\text{ha}^{-1}$  and magnesium;  $292.68 \text{ kg}\cdot\text{ha}^{-1}$  (Table 3-10 to 3-14).



**Figure 3-2** Biomass carbon stocks in DDF with and without fire

**Table 3-1** Biomass of tree species in DDF with annual fire

Plot	No	Species	Biomass (Mg.ha <sup>-1</sup> )				
			Stem	Branch	Leaf	Root	Total
1	1	<i>Dipterocarpus tuberculatus</i>	46.8563	16.9472	1.0327	8.3268	73.1630
	2	<i>Shorea obtusa</i>	11.4773	3.9454	0.3451	2.2064	17.9742
	3	<i>Gluta usitata</i>	8.8042	2.6199	0.3143	1.7971	13.5355
	4	<i>Canarium subulatum</i>	3.1537	0.9024	0.1186	0.6550	4.8298
	5	<i>Aporosa villosa</i>	2.0684	0.4853	0.1077	0.4960	3.1574
	6	<i>Millettia leucantha</i>	0.8499	0.2481	0.0310	0.1751	1.3041
	7	<i>Strychnos nux-vomica</i>	0.6507	0.1990	0.0215	0.1298	1.0011
	8	<i>Irvingia malayanann.</i>	0.6544	0.1633	0.0316	0.1532	1.0025
	9	<i>Dipterocarpus obtusifolius</i>	0.3238	0.1142	0.0069	0.0573	0.5022
	10	<i>Terminalia alata</i>	0.3078	0.0843	0.0125	0.0659	0.4706
	11	<i>Wendlandia tinctoria</i>	0.1881	0.0362	0.0123	0.0530	0.2895
	12	<i>Memecylon scutellatum</i>	0.1654	0.0416	0.0078	0.0372	0.2520
	13	<i>Anneslea fragrans</i>	0.1484	0.0377	0.0069	0.0336	0.2266
	14	<i>Garcinia cowa</i>	0.1345	0.0365	0.0056	0.0292	0.2058
	15	<i>Catunaregam tomentosa</i>	0.1157	0.0282	0.0057	0.0267	0.1763
	16	<i>Catunaregam spathulifolia</i>	0.1088	0.0233	0.0063	0.0281	0.1665
	17	<i>Stereospermum colais</i>	0.1021	0.0253	0.0049	0.0232	0.1555
	18	<i>Bridelia pierrei</i>	0.0987	0.0225	0.0053	0.0240	0.1505
	19	<i>Terminalia chebula</i>	0.0953	0.0221	0.0050	0.0231	0.1455
	20	<i>Diospyros ehretioides</i>	0.0878	0.0241	0.0035	0.0185	0.1340
	21	<i>Memecylon plebejum</i>	0.0677	0.0143	0.0040	0.0173	0.1033
	22	<i>Dimocarpus longan</i>	0.0673	0.0197	0.0024	0.0136	0.1030
	23	<i>Dillenia oborata</i>	0.0649	0.0153	0.0034	0.0153	0.0989
	24	<i>Semecarpus albescens</i>	0.0541	0.0120	0.0030	0.0134	0.0825
	25	<i>Dioecrescis erythroclada</i>	0.0500	0.0098	0.0032	0.0136	0.0765
	26	<i>Manilkara littoralis</i>	0.0358	0.0049	0.0029	0.0123	0.0558
	27	<i>Ulmus lancaefolia</i>	0.0163	0.0034	0.0010	0.0042	0.0249
	28	<i>Gardenia sootepensis</i>	0.0115	0.0022	0.0007	0.0031	0.0177
	29	<i>Schleichera oleosa</i>	0.0073	0.0014	0.0005	0.0020	0.0111
	30	<i>Millettia extensa</i>	0.0063	0.0011	0.0004	0.0018	0.0096
	31	<i>Dalbergia velutina</i>	0.0048	0.0008	0.0003	0.0014	0.0074
	33	<i>Albizia odoratissima</i>	0.0021	0.0003	0.0002	0.0007	0.0033
	32	<i>Pterocarpus macrocarpus</i>	0.0021	0.0002	0.0002	0.0008	0.0033
	34	<i>Colona floribunda</i>	0.0020	0.0003	0.0002	0.0006	0.0030
	35	<i>Phyllanthus emblica</i>	0.0004	0.0000	0.0000	0.0002	0.0006
Total			76.78	26.09	2.11	14.46	119.44

**Table 3-1** (Continued)

Plot	No	Species	Biomass (Mg.ha <sup>-1</sup> )				
			Stem	Branch	Leaf	Root	Total
2	1	<i>Dipterocarpus tuberculatus</i>	23.9287	7.9223	0.6598	4.5217	37.0325
	2	<i>Dipterocarpus obtusifolius</i>	20.4497	7.3817	0.4403	3.6179	31.8897
	3	<i>Gluta usitata</i>	5.7493	1.7605	0.1936	1.1518	8.8552
	4	<i>Shorea obtusa</i>	3.5479	0.8385	0.1847	0.8586	5.4297
	5	<i>Aporosa villosa</i>	2.1404	0.4558	0.1251	0.5470	3.2684
	6	<i>Millettia leucantha</i>	1.1903	0.3877	0.0333	0.2254	1.8367
	7	<i>Irvingia malayana</i>	1.0467	0.2992	0.0407	0.2212	1.6078
	8	<i>Canarium subulatum</i>	1.0051	0.2952	0.0362	0.2062	1.5427
	9	<i>Strychnos nux-vomica</i>	0.3166	0.0619	0.0202	0.0859	0.4845
	10	<i>Xylia xylocarpa</i>	0.1787	0.0560	0.0053	0.0343	0.2744
	11	<i>Wendlandia tinctoria</i>	0.1575	0.0337	0.0092	0.0406	0.2410
	12	<i>Quercus kerrii</i>	0.1508	0.0438	0.0054	0.0307	0.2307
	13	<i>Carallia brachiata</i>	0.1182	0.0264	0.0065	0.0293	0.1804
	14	<i>Shorea siamensis</i>	0.1130	0.0280	0.0054	0.0261	0.1725
	15	<i>Dillenia obovata</i>	0.0730	0.0187	0.0033	0.0163	0.1113
	16	<i>Manilkara littoralis</i>	0.0667	0.0110	0.0049	0.0203	0.1028
	17	<i>Pterocarpus macrocarpus</i>	0.0669	0.0197	0.0023	0.0134	0.1023
	18	<i>Stereospermum colais</i>	0.0571	0.0132	0.0030	0.0136	0.0870
	19	<i>Catunaregam spathulifolia</i>	0.0348	0.0076	0.0020	0.0088	0.0533
	20	<i>Syzygium oblatum</i>	0.0334	0.0085	0.0015	0.0074	0.0509
	21	<i>Gardenia obtusifolia</i>	0.0277	0.0061	0.0016	0.0069	0.0422
	22	<i>Vitex pinnata</i>	0.0124	0.0026	0.0007	0.0032	0.0189
	23	<i>Dioecrescis erythroclada</i>	0.0079	0.0015	0.0005	0.0021	0.0120
	24	<i>Dimocarpus longan</i>	0.0076	0.0014	0.0005	0.0021	0.0116
	25	<i>Ulmus lancaefolia</i>	0.0068	0.0011	0.0005	0.0021	0.0105
	26	<i>Millettia extensa</i>	0.0067	0.0011	0.0005	0.0021	0.0104
	27	<i>Anneslea fragrans</i>	0.0061	0.0011	0.0004	0.0017	0.0094
	28	<i>Diospyros ehretioides</i>	0.0003	0.0000	0.0000	0.0001	0.0005
	29	<i>Albizia odoratissima</i>	0.0002	0.0000	0.0000	0.0001	0.0003
Total			60.50	19.68	1.79	11.70	93.67

Table 3-1 (Continued)

Plot	No	Species	Biomass (Mg.ha <sup>-1</sup> )				
			Stem	Branch	Leaf	Root	Total
1+2 (Total)	1	<i>Dipterocarpus tuberculatus</i>	35.3925	12.4348	0.8462	6.4242	55.0978
	2	<i>Dipterocarpus obtusifolius</i>	10.3867	3.7480	0.2236	1.8376	16.1959
	3	<i>Shorea obtusa</i>	7.5126	2.3920	0.2649	1.5325	11.7019
	4	<i>Gluta usitata</i>	7.2767	2.1902	0.2540	1.4744	11.1953
	5	<i>Aporosa villosa</i>	2.1044	0.4706	0.1164	0.5215	3.2129
	6	<i>Canarium subulatum</i>	2.0794	0.5988	0.0774	0.4306	3.1863
	7	<i>Millettia leucantha</i>	1.0201	0.3179	0.0322	0.2002	1.5704
	8	<i>Irvingia malayana</i>	0.8487	0.2491	0.0311	0.1755	1.3044
	9	<i>Strychnos nux-vomica</i>	0.4855	0.1126	0.0259	0.1195	0.7435
	10	<i>Wendlandia tinctoria</i>	0.1728	0.0349	0.0107	0.0468	0.2652
	11	<i>Terminalia alata</i>	0.1539	0.0422	0.0063	0.0330	0.2353
	12	<i>Xylia xylocarpa</i>	0.0893	0.0280	0.0027	0.0172	0.1372
	13	<i>Memecylon scutellatum</i>	0.0827	0.0208	0.0039	0.0186	0.1260
	14	<i>Stereospermum neuranthum</i>	0.0796	0.0192	0.0040	0.0184	0.1212
	15	<i>Anneslea fragrans</i>	0.0772	0.0194	0.0036	0.0177	0.1180
	16	<i>Quercus kerrii</i>	0.0754	0.0219	0.0027	0.0154	0.1154
	17	<i>Catunaregam spathulifolia</i>	0.0718	0.0155	0.0042	0.0184	0.1099
	18	<i>Dillenia oborata</i>	0.0689	0.0170	0.0033	0.0158	0.1051
	19	<i>Garcinia cowa</i>	0.0673	0.0182	0.0028	0.0146	0.1029
	20	<i>Carallia brachiata</i>	0.0591	0.0132	0.0033	0.0146	0.0902
	21	<i>Catunaregam tomentosa</i>	0.0578	0.0141	0.0028	0.0133	0.0881
	22	<i>Shorea siamensis</i>	0.0565	0.0140	0.0027	0.0130	0.0863
	23	<i>Manilkara littoralis</i>	0.0512	0.0079	0.0039	0.0163	0.0793
	24	<i>Bridelia pierrei</i>	0.0493	0.0113	0.0027	0.0120	0.0752
	25	<i>Terminalia chebula</i>	0.0476	0.0110	0.0025	0.0116	0.0728
	26	<i>Diospyros ehretioides</i>	0.0441	0.0121	0.0018	0.0093	0.0673
	27	<i>Dimocarpus longan</i>	0.0375	0.0106	0.0014	0.0078	0.0573
	28	<i>Memecylon plebejum</i>	0.0339	0.0071	0.0020	0.0087	0.0517
	29	<i>Pterocarpus macrocarpus</i>	0.0345	0.0100	0.0012	0.0071	0.0528
	30	<i>Dioecrescis erythroclada</i>	0.0289	0.0056	0.0018	0.0078	0.0442
	31	<i>Semecarpus albescens</i>	0.0270	0.0060	0.0015	0.0067	0.0413
	32	<i>Syzygium oblatum</i>	0.0167	0.0043	0.0008	0.0037	0.0254
	33	<i>Gardenia obtusifolia</i>	0.0138	0.0030	0.0008	0.0035	0.0211
	34	<i>Ulmus lancaefolia</i>	0.0116	0.0023	0.0007	0.0031	0.0177
	35	<i>Millettia extensa</i>	0.0065	0.0011	0.0005	0.0019	0.0100
	36	<i>Vitex pinnata</i>	0.0062	0.0013	0.0004	0.0016	0.0095
	37	<i>Gardenia sootepensis</i>	0.0058	0.0011	0.0004	0.0016	0.0088
	38	<i>Schleichera oleosa</i>	0.0036	0.0007	0.0002	0.0010	0.0056
	39	<i>Dalbergia velutina</i>	0.0024	0.0004	0.0002	0.0007	0.0037
	40	<i>Albizia odoratissima</i>	0.0011	0.0001	0.0001	0.0004	0.0018
	41	<i>Colona floribunda</i>	0.0010	0.0001	0.0001	0.0003	0.0015
	42	<i>Phyllanthus emblica</i>	0.0002	0.0000	0.0000	0.0001	0.0003
Total			68.64	22.89	1.95	13.08	106.56

**Table 3-2** Biomass of tree species in DDF without fire

Plot	No	Species	Biomass (Mg.ha <sup>-1</sup> )				
			Stem	Branch	Leaf	Root	Total
1	1	<i>Dipterocarpus tuberculatus</i>	59.6041	22.3654	1.1797	10.3174	93.4666
	2	<i>Gluta usitata</i>	7.2038	2.4766	0.1857	1.3338	11.2000
	3	<i>Shorea obtusa</i>	6.9837	2.8681	0.1474	1.2050	11.2042
	4	<i>Canarium subulatum</i>	3.6395	1.0293	0.1424	0.7710	5.5823
	5	<i>Irvingia malayana</i>	1.2969	0.4314	0.0371	0.2492	2.0147
	6	<i>Aporosa villosa</i>	1.2495	0.2756	0.0702	0.3117	1.9070
	7	<i>Millettia leucantha</i>	0.7477	0.1886	0.0352	0.1713	1.1428
	8	<i>Garcinia cowa</i>	0.5139	0.1701	0.0137	0.0963	0.7940
	9	<i>Semecarpus albescens</i>	0.4286	0.1048	0.0211	0.1000	0.6546
	10	<i>Strychnos nux-vomica</i>	0.3800	0.0731	0.0246	0.1042	0.5819
	11	<i>Anneslea fragrans</i>	0.2968	0.0834	0.0115	0.0624	0.4542
	12	<i>Terminalia chebula</i>	0.2054	0.0506	0.0100	0.0476	0.3135
	13	<i>Terminalia alata</i>	0.1865	0.0482	0.0085	0.0428	0.2860
	14	<i>Flacourtia indica</i>	0.1789	0.0436	0.0088	0.0417	0.2729
	15	<i>Quercus kerrii</i>	0.1132	0.0290	0.0051	0.0251	0.1725
	16	<i>Dioecrescis erythroclada</i>	0.0948	0.0222	0.0049	0.0226	0.1446
	17	<i>Wendlandia tinctoria</i>	0.0886	0.0157	0.0062	0.0267	0.1372
	18	<i>Stereospermum colais</i>	0.0862	0.0190	0.0048	0.0214	0.1315
	19	<i>Bridelia pierrei</i>	0.0488	0.0085	0.0034	0.0144	0.0751
	20	<i>Glochidion velutinum</i>	0.0281	0.0061	0.0016	0.0072	0.0430
	21	<i>Memecylon plebejum</i>	0.0254	0.0059	0.0013	0.0061	0.0387
	22	<i>Diospyros ehretioides</i>	0.0222	0.0051	0.0012	0.0053	0.0338
	23	<i>Colona floribunda</i>	0.0202	0.0028	0.0016	0.0068	0.0315
	24	<i>Lagerstroemia macrocarpa</i>	0.0166	0.0031	0.0011	0.0047	0.0254
	25	<i>Albizia odoratissima</i>	0.0164	0.0029	0.0011	0.0048	0.0252
	26	<i>Catunaregam spathulifolia</i>	0.0142	0.0021	0.0011	0.0048	0.0222
	27	<i>Dalbergia cochinchinensis</i>	0.0094	0.0016	0.0007	0.0027	0.0144
	28	<i>Pterocarpus macrocarpus</i>	0.0064	0.0012	0.0004	0.0018	0.0098
	29	<i>Shorea siamensis</i>	0.0040	0.0005	0.0003	0.0014	0.0062
	30	<i>Lagerstroemia speciosa</i>	0.0027	0.0003	0.0002	0.0010	0.0042
	31	<i>Dalbergia dongnaiensis</i>	0.0023	0.0003	0.0002	0.0008	0.0036
	32	<i>Ulmus lancaefolia</i>	0.0020	0.0003	0.0002	0.0007	0.0031
	33	<i>Dillenia oborata</i>	0.0019	0.0002	0.0002	0.0007	0.0031
	34	<i>Manilkara littoralis</i>	0.0015	0.0002	0.0001	0.0005	0.0024
	35	<i>Antidesma acidum</i>	0.0012	0.0001	0.0001	0.0005	0.0019
	36	<i>Syzygium oblatum</i>	0.0005	0.0001	0.0000	0.0002	0.0009
Total			83.52	30.34	1.93	15.01	131

Table 3-2 (Continued)

Plot	No	Species	Biomass (Mg.ha <sup>-1</sup> )				
			Stem	Branch	Leaf	Root	Total
2	1	<i>Dipterocarpus tuberculatus</i>	50.8576	18.6009	1.0672	8.9381	79.4637
	2	<i>Shorea obtusa</i>	11.0381	3.4065	0.4186	2.3147	17.1780
	3	<i>Gluta usitata</i>	8.1618	3.0134	0.1765	1.4395	12.7912
	4	<i>Dipterocarpus obtusifolius</i>	4.3345	1.6700	0.0805	0.7396	6.8246
	5	<i>Aporosa villosa</i>	2.1741	0.4739	0.1238	0.5446	3.3164
	6	<i>Canarium subulatum</i>	2.0614	0.5152	0.0983	0.4722	3.1471
	7	<i>Millettia leucantha</i>	0.5189	0.1454	0.0206	0.1112	0.7960
	8	<i>Irvingia malayana</i>	0.4603	0.1215	0.0200	0.1010	0.7028
	9	<i>Strychnos nux-vomica</i>	0.3191	0.0651	0.0195	0.0842	0.4879
	10	<i>Dioecrescis erythroclada</i>	0.0998	0.0247	0.0048	0.0227	0.1520
	11	<i>Terminalia chebula</i>	0.0927	0.0224	0.0046	0.0217	0.1415
	12	<i>Mitragyna rotundifolia</i>	0.0780	0.0188	0.0039	0.0180	0.1187
	13	<i>Dillenia oborata</i>	0.0751	0.0183	0.0037	0.0174	0.1145
	14	<i>Schleichera oleosa</i>	0.0563	0.0116	0.0034	0.0146	0.0859
	15	<i>Terminalia alata</i>	0.0537	0.0149	0.0021	0.0114	0.0821
	16	<i>Wendlandia tinctoria</i>	0.0521	0.0121	0.0028	0.0128	0.0798
	17	<i>Quercus kerrii</i>	0.0393	0.0092	0.0021	0.0093	0.0598
	18	<i>Stereospermum colais</i>	0.0342	0.0088	0.0015	0.0075	0.0520
	19	<i>Catunaregam tomentosa</i>	0.0267	0.0065	0.0013	0.0061	0.0406
	20	<i>Shorea siamensis</i>	0.0241	0.0042	0.0017	0.0070	0.0371
	21	<i>Bridelia pierrei</i>	0.0170	0.0036	0.0010	0.0043	0.0259
	22	<i>Carallia brachiata</i>	0.0157	0.0031	0.0010	0.0042	0.0240
	23	<i>Catunaregam spathulifolia</i>	0.0097	0.0018	0.0006	0.0027	0.0149
	24	<i>Dalbergia oliveri</i>	0.0097	0.0017	0.0007	0.0028	0.0149
	25	<i>Flacourtia indica</i>	0.0066	0.0012	0.0004	0.0018	0.0101
	26	<i>Anneslea fragrans</i>	0.0032	0.0005	0.0002	0.0010	0.0049
	27	<i>Dalbergia cana</i>	0.0026	0.0004	0.0002	0.0008	0.0040
	28	<i>Colona floribunda</i>	0.0025	0.0003	0.0002	0.0009	0.0040
	29	<i>Syzygium oblatum</i>	0.0017	0.0002	0.0001	0.0006	0.0027
	30	<i>Albizia odoratissima</i>	0.0017	0.0002	0.0001	0.0006	0.0026
	31	<i>Ulmus lancaefolia</i>	0.0012	0.0001	0.0001	0.0005	0.0019
	32	<i>Heteropanax fragraus</i>	0.0010	0.0001	0.0001	0.0004	0.0016
	33	<i>Lagerstroemia macrocarpa</i>	0.0006	0.0001	0.0001	0.0003	0.0010
	34	<i>Pterocarpus macrocarpus</i>	0.0005	0.0001	0.0000	0.0002	0.0008
	35	<i>Phyllanthus emblica</i>	0.0004	0.0000	0.0000	0.0002	0.0006
	36	<i>Alangium chinense</i>	0.0003	0.0000	0.0000	0.0001	0.0006
		Total	80.63	28.18	2.06	14.91	125.79

Table 3-2 (Continued)

Plot	No	Species	Biomass (Mg.ha <sup>-1</sup> )				
			Stem	Branch	Leaf	Root	Total
1+2 (Total)	1	<i>Dipterocarpus tuberculatus</i>	55.2308	20.4831	1.1234	9.6277	86.4651
	2	<i>Shorea obtusa</i>	9.0109	3.1373	0.2830	1.7599	14.1911
	3	<i>Gluta usitata</i>	7.6828	2.7450	0.1811	1.3866	11.9956
	4	<i>Canarium subulatum</i>	2.8504	0.7722	0.1203	0.6216	4.3647
	5	<i>Dipterocarpus obtusifolius</i>	2.1672	0.8350	0.0402	0.3698	3.4123
	6	<i>Aporosa villosa</i>	1.7118	0.3747	0.0970	0.4282	2.6117
	7	<i>Irvingia malayana</i>	0.8786	0.2765	0.0286	0.1751	1.3587
	8	<i>Millettia leucantha</i>	0.6333	0.1670	0.0279	0.1412	0.9694
	9	<i>Strychnos nux-vomica</i>	0.3495	0.0691	0.0220	0.0942	0.5349
	10	<i>Garcinia cowa</i>	0.2569	0.0850	0.0069	0.0482	0.3970
	11	<i>Semecarpus albescens</i>	0.2143	0.0524	0.0106	0.0500	0.3273
	12	<i>Anneslea fragrans</i>	0.1500	0.0420	0.0059	0.0317	0.2296
	13	<i>Terminalia chebula</i>	0.1490	0.0365	0.0073	0.0347	0.2275
	14	<i>Terminalia alata</i>	0.1201	0.0315	0.0053	0.0271	0.1841
	15	<i>Dioecrescis erythroclada</i>	0.0973	0.0235	0.0049	0.0227	0.1483
	16	<i>Flacourtia indica</i>	0.0927	0.0224	0.0046	0.0217	0.1415
	17	<i>Quercus kerrii</i>	0.0763	0.0191	0.0036	0.0172	0.1161
	18	<i>Wendlandia tinctoria</i>	0.0703	0.0139	0.0045	0.0197	0.1085
	19	<i>Stereospermum neuranthum</i>	0.0602	0.0139	0.0032	0.0145	0.0918
	20	<i>Mitragyna rotundifolia</i>	0.0390	0.0094	0.0020	0.0090	0.0593
	21	<i>Dillenia oborata</i>	0.0385	0.0093	0.0019	0.0091	0.0588
	22	<i>Bridelia pierrei</i>	0.0329	0.0061	0.0022	0.0093	0.0505
	23	<i>Schleichera oleosa</i>	0.0281	0.0058	0.0017	0.0073	0.0429
	24	<i>Glochidion velutinum</i>	0.0140	0.0030	0.0008	0.0036	0.0215
	25	<i>Shorea siamensis</i>	0.0140	0.0024	0.0010	0.0042	0.0216
	26	<i>Catunaregam tomentosa</i>	0.0133	0.0033	0.0007	0.0030	0.0203
	27	<i>Memecylon plebejum</i>	0.0127	0.0029	0.0007	0.0031	0.0193
	28	<i>Catunaregam spathulifolia</i>	0.0120	0.0020	0.0009	0.0037	0.0185
	29	<i>Diospyros ehretioides</i>	0.0111	0.0026	0.0006	0.0026	0.0169
	30	<i>Colona floribunda</i>	0.0114	0.0016	0.0009	0.0039	0.0178
	31	<i>Albizia odoratissima</i>	0.0090	0.0015	0.0006	0.0027	0.0139
	32	<i>Lagerstroemia macrocarpa</i>	0.0086	0.0016	0.0006	0.0025	0.0132
	33	<i>Carallia brachiata</i>	0.0079	0.0016	0.0005	0.0021	0.0120
	34	<i>Dalbergia oliveri</i>	0.0060	0.0010	0.0004	0.0018	0.0093
	35	<i>Dalbergia cochinchinensis</i>	0.0047	0.0008	0.0003	0.0014	0.0072
	36	<i>Pterocarpus macrocarpus</i>	0.0034	0.0006	0.0002	0.0010	0.0053
	37	<i>Ulmus lancaefolia</i>	0.0016	0.0002	0.0001	0.0006	0.0025
	38	<i>Lagerstroemia speciosa</i>	0.0013	0.0002	0.0001	0.0005	0.0021
	39	<i>Dalbergia cana</i>	0.0013	0.0002	0.0001	0.0004	0.0020
	40	<i>Syzygium oblatum</i>	0.0011	0.0002	0.0001	0.0004	0.0018
	41	<i>Manilkara littoralis</i>	0.0008	0.0001	0.0001	0.0003	0.0012
	42	<i>Antidesma acidum</i>	0.0006	0.0001	0.0001	0.0002	0.0010
	43	<i>Heteropanax fragraus</i>	0.0005	0.0001	0.0000	0.0002	0.0008
	44	<i>Phyllanthus emblica</i>	0.0002	0.0000	0.0000	0.0001	0.0003
	45	<i>Alangium chinense</i>	0.0002	0.0000	0.0000	0.0001	0.0003
Total			82.08	29.26	2.00	14.96	128.30

**Table 3-3** Biomass carbon amounts of tree species in DDF with annual fire

Plot	No	Species	Carbon (Mg.ha <sup>-1</sup> )				
			Stem	Branch	Leaf	Root	Total
1	1	<i>Dipterocarpus tuberculatus</i>	23.3813	8.2533	0.4988	4.0135	36.1469
	2	<i>Shorea obtusa</i>	5.7272	1.9214	0.1667	1.0635	8.8788
	3	<i>Gluta usitata</i>	4.3933	1.2759	0.1518	0.8662	6.6872
	4	<i>Canarium subulatum</i>	1.5737	0.4395	0.0573	0.3157	2.3862
	5	<i>Aporosa villosa</i>	1.0321	0.2364	0.0520	0.2391	1.5596
	6	<i>Millettia leucantha</i>	0.4241	0.1208	0.0150	0.0844	0.6443
	7	<i>Strychnos nux-vomica</i>	0.3265	0.0795	0.0152	0.0738	0.4952
	8	<i>Irvingia malayanann.</i>	0.3247	0.0969	0.0104	0.0626	0.4946
	9	<i>Dipterocarpus obtusifolius</i>	0.1616	0.0556	0.0033	0.0276	0.2482
	10	<i>Terminalia alata</i>	0.1536	0.0411	0.0060	0.0318	0.2325
	11	<i>Wendlandia tinctoria</i>	0.0938	0.0176	0.0059	0.0255	0.1429
	12	<i>Memecylon scutellatum</i>	0.0826	0.0202	0.0038	0.0179	0.1245
	13	<i>Anneslea fragrans</i>	0.0740	0.0184	0.0033	0.0162	0.1119
	14	<i>Garcinia cowa</i>	0.0671	0.0178	0.0027	0.0141	0.1017
	15	<i>Catunaregam tomentosa</i>	0.0577	0.0138	0.0027	0.0129	0.0871
	16	<i>Catunaregam spathulifolia</i>	0.0543	0.0114	0.0031	0.0135	0.0822
	17	<i>Stereospermum colais</i>	0.0510	0.0123	0.0024	0.0112	0.0768
	18	<i>Bridelia pierrei</i>	0.0492	0.0110	0.0026	0.0116	0.0743
	19	<i>Terminalia chebula</i>	0.0475	0.0107	0.0024	0.0111	0.0719
	20	<i>Diospyros ehretioides</i>	0.0438	0.0118	0.0017	0.0089	0.0662
	21	<i>Memecylon plebejum</i>	0.0338	0.0069	0.0019	0.0084	0.0510
	22	<i>Dimocarpus longan</i>	0.0336	0.0096	0.0011	0.0066	0.0509
	23	<i>Dillenia oborata</i>	0.0324	0.0074	0.0016	0.0074	0.0488
	24	<i>Semecarpus albescens</i>	0.0270	0.0058	0.0015	0.0065	0.0408
	25	<i>Dioecrescis erythroclada</i>	0.0249	0.0048	0.0015	0.0065	0.0378
	26	<i>Manilkara littoralis</i>	0.0178	0.0024	0.0014	0.0059	0.0276
	27	<i>Ulmus lancaefolia</i>	0.0082	0.0017	0.0005	0.0020	0.0123
	28	<i>Gardenia sootepensis</i>	0.0058	0.0011	0.0004	0.0015	0.0087
	29	<i>Schleichera oleosa</i>	0.0036	0.0007	0.0002	0.0010	0.0055
	30	<i>Millettia extensa</i>	0.0031	0.0006	0.0002	0.0008	0.0047
	31	<i>Dalbergia velutina</i>	0.0024	0.0004	0.0002	0.0007	0.0036
	33	<i>Albizia odoratissima</i>	0.0010	0.0001	0.0001	0.0004	0.0016
	32	<i>Pterocarpus macrocarpus</i>	0.0010	0.0001	0.0001	0.0004	0.0016
	34	<i>Colona floribunda</i>	0.0010	0.0001	0.0001	0.0003	0.0015
	35	<i>Phyllanthus emblica</i>	0.0002	0.0000	0.0000	0.0001	0.0003
Total			38.32	12.71	1.02	6.97	59.01

**Table 3-3** (Continued)

Plot	No	Species	Carbon (Mg.ha <sup>-1</sup> )				
			Stem	Branch	Leaf	Root	Total
2	1	<i>Dipterocarpus tuberculatus</i>	11.9404	3.8582	0.3187	2.1794	18.2967
	2	<i>Dipterocarpus obtusifolius</i>	10.2044	3.5949	0.2127	1.7438	15.7558
	3	<i>Gluta usitata</i>	2.8689	0.8574	0.0935	0.5552	4.3749
	4	<i>Shorea obtusa</i>	1.7704	0.4083	0.0892	0.4138	2.6818
	5	<i>Aporosa villosa</i>	1.0681	0.2220	0.0604	0.2637	1.6142
	6	<i>Millettia leucantha</i>	0.5939	0.1888	0.0161	0.1086	0.9075
	7	<i>Irvingia malayana</i>	0.5223	0.1457	0.0196	0.1066	0.7943
	8	<i>Canarium subulatum</i>	0.5015	0.1438	0.0175	0.0994	0.7622
	9	<i>Strychnos nux-vomica</i>	0.1580	0.0301	0.0097	0.0414	0.2392
	10	<i>Xylia xylocarpa</i>	0.0892	0.0273	0.0026	0.0166	0.1356
	11	<i>Wendlandia tinctoria</i>	0.0786	0.0164	0.0044	0.0196	0.1190
	12	<i>Quercus kerrii</i>	0.0752	0.0213	0.0026	0.0148	0.1140
	13	<i>Carallia brachiata</i>	0.0590	0.0129	0.0032	0.0141	0.0891
	14	<i>Shorea siamensis</i>	0.0564	0.0136	0.0026	0.0126	0.0852
	15	<i>Dillenia oborata</i>	0.0364	0.0091	0.0016	0.0079	0.0550
	16	<i>Manilkara littoralis</i>	0.0333	0.0053	0.0024	0.0098	0.0508
	17	<i>Pterocarpus macrocarpus</i>	0.0334	0.0096	0.0011	0.0065	0.0505
	18	<i>Stereospermum colais</i>	0.0285	0.0064	0.0015	0.0065	0.0430
	19	<i>Catunaregam spathulifolia</i>	0.0174	0.0037	0.0010	0.0043	0.0263
	20	<i>Syzygium oblatum</i>	0.0167	0.0042	0.0007	0.0036	0.0251
	21	<i>Gardenia obtusifolia</i>	0.0138	0.0030	0.0008	0.0033	0.0209
	22	<i>Vitex pinnata</i>	0.0062	0.0013	0.0004	0.0015	0.0094
	23	<i>Dioecrescis erythroclada</i>	0.0039	0.0007	0.0002	0.0010	0.0059
	24	<i>Dimocarpus longan</i>	0.0038	0.0007	0.0002	0.0010	0.0057
	25	<i>Ulmus lancaefolia</i>	0.0034	0.0005	0.0002	0.0010	0.0052
	26	<i>Millettia extensa</i>	0.0034	0.0005	0.0002	0.0010	0.0051
	27	<i>Anneslea fragrans</i>	0.0031	0.0005	0.0002	0.0008	0.0046
	28	<i>Diospyros ehretioides</i>	0.0002	0.0000	0.0000	0.0001	0.0003
	29	<i>Albizia odoratissima</i>	0.0001	0.0000	0.0000	0.0000	0.0001
Total			30.19	9.59	0.86	5.64	46.28

Table 3-3 (Continued)

Plot	No	Species	Carbon (Mg.ha <sup>-1</sup> )				
			Stem	Branch	Leaf	Root	Total
1+2 (Total)	1	<i>Dipterocarpus tuberculatus</i>	17.6609	6.0557	0.4087	3.0965	27.2218
	2	<i>Dipterocarpus obtusifolius</i>	5.1830	1.8253	0.1080	0.8857	8.0020
	3	<i>Shorea obtusa</i>	3.7488	1.1649	0.1279	0.7387	5.7803
	4	<i>Gluta usitata</i>	3.6311	1.0666	0.1227	0.7107	5.5311
	5	<i>Aporosa villosa</i>	1.0501	0.2292	0.0562	0.2514	1.5869
	6	<i>Canarium subulatum</i>	1.0376	0.2916	0.0374	0.2075	1.5742
	7	<i>Millettia leucantha</i>	0.5090	0.1548	0.0155	0.0965	0.7759
	8	<i>Irvingia malayana</i>	0.4235	0.1213	0.0150	0.0846	0.6444
	9	<i>Strychnos nux-vomica</i>	0.2422	0.0548	0.0125	0.0576	0.3672
	10	<i>Wendlandia tinctoria</i>	0.0862	0.0170	0.0052	0.0226	0.1310
	11	<i>Terminalia alata</i>	0.0768	0.0205	0.0030	0.0159	0.1162
	12	<i>Xylia xylocarpa</i>	0.0446	0.0136	0.0013	0.0083	0.0678
	13	<i>Memecylon scutellatum</i>	0.0413	0.0101	0.0019	0.0090	0.0622
	14	<i>Stereospermum neuranthum</i>	0.0397	0.0094	0.0019	0.0089	0.0599
	15	<i>Anneslea fragrans</i>	0.0385	0.0095	0.0018	0.0085	0.0583
	16	<i>Quercus kerrii</i>	0.0376	0.0107	0.0013	0.0074	0.0570
	17	<i>Catunaregam spathulifolia</i>	0.0358	0.0075	0.0020	0.0089	0.0543
	18	<i>Dillenia oborata</i>	0.0344	0.0083	0.0016	0.0076	0.0519
	19	<i>Garcinia cowa</i>	0.0336	0.0089	0.0014	0.0070	0.0508
	20	<i>Carallia brachiata</i>	0.0295	0.0064	0.0016	0.0071	0.0445
	21	<i>Catunaregam tomentosa</i>	0.0289	0.0069	0.0014	0.0064	0.0435
	22	<i>Shorea siamensis</i>	0.0282	0.0068	0.0013	0.0063	0.0426
	23	<i>Manilkara littoralis</i>	0.0256	0.0039	0.0019	0.0079	0.0392
	24	<i>Bridelia pierrei</i>	0.0246	0.0055	0.0013	0.0058	0.0372
	25	<i>Terminalia chebula</i>	0.0238	0.0054	0.0012	0.0056	0.0359
	26	<i>Diospyros ehretioides</i>	0.0220	0.0059	0.0009	0.0045	0.0332
	27	<i>Dimocarpus longan</i>	0.0187	0.0051	0.0007	0.0038	0.0283
	28	<i>Memecylon plebejum</i>	0.0169	0.0035	0.0010	0.0042	0.0255
	29	<i>Pterocarpus macrocarpus</i>	0.0172	0.0049	0.0006	0.0034	0.0261
	30	<i>Dioecrescis erythroclada</i>	0.0144	0.0027	0.0009	0.0038	0.0218
	31	<i>Semecarpus albescens</i>	0.0135	0.0029	0.0007	0.0032	0.0204
	32	<i>Syzygium oblatum</i>	0.0083	0.0021	0.0004	0.0018	0.0126
	33	<i>Gardenia obtusifolia</i>	0.0069	0.0015	0.0004	0.0017	0.0104
	34	<i>Ulmus lancaefolia</i>	0.0058	0.0011	0.0004	0.0015	0.0087
	35	<i>Millettia extensa</i>	0.0033	0.0005	0.0002	0.0009	0.0049
	36	<i>Vitex pinnata</i>	0.0031	0.0006	0.0002	0.0008	0.0047
	37	<i>Gardenia sootepensis</i>	0.0029	0.0005	0.0002	0.0008	0.0044
	38	<i>Schleichera oleosa</i>	0.0018	0.0003	0.0001	0.0005	0.0028
	39	<i>Dalbergia velutina</i>	0.0012	0.0002	0.0001	0.0003	0.0018
	40	<i>Albizia odoratissima</i>	0.0006	0.0001	0.0000	0.0002	0.0009
	41	<i>Colona floribunda</i>	0.0005	0.0001	0.0000	0.0002	0.0008
	42	<i>Phyllanthus emblica</i>	0.0001	0.0000	0.0000	0.0000	0.0001
Total			34.25	11.15	0.94	6.30	52.64

**Table 3-4** Biomass nitrogen amounts of tree species in DDF with annual fire

Plot	No	Species	Nitrogen (kg.ha <sup>-1</sup> )				
			Stem	Branch	Leaf	Root	Total
1	1	<i>Dipterocarpus tuberculatus</i>	248.3384	89.8203	16.4192	44.1321	398.7100
	2	<i>Shorea obtusa</i>	60.8297	20.9107	5.4868	11.6941	98.9213
	3	<i>Gluta usitata</i>	46.6620	13.8857	4.9977	9.5246	75.0699
	4	<i>Canarium subulatum</i>	16.7148	4.7829	1.8865	3.4714	26.8556
	5	<i>Aporosa villosa</i>	10.9624	2.5722	1.7123	2.6289	17.8758
	6	<i>Millettia leucantha</i>	4.5043	1.3149	0.4932	0.9280	7.2404
	7	<i>Strychnos nux-vomica</i>	3.4682	0.8657	0.5017	0.8120	5.6476
	8	<i>Irvingia malayanann.</i>	3.4489	1.0547	0.3423	0.6880	5.5339
	9	<i>Dipterocarpus obtusifolius</i>	1.7159	0.6055	0.1100	0.3037	2.7351
	10	<i>Terminalia alata</i>	1.6311	0.4470	0.1989	0.3495	2.6265
	11	<i>Wendlandia tinctoria</i>	0.9967	0.1917	0.1948	0.2808	1.6641
	12	<i>Memecylon scutellatum</i>	0.8769	0.2203	0.1235	0.1972	1.4179
	13	<i>Anneslea fragrans</i>	0.7863	0.2000	0.1092	0.1781	1.2736
	14	<i>Garcinia cowa</i>	0.7131	0.1933	0.0889	0.1546	1.1499
	15	<i>Catunaregam tomentosa</i>	0.6130	0.1497	0.0903	0.1415	0.9945
	16	<i>Catunaregam spathulifolia</i>	0.5766	0.1236	0.1007	0.1487	0.9496
	17	<i>Stereospermum colais</i>	0.5414	0.1339	0.0782	0.1230	0.8764
	18	<i>Bridelia pierrei</i>	0.5230	0.1194	0.0845	0.1271	0.8539
	19	<i>Terminalia chebula</i>	0.5050	0.1170	0.0802	0.1225	0.8246
	20	<i>Diospyros ehretioides</i>	0.4655	0.1279	0.0562	0.0982	0.7478
	21	<i>Memecylon plebejum</i>	0.3591	0.0756	0.0637	0.0918	0.5902
	22	<i>Dimocarpus longan</i>	0.3567	0.1044	0.0377	0.0722	0.5710
	23	<i>Dillenia oborata</i>	0.3441	0.0810	0.0533	0.0811	0.5595
	24	<i>Semecarpus albescens</i>	0.2866	0.0635	0.0481	0.0713	0.4695
	25	<i>Dioecrescis erythroclada</i>	0.2648	0.0518	0.0506	0.0718	0.4390
	26	<i>Manilkara littoralis</i>	0.1895	0.0260	0.0468	0.0649	0.3272
	27	<i>Ulmus lancaefolia</i>	0.0866	0.0181	0.0154	0.0222	0.1424
	28	<i>Gardenia sootepensis</i>	0.0612	0.0117	0.0119	0.0167	0.1015
	29	<i>Schleichera oleosa</i>	0.0387	0.0073	0.0077	0.0106	0.0642
	30	<i>Millettia extensa</i>	0.0333	0.0061	0.0068	0.0093	0.0554
	31	<i>Dalbergia velutina</i>	0.0254	0.0044	0.0054	0.0074	0.0426
	33	<i>Albizia odoratissima</i>	0.0109	0.0013	0.0029	0.0041	0.0192
	32	<i>Pterocarpus macrocarpus</i>	0.0111	0.0014	0.0028	0.0039	0.0192
	34	<i>Colona floribunda</i>	0.0104	0.0015	0.0025	0.0034	0.0178
	35	<i>Phyllanthus emblica</i>	0.0019	0.0002	0.0006	0.0008	0.0035
Total			406.95	138.29	33.51	76.64	655.39

**Table 3-4 (Continued)**

Plot	No	Species	Nitrogen (kg.ha <sup>-1</sup> )				
			Stem	Branch	Leaf	Root	Total
2	1	<i>Dipterocarpus tuberculatus</i>	126.8223	41.9884	10.4903	23.9649	203.2660
	2	<i>Dipterocarpus obtusifolius</i>	108.3834	39.1231	7.0014	19.1749	173.6828
	3	<i>Gluta usitata</i>	30.4711	9.3306	3.0787	6.1046	48.9849
	4	<i>Shorea obtusa</i>	18.8040	4.4440	2.9367	4.5504	30.7350
	5	<i>Aporosa villosa</i>	11.3444	2.4159	1.9889	2.8992	18.6483
	6	<i>Millettia leucantha</i>	6.3084	2.0548	0.5299	1.1946	10.0876
	7	<i>Irvingia malayana</i>	5.5473	1.5860	0.6465	1.1726	8.9524
	8	<i>Canarium subulatum</i>	5.3271	1.5648	0.5750	1.0927	8.5596
	9	<i>Strychnos nux-vomica</i>	1.6777	0.3281	0.3207	0.4550	2.7815
	10	<i>Xylocarpa xylocarpa</i>	0.9470	0.2968	0.0851	0.1820	1.5108
	11	<i>Wendlandia tinctoria</i>	0.8346	0.1786	0.1459	0.2154	1.3745
	12	<i>Quercus kerrii</i>	0.7990	0.2321	0.0866	0.1629	1.2806
	13	<i>Carallia brachiata</i>	0.6262	0.1400	0.1039	0.1552	1.0253
	14	<i>Shorea siamensis</i>	0.5990	0.1483	0.0866	0.1383	0.9722
	15	<i>Dillenia oborata</i>	0.3868	0.0989	0.0531	0.0864	0.6251
	16	<i>Manilkara littoralis</i>	0.3533	0.0582	0.0777	0.1077	0.5968
	17	<i>Pterocarpus macrocarpus</i>	0.3544	0.1044	0.0368	0.0710	0.5667
	18	<i>Stereospermum colais</i>	0.3029	0.0700	0.0481	0.0720	0.4929
	19	<i>Catunaregam spathulifolia</i>	0.1846	0.0404	0.0314	0.0468	0.3033
	20	<i>Syzygium oblatum</i>	0.1772	0.0453	0.0242	0.0392	0.2858
	21	<i>Gardenia obtusifolia</i>	0.1467	0.0323	0.0248	0.0366	0.2404
	22	<i>Vitex pinnata</i>	0.0660	0.0138	0.0118	0.0168	0.1083
	23	<i>Dioecrescis erythroclada</i>	0.0416	0.0079	0.0081	0.0113	0.0689
	24	<i>Dimocarpus longan</i>	0.0403	0.0076	0.0079	0.0110	0.0667
	25	<i>Ulmus lancaefolia</i>	0.0362	0.0058	0.0080	0.0110	0.0611
	26	<i>Millettia extensa</i>	0.0358	0.0057	0.0080	0.0109	0.0604
	27	<i>Anneslea fragrans</i>	0.0325	0.0059	0.0066	0.0091	0.0541
	28	<i>Diospyros ehretioides</i>	0.0017	0.0002	0.0005	0.0007	0.0031
	29	<i>Albizia odoratissima</i>	0.0009	0.0001	0.0003	0.0004	0.0017
Total			320.65	104.33	28.42	61.99	515.40

Table 3-4 (Continued)

Plot	No	Species	Nitrogen (kg.ha <sup>-1</sup> )				
			Stem	Branch	Leaf	Root	Total
1+2 (Total)	1	<i>Dipterocarpus tuberculatus</i>	187.5804	65.9044	13.4548	34.0485	300.9880
	2	<i>Dipterocarpus obtusifolius</i>	55.0497	19.8643	3.5557	9.7393	88.2090
	3	<i>Shorea obtusa</i>	39.8168	12.6773	4.2118	8.1222	64.8282
	4	<i>Gluta usitata</i>	38.5665	11.6081	4.0382	7.8146	62.0274
	5	<i>Aporosa villosa</i>	11.1534	2.4940	1.8506	2.7641	18.2621
	6	<i>Canarium subulatum</i>	11.0209	3.1739	1.2308	2.2821	17.7076
	7	<i>Millettia leucantha</i>	5.4063	1.6848	0.5115	1.0613	8.6640
	8	<i>Irvingia malayana</i>	4.4981	1.3203	0.4944	0.9303	7.2432
	9	<i>Strychnos nux-vomica</i>	2.5730	0.5969	0.4112	0.6335	4.2146
	10	<i>Wendlandia tinctoria</i>	0.9157	0.1852	0.1703	0.2481	1.5193
	11	<i>Terminalia alata</i>	0.8156	0.2235	0.0995	0.1747	1.3133
	12	<i>Xylia xylocarpa</i>	0.4735	0.1484	0.0425	0.0910	0.7554
	13	<i>Memecylon scutellatum</i>	0.4384	0.1102	0.0618	0.0986	0.7089
	14	<i>Stereospermum neuranthum</i>	0.4221	0.1019	0.0631	0.0975	0.6847
	15	<i>Anneslea fragrans</i>	0.4094	0.1029	0.0579	0.0936	0.6638
	16	<i>Quercus kerrii</i>	0.3995	0.1161	0.0433	0.0815	0.6403
	17	<i>Catunaregam spathulifolia</i>	0.3806	0.0820	0.0661	0.0978	0.6264
	18	<i>Dillenia oborata</i>	0.3654	0.0900	0.0532	0.0837	0.5923
	19	<i>Garcinia cowa</i>	0.3566	0.0966	0.0444	0.0773	0.5749
	20	<i>Carallia brachiata</i>	0.3131	0.0700	0.0519	0.0776	0.5126
	21	<i>Catunaregam tomentosa</i>	0.3065	0.0748	0.0451	0.0707	0.4972
	22	<i>Shorea siamensis</i>	0.2995	0.0741	0.0433	0.0692	0.4861
	23	<i>Manilkara littoralis</i>	0.2714	0.0421	0.0622	0.0863	0.4620
	24	<i>Bridelia pierrei</i>	0.2615	0.0597	0.0423	0.0635	0.4270
	25	<i>Terminalia chebula</i>	0.2525	0.0585	0.0401	0.0613	0.4123
	26	<i>Diospyros ehretoides</i>	0.2336	0.0640	0.0283	0.0495	0.3754
	27	<i>Dimocarpus longan</i>	0.1985	0.0560	0.0228	0.0416	0.3189
	28	<i>Memecylon plebejum</i>	0.1795	0.0378	0.0319	0.0459	0.2951
	29	<i>Pterocarpus macrocarpus</i>	0.1826	0.0528	0.0199	0.0376	0.2929
	30	<i>Dioecrescis erythroclada</i>	0.1532	0.0298	0.0294	0.0416	0.2540
	31	<i>Semecarpus albescens</i>	0.1433	0.0317	0.0240	0.0356	0.2347
	32	<i>Syzygium oblatum</i>	0.0886	0.0227	0.0121	0.0196	0.1429
	33	<i>Gardenia obtusifolia</i>	0.0734	0.0161	0.0124	0.0183	0.1202
	34	<i>Ulmus lancaefolia</i>	0.0614	0.0120	0.0117	0.0166	0.1017
	35	<i>Millettia extensa</i>	0.0345	0.0059	0.0074	0.0101	0.0579
	36	<i>Vitex pinnata</i>	0.0330	0.0069	0.0059	0.0084	0.0541
	37	<i>Gardenia sootepensis</i>	0.0306	0.0059	0.0059	0.0083	0.0508
	38	<i>Schleichera oleosa</i>	0.0193	0.0036	0.0038	0.0053	0.0321
	39	<i>Dalbergia velutina</i>	0.0127	0.0022	0.0027	0.0037	0.0213
	40	<i>Albizia odoratissima</i>	0.0060	0.0007	0.0016	0.0022	0.0105
	41	<i>Colona floribunda</i>	0.0052	0.0007	0.0012	0.0017	0.0089
	42	<i>Phyllanthus emblica</i>	0.0010	0.0001	0.0003	0.0004	0.0018
Total			363.80	121.31	30.97	69.31	585.39

**Table 3-5** Biomass phosphorus amounts of tree species in DDF with annual fire

Plot	No	Species	Phosphorus (kg.ha <sup>-1</sup> )				
			Stem	Branch	Leaf	Root	Total
1	1	<i>Dipterocarpus tuberculatus</i>	37.4850	16.9472	1.3425	1.6654	57.4401
	2	<i>Shorea obtusa</i>	9.1818	3.9454	0.4486	0.4413	14.0172
	3	<i>Gluta usitata</i>	7.0433	2.6199	0.4086	0.3594	10.4313
	4	<i>Canarium subulatum</i>	2.5230	0.9024	0.1542	0.1310	3.7107
	5	<i>Aporosa villosa</i>	1.6547	0.4853	0.1400	0.0992	2.3792
	6	<i>Millettia leucantha</i>	0.6799	0.2481	0.0403	0.0350	1.0033
	7	<i>Strychnos nux-vomica</i>	0.5235	0.1633	0.0410	0.0306	0.7585
	8	<i>Irvingia malayanann.</i>	0.5206	0.1990	0.0280	0.0260	0.7735
	9	<i>Dipterocarpus obtusifolius</i>	0.2590	0.1142	0.0090	0.0115	0.3937
	10	<i>Terminalia alata</i>	0.2462	0.0843	0.0163	0.0132	0.3600
	11	<i>Wendlandia tinctoria</i>	0.1504	0.0362	0.0159	0.0106	0.2131
	12	<i>Memecylon scutellatum</i>	0.1324	0.0416	0.0101	0.0074	0.1915
	13	<i>Anneslea fragrans</i>	0.1187	0.0377	0.0089	0.0067	0.1721
	14	<i>Garcinia cowa</i>	0.1076	0.0365	0.0073	0.0058	0.1572
	15	<i>Catunaregam tomentosa</i>	0.0925	0.0282	0.0074	0.0053	0.1335
	16	<i>Catunaregam spathulifolia</i>	0.0870	0.0233	0.0082	0.0056	0.1242
	17	<i>Stereospermum colais</i>	0.0817	0.0253	0.0064	0.0046	0.1180
	18	<i>Bridelia pierrei</i>	0.0789	0.0225	0.0069	0.0048	0.1132
	19	<i>Terminalia chebula</i>	0.0762	0.0221	0.0066	0.0046	0.1095
	20	<i>Diospyros ehretioides</i>	0.0703	0.0241	0.0046	0.0037	0.1027
	21	<i>Memecylon plebejum</i>	0.0542	0.0143	0.0052	0.0035	0.0771
	22	<i>Dimocarpus longan</i>	0.0538	0.0197	0.0031	0.0027	0.0794
	23	<i>Dillenia oborata</i>	0.0519	0.0153	0.0044	0.0031	0.0746
	24	<i>Semecarpus albescens</i>	0.0433	0.0120	0.0039	0.0027	0.0619
	25	<i>Dioecrescis erythroclada</i>	0.0400	0.0098	0.0041	0.0027	0.0566
	26	<i>Manilkara littoralis</i>	0.0286	0.0049	0.0038	0.0025	0.0398
	27	<i>Ulmus lancaefolia</i>	0.0131	0.0034	0.0013	0.0008	0.0186
	28	<i>Gardenia sootepensis</i>	0.0092	0.0022	0.0010	0.0006	0.0131
	29	<i>Schleichera oleosa</i>	0.0058	0.0014	0.0006	0.0004	0.0082
	30	<i>Millettia extensa</i>	0.0050	0.0011	0.0006	0.0004	0.0071
	31	<i>Dalbergia velutina</i>	0.0038	0.0008	0.0004	0.0003	0.0054
	33	<i>Albizia odoratissima</i>	0.0016	0.0002	0.0002	0.0002	0.0023
	32	<i>Pterocarpus macrocarpus</i>	0.0017	0.0003	0.0002	0.0001	0.0023
	34	<i>Colona floribunda</i>	0.0016	0.0003	0.0002	0.0001	0.0022
	35	<i>Phyllanthus emblica</i>	0.0003	0.0000	0.0000	0.0000	0.0004
Total			61.43	26.09	2.74	2.89	93.15

Table 3-5 (Continued)

Plot	No	Species	Phosphorus (kg.ha <sup>-1</sup> )				
			Stem	Branch	Leaf	Root	Total
2	1	<i>Dipterocarpus tuberculatus</i>	19.1430	7.9223	0.8577	0.9043	28.8274
	2	<i>Dipterocarpus obtusifolius</i>	16.3598	7.3817	0.5724	0.7236	25.0375
	3	<i>Gluta usitata</i>	4.5994	1.7605	0.2517	0.2304	6.8420
	4	<i>Shorea obtusa</i>	2.8383	0.8385	0.2401	0.1717	4.0886
	5	<i>Aporosa villosa</i>	1.7124	0.4558	0.1626	0.1094	2.4402
	6	<i>Millettia leucantha</i>	0.9522	0.3877	0.0433	0.0451	1.4283
	7	<i>Irvingia malayana</i>	0.8373	0.2992	0.0529	0.0442	1.2337
	8	<i>Canarium subulatum</i>	0.8041	0.2952	0.0470	0.0412	1.1876
	9	<i>Strychnos nux-vomica</i>	0.2532	0.0619	0.0262	0.0172	0.3585
	10	<i>Xylocarpus xylocarpa</i>	0.1429	0.0560	0.0070	0.0069	0.2128
	11	<i>Wendlandia tinctoria</i>	0.1260	0.0337	0.0119	0.0081	0.1797
	12	<i>Quercus kerrii</i>	0.1206	0.0438	0.0071	0.0061	0.1776
	13	<i>Carallia brachiata</i>	0.0945	0.0264	0.0085	0.0059	0.1353
	14	<i>Shorea siamensis</i>	0.0904	0.0280	0.0071	0.0052	0.1307
	15	<i>Dillenia oborata</i>	0.0584	0.0187	0.0043	0.0033	0.0846
	16	<i>Manilkara littoralis</i>	0.0533	0.0110	0.0064	0.0041	0.0747
	17	<i>Pterocarpus macrocarpus</i>	0.0535	0.0197	0.0030	0.0027	0.0789
	18	<i>Stereospermum colais</i>	0.0457	0.0132	0.0039	0.0027	0.0656
	19	<i>Catunaregam spathulifolia</i>	0.0279	0.0076	0.0026	0.0018	0.0398
	20	<i>Syzygium oblatum</i>	0.0267	0.0085	0.0020	0.0015	0.0387
	21	<i>Gardenia obtusifolia</i>	0.0221	0.0061	0.0020	0.0014	0.0316
	22	<i>Vitex pinnata</i>	0.0100	0.0026	0.0010	0.0006	0.0142
	23	<i>Dioecrescis erythroclada</i>	0.0063	0.0015	0.0007	0.0004	0.0089
	24	<i>Dimocarpus longan</i>	0.0061	0.0014	0.0006	0.0004	0.0086
	25	<i>Ulmus lancaefolia</i>	0.0055	0.0011	0.0007	0.0004	0.0076
	26	<i>Millettia extensa</i>	0.0054	0.0011	0.0007	0.0004	0.0075
	27	<i>Anneslea fragrans</i>	0.0049	0.0011	0.0005	0.0003	0.0069
	28	<i>Diospyros ehretioides</i>	0.0003	0.0000	0.0000	0.0000	0.0004
	29	<i>Albizia odoratissima</i>	0.0001	0.0000	0.0000	0.0000	0.0002
Total			48.40	19.68	2.32	2.34	72.75

Table 3-5 (Continued)

Plot	No	Species	Phosphorus (kg.ha <sup>-1</sup> )				
			Stem	Branch	Leaf	Root	Total
1+2 (Total)	1	<i>Dipterocarpus tuberculatus</i>	28.3140	12.4348	1.1001	1.2848	43.1337
	2	<i>Dipterocarpus obtusifolius</i>	8.3094	3.7480	0.2907	0.3675	12.7156
	3	<i>Shorea obtusa</i>	6.0101	2.3920	0.3444	0.3065	9.0529
	4	<i>Gluta usitata</i>	5.8214	2.1902	0.3302	0.2949	8.6366
	5	<i>Aporosa villosa</i>	1.6835	0.4706	0.1513	0.1043	2.4097
	6	<i>Canarium subulatum</i>	1.6635	0.5988	0.1006	0.0861	2.4491
	7	<i>Millettia leucantha</i>	0.8161	0.3179	0.0418	0.0400	1.2158
	8	<i>Irvingia malayana</i>	0.6790	0.2491	0.0404	0.0351	1.0036
	9	<i>Strychnos nux-vomica</i>	0.3884	0.1126	0.0336	0.0239	0.5585
	10	<i>Wendlandia tinctoria</i>	0.1382	0.0349	0.0139	0.0094	0.1964
	11	<i>Terminalia alata</i>	0.1231	0.0422	0.0081	0.0066	0.1800
	12	<i>Xylia xylocarpa</i>	0.0715	0.0280	0.0035	0.0034	0.1064
	13	<i>Memecylon scutellatum</i>	0.0662	0.0208	0.0050	0.0037	0.0957
	14	<i>Stereospermum neuranthum</i>	0.0637	0.0192	0.0052	0.0037	0.0918
	15	<i>Anneslea fragrans</i>	0.0618	0.0194	0.0047	0.0035	0.0895
	16	<i>Quercus kerrii</i>	0.0603	0.0219	0.0035	0.0031	0.0888
	17	<i>Catunaregam spathulifolia</i>	0.0575	0.0155	0.0054	0.0037	0.0820
	18	<i>Dillenia obovata</i>	0.0552	0.0170	0.0043	0.0032	0.0796
	19	<i>Garcinia cowa</i>	0.0538	0.0182	0.0036	0.0029	0.0786
	20	<i>Carallia brachiata</i>	0.0473	0.0132	0.0042	0.0029	0.0676
	21	<i>Catunaregam tomentosa</i>	0.0463	0.0141	0.0037	0.0027	0.0667
	22	<i>Shorea siamensis</i>	0.0452	0.0140	0.0035	0.0026	0.0653
	23	<i>Manilkara littoralis</i>	0.0410	0.0079	0.0051	0.0033	0.0572
	24	<i>Bridelia pierrei</i>	0.0395	0.0113	0.0035	0.0024	0.0566
	25	<i>Terminalia chebula</i>	0.0381	0.0110	0.0033	0.0023	0.0547
	26	<i>Diospyros ehretioides</i>	0.0353	0.0121	0.0023	0.0019	0.0515
	27	<i>Dimocarpus longan</i>	0.0300	0.0106	0.0019	0.0016	0.0440
	28	<i>Memecylon plebejum</i>	0.0271	0.0071	0.0026	0.0017	0.0386
	29	<i>Pterocarpus macrocarpus</i>	0.0276	0.0100	0.0016	0.0014	0.0406
	30	<i>Dioecrescis erythroclada</i>	0.0231	0.0056	0.0024	0.0016	0.0327
	31	<i>Semecarpus albescens</i>	0.0216	0.0060	0.0020	0.0013	0.0309
	32	<i>Syzygium oblatum</i>	0.0134	0.0043	0.0010	0.0007	0.0194
	33	<i>Gardenia obtusifolia</i>	0.0111	0.0030	0.0010	0.0007	0.0158
	34	<i>Ulmus lancaefolia</i>	0.0093	0.0023	0.0010	0.0006	0.0131
	35	<i>Millettia extensa</i>	0.0052	0.0011	0.0006	0.0004	0.0073
	36	<i>Vitex pinnata</i>	0.0050	0.0013	0.0005	0.0003	0.0071
	37	<i>Gardenia sootepensis</i>	0.0046	0.0011	0.0005	0.0003	0.0065
	38	<i>Schleichera oleosa</i>	0.0029	0.0007	0.0003	0.0002	0.0041
	39	<i>Dalbergia velutina</i>	0.0019	0.0004	0.0002	0.0001	0.0027
	40	<i>Albizia odoratissima</i>	0.0009	0.0001	0.0001	0.0001	0.0013
	41	<i>Colona floribunda</i>	0.0008	0.0001	0.0001	0.0001	0.0011
	42	<i>Phyllanthus emblica</i>	0.0001	0.0000	0.0000	0.0000	0.0002
Total			54.91	22.89	2.53	2.62	82.95

**Table 3-6** Biomass potassium amounts of tree species in DDF with annual fire

Plot	No	Species	Potassium (kg.ha <sup>-1</sup> )				
			Stem	Branch	Leaf	Root	Total
1	1	<i>Dipterocarpus tuberculatus</i>	173.3683	67.7889	11.3592	22.4824	274.9988
	2	<i>Shorea obtusa</i>	42.4660	15.7817	3.7959	5.9574	68.0009
	3	<i>Gluta usitata</i>	32.5754	10.4797	3.4575	4.8521	51.3648
	4	<i>Canarium subulatum</i>	11.6688	3.6098	1.3051	1.7684	18.3522
	5	<i>Aporosa villosa</i>	7.6530	1.9413	1.1846	1.3392	12.1181
	6	<i>Millettia leucantha</i>	3.1445	0.9924	0.3412	0.4727	4.9508
	7	<i>Strychnos nux-vomica</i>	2.4212	0.6534	0.3471	0.4137	3.8353
	8	<i>Irvingia malayanann.</i>	2.4077	0.7960	0.2368	0.3505	3.7910
	9	<i>Dipterocarpus obtusifolius</i>	1.1979	0.4570	0.0761	0.1547	1.8857
	10	<i>Terminalia alata</i>	1.1387	0.3374	0.1376	0.1780	1.7917
	11	<i>Wendlandia tinctoria</i>	0.6958	0.1447	0.1348	0.1431	1.1183
	12	<i>Memecylon scutellatum</i>	0.6122	0.1663	0.0855	0.1004	0.9643
	13	<i>Anneslea fragrans</i>	0.5489	0.1509	0.0755	0.0907	0.8661
	14	<i>Garcinia cowa</i>	0.4978	0.1459	0.0615	0.0788	0.7840
	15	<i>Catunaregam tomentosa</i>	0.4280	0.1130	0.0625	0.0721	0.6755
	16	<i>Catunaregam spathulifolia</i>	0.4025	0.0932	0.0697	0.0758	0.6412
	17	<i>Stereospermum colais</i>	0.3779	0.1010	0.0541	0.0626	0.5957
	18	<i>Bridelia pierrei</i>	0.3651	0.0901	0.0585	0.0647	0.5784
	19	<i>Terminalia chebula</i>	0.3525	0.0883	0.0555	0.0624	0.5587
	20	<i>Diospyros ehretioides</i>	0.3250	0.0965	0.0389	0.0500	0.5104
	21	<i>Memecylon plebejum</i>	0.2507	0.0571	0.0441	0.0468	0.3986
	22	<i>Dimocarpus longan</i>	0.2490	0.0788	0.0261	0.0368	0.3907
	23	<i>Dillenia oborata</i>	0.2402	0.0612	0.0369	0.0413	0.3795
	24	<i>Semecarpus albescens</i>	0.2001	0.0479	0.0333	0.0363	0.3176
	25	<i>Dioecrescis erythroclada</i>	0.1849	0.0391	0.0350	0.0366	0.2956
	26	<i>Manilkara littoralis</i>	0.1323	0.0196	0.0324	0.0331	0.2173
	27	<i>Ulmus lancaefolia</i>	0.0605	0.0137	0.0107	0.0113	0.0961
	28	<i>Gardenia sootepensis</i>	0.0427	0.0089	0.0082	0.0085	0.0683
	29	<i>Schleichera oleosa</i>	0.0270	0.0055	0.0053	0.0054	0.0432
	30	<i>Millettia extensa</i>	0.0232	0.0046	0.0047	0.0047	0.0372
	31	<i>Dalbergia velutina</i>	0.0177	0.0033	0.0037	0.0038	0.0285
	33	<i>Albizia odoratissima</i>	0.0076	0.0010	0.0020	0.0021	0.0127
	32	<i>Pterocarpus macrocarpus</i>	0.0077	0.0011	0.0020	0.0020	0.0128
	34	<i>Colona floribunda</i>	0.0073	0.0011	0.0017	0.0017	0.0119
	35	<i>Phyllanthus emblica</i>	0.0014	0.0001	0.0004	0.0004	0.0023
Total			284.10	104.37	23.18	39.04	450.69

**Table 3-6** (Continued)

Plot	No	Species	Potassium (kg.ha <sup>-1</sup> )				
			Stem	Branch	Leaf	Root	Total
2	1	<i>Dipterocarpus tuberculatus</i>	88.5364	31.6894	7.2575	12.2085	139.6917
	2	<i>Dipterocarpus obtusifolius</i>	75.6639	29.5269	4.8437	9.7683	119.8029
	3	<i>Gluta usitata</i>	21.2722	7.0419	2.1299	3.1099	33.5540
	4	<i>Shorea obtusa</i>	13.1273	3.3539	2.0317	2.3181	20.8311
	5	<i>Aporosa villosa</i>	7.9196	1.8233	1.3759	1.4770	12.5959
	6	<i>Millettia leucantha</i>	4.4040	1.5508	0.3666	0.6086	6.9299
	7	<i>Irvingia malayana</i>	3.8727	1.1970	0.4473	0.5974	6.1143
	8	<i>Canarium subulatum</i>	3.7189	1.1810	0.3978	0.5567	5.8544
	9	<i>Strychnos nux-vomica</i>	1.1712	0.2476	0.2219	0.2318	1.8725
	10	<i>Xylia xylocarpa</i>	0.6611	0.2240	0.0588	0.0927	1.0366
	11	<i>Wendlandia tinctoria</i>	0.5827	0.1348	0.1009	0.1097	0.9281
	12	<i>Quercus kerrii</i>	0.5578	0.1752	0.0599	0.0830	0.8759
	13	<i>Carallia brachiata</i>	0.4372	0.1056	0.0719	0.0791	0.6937
	14	<i>Shorea siamensis</i>	0.4182	0.1119	0.0599	0.0705	0.6605
	15	<i>Dillenia oborata</i>	0.2700	0.0746	0.0367	0.0440	0.4254
	16	<i>Manilkara littoralis</i>	0.2466	0.0439	0.0537	0.0549	0.3991
	17	<i>Pterocarpus macrocarpus</i>	0.2474	0.0788	0.0255	0.0362	0.3879
	18	<i>Stereospermum colais</i>	0.2114	0.0528	0.0333	0.0367	0.3342
	19	<i>Catunaregam spathulifolia</i>	0.1289	0.0305	0.0218	0.0238	0.2050
	20	<i>Syzygium oblatum</i>	0.1237	0.0342	0.0168	0.0199	0.1946
	21	<i>Gardenia obtusifolia</i>	0.1024	0.0244	0.0172	0.0186	0.1626
	22	<i>Vitex pinnata</i>	0.0460	0.0104	0.0081	0.0085	0.0731
	23	<i>Dioecrescis erythroclada</i>	0.0290	0.0060	0.0056	0.0057	0.0464
	24	<i>Dimocarpus longan</i>	0.0281	0.0057	0.0055	0.0056	0.0449
	25	<i>Ulmus lancaefolia</i>	0.0253	0.0044	0.0056	0.0056	0.0409
	26	<i>Millettia extensa</i>	0.0250	0.0043	0.0055	0.0056	0.0404
	27	<i>Anneslea fragrans</i>	0.0227	0.0044	0.0046	0.0046	0.0363
	28	<i>Diospyros ehretioides</i>	0.0012	0.0001	0.0003	0.0004	0.0020
	29	<i>Albizia odoratissima</i>	0.0006	0.0001	0.0002	0.0002	0.0011
Total			223.85	78.74	19.66	31.58	353.84

Table 3-6 (Continued)

Plot	No	Species	Potassium (kg.ha <sup>-1</sup> )				
			Stem	Branch	Leaf	Root	Total
1+2 (Total)	1	<i>Dipterocarpus tuberculatus</i>	130.9523	49.7391	9.3083	17.3454	207.3452
	2	<i>Dipterocarpus obtusifolius</i>	38.4309	14.9919	2.4599	4.9615	60.8443
	3	<i>Shorea obtusa</i>	27.7967	9.5678	2.9138	4.1377	44.4160
	4	<i>Gluta usitata</i>	26.9238	8.7608	2.7937	3.9810	42.4594
	5	<i>Aporosa villosa</i>	7.7863	1.8823	1.2803	1.4081	12.3570
	6	<i>Canarium subulatum</i>	7.6939	2.3954	0.8515	1.1626	12.1033
	7	<i>Millettia leucantha</i>	3.7742	1.2716	0.3539	0.5407	5.9404
	8	<i>Irvingia malayana</i>	3.1402	0.9965	0.3420	0.4739	4.9527
	9	<i>Strychnos nux-vomica</i>	1.7962	0.4505	0.2845	0.3227	2.8539
	10	<i>Wendlandia tinctoria</i>	0.6392	0.1397	0.1178	0.1264	1.0232
	11	<i>Terminalia alata</i>	0.5694	0.1687	0.0688	0.0890	0.8959
	12	<i>Xylia xylocarpa</i>	0.3305	0.1120	0.0294	0.0464	0.5183
	13	<i>Memecylon scutellatum</i>	0.3061	0.0831	0.0427	0.0502	0.4822
	14	<i>Stereospermum neuranthum</i>	0.2947	0.0769	0.0437	0.0497	0.4650
	15	<i>Anneslea fragrans</i>	0.2858	0.0777	0.0400	0.0477	0.4512
	16	<i>Quercus kerrii</i>	0.2789	0.0876	0.0300	0.0415	0.4379
	17	<i>Catunaregam spathulifolia</i>	0.2657	0.0619	0.0457	0.0498	0.4231
	18	<i>Dillenia oborata</i>	0.2551	0.0679	0.0368	0.0427	0.4024
	19	<i>Garcinia cowa</i>	0.2489	0.0729	0.0308	0.0394	0.3920
	20	<i>Carallia brachiata</i>	0.2186	0.0528	0.0359	0.0395	0.3469
	21	<i>Catunaregam tomentosa</i>	0.2140	0.0565	0.0312	0.0360	0.3377
	22	<i>Shorea siamensis</i>	0.2091	0.0560	0.0300	0.0352	0.3302
	23	<i>Manilkara littoralis</i>	0.1895	0.0318	0.0431	0.0440	0.3082
	24	<i>Bridelia pierrei</i>	0.1826	0.0450	0.0292	0.0324	0.2892
	25	<i>Terminalia chebula</i>	0.1763	0.0441	0.0277	0.0312	0.2793
	26	<i>Diospyros ehretioides</i>	0.1631	0.0483	0.0196	0.0252	0.2562
	27	<i>Dimocarpus longan</i>	0.1386	0.0423	0.0158	0.0212	0.2178
	28	<i>Memecylon plebejum</i>	0.1253	0.0285	0.0220	0.0234	0.1993
	29	<i>Pterocarpus macrocarpus</i>	0.1275	0.0399	0.0137	0.0191	0.2003
	30	<i>Dioecrescis erythroclada</i>	0.1070	0.0225	0.0203	0.0212	0.1710
	31	<i>Semecarpus albescens</i>	0.1001	0.0240	0.0166	0.0182	0.1588
	32	<i>Syzygium oblatum</i>	0.0618	0.0171	0.0084	0.0100	0.0973
	33	<i>Gardenia obtusifolia</i>	0.0512	0.0122	0.0086	0.0093	0.0813
	34	<i>Ulmus lancaefolia</i>	0.0429	0.0090	0.0081	0.0085	0.0685
	35	<i>Millettia extensa</i>	0.0241	0.0044	0.0051	0.0052	0.0388
	36	<i>Vitex pinnata</i>	0.0230	0.0052	0.0041	0.0043	0.0366
	37	<i>Gardenia sootepensis</i>	0.0214	0.0044	0.0041	0.0042	0.0342
	38	<i>Schleichera oleosa</i>	0.0135	0.0027	0.0026	0.0027	0.0216
	39	<i>Dalbergia velutina</i>	0.0089	0.0017	0.0019	0.0019	0.0143
	40	<i>Albizia odoratissima</i>	0.0042	0.0006	0.0011	0.0011	0.0069
	41	<i>Colona floribunda</i>	0.0036	0.0006	0.0009	0.0009	0.0059
	42	<i>Phyllanthus emblica</i>	0.0007	0.0001	0.0002	0.0002	0.0012
Total			253.98	91.55	21.42	35.31	402.26

**Table 3-7** Biomass calcium amounts of tree species in DDF with annual fire

Plot	No	Species	Calcium (kg.ha <sup>-1</sup> )				
			Stem	Branch	Leaf	Root	Total
1	1	<i>Dipterocarpus tuberculatus</i>	356.1079	135.5778	15.4898	73.2759	580.4514
	2	<i>Shorea obtusa</i>	87.2275	31.5634	5.1762	19.4166	143.3837
	3	<i>Gluta usitata</i>	66.9116	20.9595	4.7148	15.8144	108.4002
	4	<i>Canarium subulatum</i>	23.9684	7.2195	1.7797	5.7638	38.7315
	5	<i>Aporosa villosa</i>	15.7197	3.8826	1.6154	4.3649	25.5826
	6	<i>Millettia leucantha</i>	6.4590	1.9848	0.4653	1.5408	10.4498
	7	<i>Strychnos nux-vomica</i>	4.9732	1.3068	0.4733	1.3482	8.1015
	8	<i>Irvingia malayanann.</i>	4.9456	1.5920	0.3229	1.1424	8.0029
	9	<i>Dipterocarpus obtusifolius</i>	2.4606	0.9139	0.1038	0.5043	3.9826
	10	<i>Terminalia alata</i>	2.3390	0.6748	0.1876	0.5803	3.7816
	11	<i>Wendlandia tinctoria</i>	1.4292	0.2894	0.1838	0.4663	2.3687
	12	<i>Memecylon scutellatum</i>	1.2574	0.3326	0.1165	0.3273	2.0339
	13	<i>Anneslea fragrans</i>	1.1276	0.3019	0.1030	0.2957	1.8282
	14	<i>Garcinia cowa</i>	1.0226	0.2917	0.0839	0.2567	1.6548
	15	<i>Catunaregam tomentosa</i>	0.8791	0.2259	0.0852	0.2349	1.4251
	16	<i>Catunaregam spathulifolia</i>	0.8269	0.1865	0.0950	0.2470	1.3553
	17	<i>Stereospermum colais</i>	0.7763	0.2021	0.0737	0.2042	1.2563
	18	<i>Bridelia pierrei</i>	0.7499	0.1802	0.0797	0.2110	1.2208
	19	<i>Terminalia chebula</i>	0.7241	0.1766	0.0756	0.2034	1.1797
	20	<i>Diospyros ehretioides</i>	0.6675	0.1930	0.0530	0.1631	1.0766
	21	<i>Memecylon plebejum</i>	0.5149	0.1141	0.0601	0.1525	0.8416
	22	<i>Dimocarpus longan</i>	0.5115	0.1576	0.0356	0.1198	0.8246
	23	<i>Dillenia oborata</i>	0.4934	0.1223	0.0503	0.1347	0.8006
	24	<i>Semecarpus albescens</i>	0.4110	0.0958	0.0453	0.1183	0.6706
	25	<i>Dioecrescis erythroclada</i>	0.3797	0.0781	0.0478	0.1193	0.6249
	26	<i>Manilkara littoralis</i>	0.2717	0.0392	0.0441	0.1078	0.4629
	27	<i>Ulmus lancaefolia</i>	0.1242	0.0274	0.0146	0.0368	0.2030
	28	<i>Gardenia sootepensis</i>	0.0878	0.0177	0.0112	0.0277	0.1444
	29	<i>Schleichera oleosa</i>	0.0555	0.0109	0.0072	0.0176	0.0912
	30	<i>Millettia extensa</i>	0.0477	0.0091	0.0064	0.0155	0.0787
	31	<i>Dalbergia velutina</i>	0.0365	0.0066	0.0051	0.0123	0.0604
	33	<i>Albizia odoratissima</i>	0.0156	0.0020	0.0027	0.0068	0.0271
	32	<i>Pterocarpus macrocarpus</i>	0.0158	0.0021	0.0027	0.0066	0.0272
	34	<i>Colona floribunda</i>	0.0149	0.0023	0.0024	0.0057	0.0252
	35	<i>Phyllanthus emblica</i>	0.0028	0.0003	0.0005	0.0013	0.0050
Total			583.56	208.74	31.61	127.24	951.15

**Table 3-7 (Continued)**

Plot	No	Species	Calcium (kg.ha <sup>-1</sup> )				
			Stem	Branch	Leaf	Root	Total
2	1	<i>Dipterocarpus tuberculatus</i>	181.8585	63.3788	9.8965	39.7907	294.9245
	2	<i>Dipterocarpus obtusifolius</i>	155.4178	59.0538	6.6051	31.8375	252.9141
	3	<i>Gluta usitata</i>	43.6943	14.0839	2.9044	10.1359	70.8186
	4	<i>Shorea obtusa</i>	26.9642	6.7079	2.7705	7.5553	43.9979
	5	<i>Aporosa villosa</i>	16.2674	3.6466	1.8763	4.8138	26.6041
	6	<i>Millettia leucantha</i>	9.0460	3.1015	0.4999	1.9835	14.6309
	7	<i>Irvingia malayana</i>	7.9547	2.3939	0.6099	1.9470	12.9055
	8	<i>Canarium subulatum</i>	7.6388	2.3620	0.5425	1.8144	12.3576
	9	<i>Strychnos nux-vomica</i>	2.4058	0.4952	0.3025	0.7555	3.9591
	10	<i>Xylia xylocarpa</i>	1.3579	0.4480	0.0802	0.3022	2.1883
	11	<i>Wendlandia tinctoria</i>	1.1968	0.2696	0.1376	0.3577	1.9617
	12	<i>Quercus kerrii</i>	1.1457	0.3504	0.0817	0.2705	1.8483
	13	<i>Carallia brachiata</i>	0.8980	0.2113	0.0980	0.2577	1.4649
	14	<i>Shorea siamensis</i>	0.8589	0.2238	0.0817	0.2297	1.3942
	15	<i>Dillenia oborata</i>	0.5546	0.1493	0.0500	0.1434	0.8974
	16	<i>Manilkara littoralis</i>	0.5066	0.0878	0.0733	0.1788	0.8465
	17	<i>Pterocarpus macrocarpus</i>	0.5082	0.1576	0.0348	0.1180	0.8184
	18	<i>Stereospermum colais</i>	0.4343	0.1057	0.0454	0.1195	0.7049
	19	<i>Catunaregam spathulifolia</i>	0.2647	0.0610	0.0297	0.0777	0.4331
	20	<i>Syzygium oblatum</i>	0.2540	0.0684	0.0229	0.0650	0.4103
	21	<i>Gardenia obtusifolia</i>	0.2104	0.0487	0.0234	0.0607	0.3432
	22	<i>Vitex pinnata</i>	0.0946	0.0208	0.0111	0.0278	0.1543
	23	<i>Dioecrescis erythroclada</i>	0.0597	0.0120	0.0077	0.0187	0.0980
	24	<i>Dimocarpus longan</i>	0.0577	0.0115	0.0075	0.0182	0.0949
	25	<i>Ulmus lancaefolia</i>	0.0519	0.0088	0.0076	0.0183	0.0866
	26	<i>Millettia extensa</i>	0.0513	0.0086	0.0075	0.0181	0.0856
	27	<i>Anneslea fragrans</i>	0.0465	0.0089	0.0062	0.0151	0.0768
	28	<i>Diospyros ehretioides</i>	0.0025	0.0003	0.0005	0.0012	0.0044
	29	<i>Albizia odoratissima</i>	0.0013	0.0001	0.0003	0.0007	0.0024
Total			459.80	157.48	26.81	102.93	747.03

Table 3-7 (Continued)

Plot	No	Species	Calcium (kg ha <sup>-1</sup> )				
			Stem	Branch	Leaf	Root	Total
1+2 (Total)	1	<i>Dipterocarpus tuberculatus</i>	268.9832	99.4783	12.6932	56.5333	437.6879
	2	<i>Dipterocarpus obtusifolius</i>	78.9392	29.9839	3.3544	16.1709	128.4484
	3	<i>Shorea obtusa</i>	57.0958	19.1356	3.9734	13.4860	93.6908
	4	<i>Gluta usitata</i>	55.3030	17.5217	3.8096	12.9751	89.6094
	5	<i>Aporosa villosa</i>	15.9935	3.7646	1.7458	4.5894	26.0933
	6	<i>Canarium subulatum</i>	15.8036	4.7907	1.1611	3.7891	25.5445
	7	<i>Millettia leucantha</i>	7.7525	2.5432	0.4826	1.7622	12.5404
	8	<i>Irvingia malayana</i>	6.4501	1.9930	0.4664	1.5447	10.4542
	9	<i>Strychnos nux-vomica</i>	3.6895	0.9010	0.3879	1.0519	6.0303
	10	<i>Wendlandia tinctoria</i>	1.3130	0.2795	0.1607	0.4120	2.1652
	11	<i>Terminalia alata</i>	1.1695	0.3374	0.0938	0.2901	1.8908
	12	<i>Xylia xylocarpa</i>	0.6790	0.2240	0.0401	0.1511	1.0942
	13	<i>Memecylon scutellatum</i>	0.6287	0.1663	0.0583	0.1637	1.0169
	14	<i>Stereospermum neuranthum</i>	0.6053	0.1539	0.0595	0.1619	0.9806
	15	<i>Anneslea fragrans</i>	0.5870	0.1554	0.0546	0.1554	0.9525
	16	<i>Quercus kerrii</i>	0.5729	0.1752	0.0408	0.1353	0.9241
	17	<i>Catunaregam spathulifolia</i>	0.5458	0.1238	0.0623	0.1623	0.8942
	18	<i>Dillenia oborata</i>	0.5240	0.1358	0.0502	0.1390	0.8490
	19	<i>Garcinia cowa</i>	0.5113	0.1459	0.0419	0.1283	0.8274
	20	<i>Carallia brachiata</i>	0.4490	0.1056	0.0490	0.1288	0.7325
	21	<i>Catunaregam tomentosa</i>	0.4395	0.1130	0.0426	0.1175	0.7125
	22	<i>Shorea siamensis</i>	0.4295	0.1119	0.0409	0.1148	0.6971
	23	<i>Manilkara littoralis</i>	0.3891	0.0635	0.0587	0.1433	0.6547
	24	<i>Bridelia pierrei</i>	0.3750	0.0901	0.0399	0.1055	0.6104
	25	<i>Terminalia chebula</i>	0.3621	0.0883	0.0378	0.1017	0.5899
	26	<i>Diospyros ehretioides</i>	0.3350	0.0966	0.0267	0.0821	0.5405
	27	<i>Dimocarpus longan</i>	0.2846	0.0846	0.0215	0.0690	0.4597
	28	<i>Memecylon plebejum</i>	0.2574	0.0571	0.0301	0.0762	0.4208
	29	<i>Pterocarpus macrocarpus</i>	0.2619	0.0798	0.0187	0.0624	0.4228
	30	<i>Dioecrescis erythroclada</i>	0.2197	0.0450	0.0277	0.0690	0.3615
	31	<i>Semecarpus albescens</i>	0.2055	0.0479	0.0227	0.0592	0.3353
	32	<i>Syzygium oblatum</i>	0.1270	0.0342	0.0114	0.0325	0.2051
	33	<i>Gardenia obtusifolia</i>	0.1052	0.0244	0.0117	0.0304	0.1716
	34	<i>Ulmus lancaefolia</i>	0.0880	0.0181	0.0111	0.0276	0.1448
	35	<i>Millettia extensa</i>	0.0495	0.0089	0.0069	0.0168	0.0821
	36	<i>Vitex pinnata</i>	0.0473	0.0104	0.0056	0.0139	0.0772
	37	<i>Gardenia sootepensis</i>	0.0439	0.0089	0.0056	0.0138	0.0722
	38	<i>Schleichera oleosa</i>	0.0277	0.0055	0.0036	0.0088	0.0456
	39	<i>Dalbergia velutina</i>	0.0182	0.0033	0.0025	0.0061	0.0302
	40	<i>Albizia odoratissima</i>	0.0086	0.0011	0.0015	0.0036	0.0148
	41	<i>Colona floribunda</i>	0.0075	0.0011	0.0012	0.0028	0.0126
	42	<i>Phyllanthus emblica</i>	0.0014	0.0001	0.0003	0.0007	0.0025
Total			521.68	183.11	29.21	115.09	849.09

**Table 3-8** Biomass magnesium amounts of tree species in DDF with annual fire

Plot	No	Species	Magnesium (kg.ha <sup>-1</sup> )				
			Stem	Branch	Leaf	Root	Total
1	1	<i>Dipterocarpus tuberculatus</i>	79.6557	33.8945	9.2939	8.3268	131.1709
	2	<i>Shorea obtusa</i>	19.5114	7.8908	3.1057	2.2064	32.7144
	3	<i>Gluta usitata</i>	14.9671	5.2399	2.8289	1.7971	24.8329
	4	<i>Canarium subulatum</i>	5.3614	1.8049	1.0678	0.6550	8.8890
	5	<i>Aporosa villosa</i>	3.5162	0.9706	0.9692	0.4960	5.9521
	6	<i>Millettia leucantha</i>	1.4448	0.4962	0.2792	0.1751	2.3952
	7	<i>Strychnos nux-vomica</i>	1.1124	0.3267	0.2840	0.1532	1.8763
	8	<i>Irvingia malayanann.</i>	1.1062	0.3980	0.1938	0.1298	1.8278
	9	<i>Dipterocarpus obtusifolius</i>	0.5504	0.2285	0.0623	0.0573	0.8984
	10	<i>Terminalia alata</i>	0.5232	0.1687	0.1126	0.0659	0.8704
	11	<i>Wendlandia tinctoria</i>	0.3197	0.0724	0.1103	0.0530	0.5553
	12	<i>Memecylon scutellatum</i>	0.2813	0.0831	0.0699	0.0372	0.4715
	13	<i>Anneslea fragrans</i>	0.2522	0.0755	0.0618	0.0336	0.4231
	14	<i>Garcinia cowa</i>	0.2287	0.0729	0.0503	0.0292	0.3812
	15	<i>Catunaregam tomentosa</i>	0.1966	0.0565	0.0511	0.0267	0.3309
	16	<i>Catunaregam spathulifolia</i>	0.1850	0.0466	0.0570	0.0281	0.3167
	17	<i>Stereospermum colais</i>	0.1737	0.0505	0.0442	0.0232	0.2916
	18	<i>Bridelia pierrei</i>	0.1677	0.0450	0.0478	0.0240	0.2846
	19	<i>Terminalia chebula</i>	0.1620	0.0441	0.0454	0.0231	0.2746
	20	<i>Diospyros ehretioides</i>	0.1493	0.0483	0.0318	0.0185	0.2479
	21	<i>Memecylon plebejum</i>	0.1152	0.0285	0.0361	0.0173	0.1971
	22	<i>Dimocarpus longan</i>	0.1144	0.0394	0.0213	0.0136	0.1888
	23	<i>Dillenia oborata</i>	0.1104	0.0306	0.0302	0.0153	0.1864
	24	<i>Semecarpus albescens</i>	0.0919	0.0240	0.0272	0.0134	0.1566
	25	<i>Dioecrescis erythroclada</i>	0.0849	0.0195	0.0287	0.0136	0.1467
	26	<i>Manilkara littoralis</i>	0.0608	0.0098	0.0265	0.0123	0.1093
	27	<i>Ulmus lancaefolia</i>	0.0278	0.0068	0.0087	0.0042	0.0476
	28	<i>Gardenia sootepensis</i>	0.0196	0.0044	0.0067	0.0031	0.0339
	29	<i>Schleichera oleosa</i>	0.0124	0.0027	0.0043	0.0020	0.0215
	30	<i>Millettia extensa</i>	0.0107	0.0023	0.0038	0.0018	0.0185
	31	<i>Dalbergia velutina</i>	0.0082	0.0017	0.0030	0.0014	0.0142
	33	<i>Albizia odoratissima</i>	0.0035	0.0005	0.0016	0.0008	0.0064
	32	<i>Pterocarpus macrocarpus</i>	0.0035	0.0005	0.0016	0.0007	0.0064
	34	<i>Colona floribunda</i>	0.0033	0.0006	0.0014	0.0006	0.0060
	35	<i>Phyllanthus emblica</i>	0.0006	0.0001	0.0003	0.0002	0.0012
Total			130.53	52.19	18.97	14.46	216.15

**Table 3-8** (Continued)

Plot	No	Species	Magnesium (kg.ha <sup>-1</sup> )				
			Stem	Branch	Leaf	Root	Total
2	1	<i>Dipterocarpus tuberculatus</i>	40.6789	15.8447	5.9379	4.5217	66.9832
	2	<i>Dipterocarpus obtusifolius</i>	34.7645	14.7634	3.9631	3.6179	57.1089
	3	<i>Gluta usitata</i>	9.7737	3.5210	1.7427	1.1518	16.1892
	4	<i>Shorea obtusa</i>	6.0315	1.6770	1.6623	0.8586	10.2293
	5	<i>Aporosa villosa</i>	3.6388	0.9117	1.1258	0.5470	6.2232
	6	<i>Millettia leucantha</i>	2.0234	0.7754	0.2999	0.2254	3.3241
	7	<i>Irvingia malayana</i>	1.7793	0.5985	0.3659	0.2212	2.9650
	8	<i>Canarium subulatum</i>	1.7087	0.5905	0.3255	0.2062	2.8308
	9	<i>Strychnos nux-vomica</i>	0.5381	0.1238	0.1815	0.0859	0.9293
	10	<i>Xylia xylocarpa</i>	0.3037	0.1120	0.0481	0.0343	0.4982
	11	<i>Wendlandia tinctoria</i>	0.2677	0.0674	0.0826	0.0406	0.4583
	12	<i>Quercus kerrii</i>	0.2563	0.0876	0.0490	0.0307	0.4236
	13	<i>Carallia brachiata</i>	0.2009	0.0528	0.0588	0.0293	0.3418
	14	<i>Shorea siamensis</i>	0.1921	0.0560	0.0490	0.0261	0.3232
	15	<i>Dillenia oborata</i>	0.1241	0.0373	0.0300	0.0163	0.2077
	16	<i>Manilkara littoralis</i>	0.1133	0.0220	0.0440	0.0203	0.1996
	17	<i>Pterocarpus macrocarpus</i>	0.1137	0.0394	0.0209	0.0134	0.1873
	18	<i>Stereospermum colais</i>	0.0972	0.0264	0.0272	0.0136	0.1644
	19	<i>Catunaregam spathulifolia</i>	0.0592	0.0153	0.0178	0.0088	0.1011
	20	<i>Syzygium oblatum</i>	0.0568	0.0171	0.0137	0.0074	0.0950
	21	<i>Gardenia obtusifolia</i>	0.0471	0.0122	0.0140	0.0069	0.0802
	22	<i>Vitex pinnata</i>	0.0212	0.0052	0.0067	0.0032	0.0362
	23	<i>Dioecrescis erythroclada</i>	0.0133	0.0030	0.0046	0.0021	0.0231
	24	<i>Dimocarpus longan</i>	0.0129	0.0029	0.0045	0.0021	0.0223
	25	<i>Ulmus lancaefolia</i>	0.0116	0.0022	0.0046	0.0021	0.0204
	26	<i>Millettia extensa</i>	0.0115	0.0022	0.0045	0.0021	0.0202
	27	<i>Anneslea fragrans</i>	0.0104	0.0022	0.0037	0.0017	0.0181
	28	<i>Diospyros ehretioides</i>	0.0005	0.0001	0.0003	0.0001	0.0010
	29	<i>Albizia odoratissima</i>	0.0003	0.0000	0.0002	0.0001	0.0006
Total			102.85	39.37	16.09	11.70	170.01

Table 3-8 (Continued)

Plot	No	Species	Magnesium (kg.ha <sup>-1</sup> )				
			Stem	Branch	Leaf	Root	Total
1+2 (Total)	1	<i>Dipterocarpus tuberculatus</i>	60.1673	24.8696	7.6159	6.4242	99.0770
	2	<i>Dipterocarpus obtusifolius</i>	17.6574	7.4960	2.0127	1.8376	29.0037
	3	<i>Shorea obtusa</i>	12.7714	4.7839	2.3840	1.5325	21.4719
	4	<i>Gluta usitata</i>	12.3704	4.3804	2.2858	1.4744	20.5110
	5	<i>Aporosa villosa</i>	3.5775	0.9411	1.0475	0.5215	6.0877
	6	<i>Canarium subulatum</i>	3.5350	1.1977	0.6967	0.4306	5.8599
	7	<i>Millettia leucantha</i>	1.7341	0.6358	0.2895	0.2002	2.8597
	8	<i>Irvingia malayana</i>	1.4428	0.4982	0.2798	0.1755	2.3964
	9	<i>Strychnos nux-vomica</i>	0.8253	0.2252	0.2328	0.1195	1.4028
	10	<i>Wendlandia tinctoria</i>	0.2937	0.0699	0.0964	0.0468	0.5068
	11	<i>Terminalia alata</i>	0.2616	0.0843	0.0563	0.0330	0.4352
	12	<i>Xylia xylocarpa</i>	0.1519	0.0560	0.0241	0.0172	0.2491
	13	<i>Memecylon scutellatum</i>	0.1406	0.0416	0.0350	0.0186	0.2358
	14	<i>Stereospermum neuranthum</i>	0.1354	0.0385	0.0357	0.0184	0.2280
	15	<i>Anneslea fragrans</i>	0.1313	0.0388	0.0328	0.0177	0.2206
	16	<i>Quercus kerrii</i>	0.1281	0.0438	0.0245	0.0154	0.2118
	17	<i>Catunaregam spathulifolia</i>	0.1221	0.0309	0.0374	0.0184	0.2089
	18	<i>Dillenia obovata</i>	0.1172	0.0340	0.0301	0.0158	0.1971
	19	<i>Garcinia cowa</i>	0.1144	0.0365	0.0252	0.0146	0.1906
	20	<i>Carallia brachiata</i>	0.1004	0.0264	0.0294	0.0146	0.1709
	21	<i>Catunaregam tomentosa</i>	0.0983	0.0282	0.0256	0.0133	0.1655
	22	<i>Shorea siamensis</i>	0.0961	0.0280	0.0245	0.0130	0.1616
	23	<i>Manilkara littoralis</i>	0.0870	0.0159	0.0352	0.0163	0.1544
	24	<i>Bridelia pierrei</i>	0.0839	0.0225	0.0239	0.0120	0.1423
	25	<i>Terminalia chebula</i>	0.0810	0.0221	0.0227	0.0116	0.1373
	26	<i>Diospyros ehretioides</i>	0.0749	0.0242	0.0160	0.0093	0.1245
	27	<i>Dimocarpus longan</i>	0.0637	0.0211	0.0129	0.0078	0.1056
	28	<i>Memecylon plebejum</i>	0.0576	0.0143	0.0180	0.0087	0.0985
	29	<i>Pterocarpus macrocarpus</i>	0.0586	0.0199	0.0112	0.0071	0.0969
	30	<i>Dioecrescis erythroclada</i>	0.0491	0.0113	0.0166	0.0078	0.0849
	31	<i>Semecarpus albescens</i>	0.0460	0.0120	0.0136	0.0067	0.0783
	32	<i>Syzygium oblatum</i>	0.0284	0.0085	0.0069	0.0037	0.0475
	33	<i>Gardenia obtusifolia</i>	0.0235	0.0061	0.0070	0.0035	0.0401
	34	<i>Ulmus lancaefolia</i>	0.0197	0.0045	0.0066	0.0031	0.0340
	35	<i>Millettia extensa</i>	0.0111	0.0022	0.0042	0.0019	0.0194
	36	<i>Vitex pinnata</i>	0.0106	0.0026	0.0033	0.0016	0.0181
	37	<i>Gardenia sootepensis</i>	0.0098	0.0022	0.0034	0.0016	0.0170
	38	<i>Schleichera oleosa</i>	0.0062	0.0014	0.0022	0.0010	0.0107
	39	<i>Dalbergia velutina</i>	0.0041	0.0008	0.0015	0.0007	0.0071
	40	<i>Albizia odoratissima</i>	0.0019	0.0003	0.0009	0.0004	0.0035
	41	<i>Colona floribunda</i>	0.0017	0.0003	0.0007	0.0003	0.0030
	42	<i>Phyllanthus emblica</i>	0.0003	0.0000	0.0002	0.0001	0.0006
Total			116.69	45.78	17.53	13.08	193.08

**Table 3-9** Biomass carbon amounts of tree species in DDF without fire

Plot	No	Species	Carbon (Mg.ha <sup>-1</sup> )				
			Stem	Branch	Leaf	Root	Total
1	1	<i>Dipterocarpus tuberculatus</i>	29.7424	10.8919	0.5698	4.9730	46.1772
	2	<i>Gluta usitata</i>	3.5947	1.2061	0.0897	0.6429	5.5334
	3	<i>Shorea obtusa</i>	3.4849	1.3967	0.0712	0.5808	5.5336
	4	<i>Canarium subulatum</i>	1.8161	0.5013	0.0688	0.3716	2.7578
	5	<i>Irvingia malayana</i>	0.6472	0.2101	0.0179	0.1201	0.9953
	6	<i>Aporosa villosa</i>	0.6235	0.1342	0.0339	0.1502	0.9419
	7	<i>Millettia leucantha</i>	0.3731	0.0918	0.0170	0.0826	0.5645
	8	<i>Garcinia cowa</i>	0.2564	0.0828	0.0066	0.0464	0.3923
	9	<i>Semecarpus albescens</i>	0.2139	0.0510	0.0102	0.0482	0.3233
	10	<i>Strychnos nux-vomica</i>	0.1896	0.0356	0.0119	0.0502	0.2873
	11	<i>Anneslea fragrans</i>	0.1481	0.0406	0.0056	0.0301	0.2244
	12	<i>Terminalia chebula</i>	0.1025	0.0246	0.0048	0.0229	0.1549
	13	<i>Terminalia alata</i>	0.0931	0.0235	0.0041	0.0206	0.1413
	14	<i>Flacourtia indica</i>	0.0893	0.0212	0.0043	0.0201	0.1348
	15	<i>Quercus kerrii</i>	0.0565	0.0141	0.0025	0.0121	0.0852
	16	<i>Dioecrescis erythroclada</i>	0.0473	0.0108	0.0024	0.0109	0.0714
	17	<i>Wendlandia tinctoria</i>	0.0442	0.0076	0.0030	0.0129	0.0677
	18	<i>Stereospermum colais</i>	0.0430	0.0093	0.0023	0.0103	0.0650
	19	<i>Bridelia pierrei</i>	0.0243	0.0041	0.0017	0.0069	0.0371
	20	<i>Glochidion velutinum</i>	0.0140	0.0030	0.0008	0.0035	0.0212
	21	<i>Memecylon plebejum</i>	0.0127	0.0029	0.0006	0.0029	0.0191
	22	<i>Diospyros ehretioides</i>	0.0111	0.0025	0.0006	0.0026	0.0167
	23	<i>Colona floribunda</i>	0.0101	0.0014	0.0008	0.0033	0.0156
	24	<i>Lagerstroemia macrocarpa</i>	0.0083	0.0015	0.0005	0.0023	0.0125
	25	<i>Albizia odoratissima</i>	0.0082	0.0014	0.0006	0.0023	0.0124
	26	<i>Catunaregam spathulifolia</i>	0.0071	0.0010	0.0005	0.0023	0.0110
	27	<i>Dalbergia cochinchinensis</i>	0.0047	0.0008	0.0003	0.0013	0.0071
	28	<i>Pterocarpus macrocarpus</i>	0.0032	0.0006	0.0002	0.0009	0.0048
	29	<i>Shorea siamensis</i>	0.0020	0.0003	0.0002	0.0007	0.0031
	30	<i>Lagerstroemia speciosa</i>	0.0013	0.0002	0.0001	0.0005	0.0021
	31	<i>Dalbergia dongnaiensis</i>	0.0011	0.0001	0.0001	0.0004	0.0018
	32	<i>Ulmus lancaefolia</i>	0.0010	0.0001	0.0001	0.0003	0.0015
	33	<i>Dillenia oborata</i>	0.0010	0.0001	0.0001	0.0004	0.0015
	34	<i>Manilkara littoralis</i>	0.0008	0.0001	0.0001	0.0002	0.0012
	35	<i>Antidesma acidum</i>	0.0006	0.0001	0.0001	0.0002	0.0010
	36	<i>Syzygium oblatum</i>	0.0003	0.0000	0.0000	0.0001	0.0004
Total			41.68	14.77	0.93	7.24	64.62

Table 3-9 (Continued)

Plot	No	Species	Carbon (Mg.ha <sup>-1</sup> )				
			Stem	Branch	Leaf	Root	Total
2	1	<i>Dipterocarpus tuberculatus</i>	25.3779	9.0586	0.5154	4.3081	39.2602
	2	<i>Shorea obtusa</i>	5.5080	1.6590	0.2022	1.1157	8.4849
	3	<i>Gluta usitata</i>	4.0727	1.4675	0.0852	0.6938	6.3193
	4	<i>Dipterocarpus obtusifolius</i>	2.1629	0.8133	0.0389	0.3565	3.3716
	5	<i>Aporosa villosa</i>	1.0849	0.2308	0.0598	0.2625	1.6379
	6	<i>Canarium subulatum</i>	1.0286	0.2509	0.0475	0.2276	1.5546
	7	<i>Millettia leucantha</i>	0.2589	0.0708	0.0100	0.0536	0.3932
	8	<i>Irvingia malayana</i>	0.2297	0.0592	0.0097	0.0487	0.3472
	9	<i>Strychnos nux-vomica</i>	0.1592	0.0317	0.0094	0.0406	0.2409
	10	<i>Dioecrescis erythroclada</i>	0.0498	0.0120	0.0023	0.0109	0.0751
	11	<i>Terminalia chebula</i>	0.0463	0.0109	0.0022	0.0105	0.0699
	12	<i>Mitragyna rotundifolia</i>	0.0389	0.0091	0.0019	0.0087	0.0586
	13	<i>Dillenia oborata</i>	0.0375	0.0089	0.0018	0.0084	0.0566
	14	<i>Schleichera oleosa</i>	0.0281	0.0057	0.0016	0.0070	0.0424
	15	<i>Terminalia alata</i>	0.0268	0.0072	0.0010	0.0055	0.0406
	16	<i>Wendlandia tinctoria</i>	0.0260	0.0059	0.0013	0.0062	0.0394
	17	<i>Quercus kerrii</i>	0.0196	0.0045	0.0010	0.0045	0.0296
	18	<i>Stereospermum colais</i>	0.0170	0.0043	0.0007	0.0036	0.0257
	19	<i>Catunaregam tomentosa</i>	0.0133	0.0032	0.0006	0.0029	0.0201
	20	<i>Shorea siamensis</i>	0.0120	0.0021	0.0008	0.0034	0.0183
	21	<i>Bridelia pierrei</i>	0.0085	0.0018	0.0005	0.0021	0.0128
	22	<i>Carallia brachiata</i>	0.0078	0.0015	0.0005	0.0020	0.0119
	23	<i>Catunaregam spathulifolia</i>	0.0048	0.0009	0.0003	0.0013	0.0073
	24	<i>Dalbergia oliveri</i>	0.0049	0.0008	0.0003	0.0014	0.0074
	25	<i>Flacourtia indica</i>	0.0033	0.0006	0.0002	0.0009	0.0050
	26	<i>Anneslea fragrans</i>	0.0016	0.0002	0.0001	0.0005	0.0024
	27	<i>Dalbergia cana</i>	0.0013	0.0002	0.0001	0.0004	0.0020
	28	<i>Colona floribunda</i>	0.0013	0.0002	0.0001	0.0004	0.0020
	29	<i>Syzygium oblatum</i>	0.0009	0.0001	0.0001	0.0003	0.0013
	30	<i>Albizia odoratissima</i>	0.0008	0.0001	0.0001	0.0003	0.0013
	31	<i>Ulmus lancaefolia</i>	0.0006	0.0001	0.0001	0.0002	0.0009
	32	<i>Heteropanax fragraus</i>	0.0005	0.0001	0.0000	0.0002	0.0008
	33	<i>Lagerstroemia macrocarpa</i>	0.0003	0.0000	0.0000	0.0001	0.0005
	34	<i>Pterocarpus macrocarpus</i>	0.0003	0.0000	0.0000	0.0001	0.0004
	35	<i>Phyllanthus emblica</i>	0.0002	0.0000	0.0000	0.0001	0.0003
	36	<i>Alangium chinense</i>	0.0002	0.0000	0.0000	0.0001	0.0003
		Total	40.24	13.72	1.00	7.19	62.14

Table 3-9 (Continued)

Plot	No	Species	Carbon (Mg.ha <sup>-1</sup> )				
			Stem	Branch	Leaf	Root	Total
1+2 (Total)	1	<i>Dipterocarpus tuberculatus</i>	27.5602	9.9753	0.5426	4.6406	42.7187
	2	<i>Shorea obtusa</i>	4.4965	1.5278	0.1367	0.8483	7.0092
	3	<i>Gluta usitata</i>	3.8337	1.3368	0.0875	0.6684	5.9264
	4	<i>Canarium subulatum</i>	1.4224	0.3761	0.0581	0.2996	2.1562
	5	<i>Dipterocarpus obtusifolius</i>	1.0815	0.4066	0.0194	0.1783	1.6858
	6	<i>Aporosa villosa</i>	0.8542	0.1825	0.0468	0.2064	1.2899
	7	<i>Irvingia malayana</i>	0.4384	0.1346	0.0138	0.0844	0.6713
	8	<i>Millettia leucantha</i>	0.3160	0.0813	0.0135	0.0681	0.4789
	9	<i>Strychnos nux-vomica</i>	0.1744	0.0337	0.0106	0.0454	0.2641
	10	<i>Garcinia cowa</i>	0.1282	0.0414	0.0033	0.0232	0.1962
	11	<i>Semecarpus albescens</i>	0.1069	0.0255	0.0051	0.0241	0.1617
	12	<i>Anneslea fragrans</i>	0.0749	0.0204	0.0028	0.0153	0.1134
	13	<i>Terminalia chebula</i>	0.0744	0.0178	0.0035	0.0167	0.1124
	14	<i>Terminalia alata</i>	0.0599	0.0154	0.0026	0.0131	0.0909
	15	<i>Dioecrescis erythroclada</i>	0.0485	0.0114	0.0023	0.0109	0.0733
	16	<i>Flacourtia indica</i>	0.0463	0.0109	0.0022	0.0105	0.0699
	17	<i>Quercus kerrii</i>	0.0381	0.0093	0.0017	0.0083	0.0574
	18	<i>Wendlandia tinctoria</i>	0.0351	0.0068	0.0022	0.0095	0.0535
	19	<i>Stereospermum neuranthum</i>	0.0300	0.0068	0.0015	0.0070	0.0453
	20	<i>Mitragyna rotundifolia</i>	0.0194	0.0046	0.0009	0.0043	0.0293
	21	<i>Dillenia obovata</i>	0.0192	0.0045	0.0009	0.0044	0.0290
	22	<i>Bridelia pierrei</i>	0.0164	0.0030	0.0011	0.0045	0.0249
	23	<i>Schleichera oleosa</i>	0.0140	0.0028	0.0008	0.0035	0.0212
	24	<i>Glochidion velutinum</i>	0.0070	0.0015	0.0004	0.0017	0.0106
	25	<i>Shorea siamensis</i>	0.0070	0.0012	0.0005	0.0020	0.0107
	26	<i>Catunaregam tomentosa</i>	0.0067	0.0016	0.0003	0.0015	0.0100
	27	<i>Memecylon plebejum</i>	0.0063	0.0014	0.0003	0.0015	0.0095
	28	<i>Catunaregam spathulifolia</i>	0.0060	0.0010	0.0004	0.0018	0.0091
	29	<i>Diospyros ehretioides</i>	0.0055	0.0013	0.0003	0.0013	0.0084
	30	<i>Colona floribunda</i>	0.0057	0.0008	0.0004	0.0019	0.0088
	31	<i>Albizia odoratissima</i>	0.0045	0.0008	0.0003	0.0013	0.0069
	32	<i>Lagerstroemia macrocarpa</i>	0.0043	0.0008	0.0003	0.0012	0.0065
	33	<i>Carallia brachiata</i>	0.0039	0.0008	0.0002	0.0010	0.0059
	34	<i>Dalbergia oliveri</i>	0.0030	0.0005	0.0002	0.0009	0.0046
	35	<i>Dalbergia cochinchinensis</i>	0.0023	0.0004	0.0002	0.0007	0.0036
	36	<i>Pterocarpus macrocarpus</i>	0.0017	0.0003	0.0001	0.0005	0.0026
	37	<i>Ulmus lancaefolia</i>	0.0008	0.0001	0.0001	0.0003	0.0012
	38	<i>Lagerstroemia speciosa</i>	0.0007	0.0001	0.0001	0.0002	0.0010
	39	<i>Dalbergia cana</i>	0.0006	0.0001	0.0000	0.0002	0.0010
	40	<i>Syzygium oblatum</i>	0.0006	0.0001	0.0000	0.0002	0.0009
	41	<i>Manilkara littoralis</i>	0.0004	0.0001	0.0000	0.0001	0.0006
	42	<i>Antidesma acidum</i>	0.0003	0.0000	0.0000	0.0001	0.0005
	43	<i>Heteropanax fragraus</i>	0.0003	0.0000	0.0000	0.0001	0.0004
	44	<i>Phyllanthus emblica</i>	0.0001	0.0000	0.0000	0.0000	0.0002
	45	<i>Alangium chinense</i>	0.0001	0.0000	0.0000	0.0000	0.0001
Total			40.96	14.25	0.96	7.21	63.38

**Table 3-10** Biomass nitrogen amounts of tree species in DDF without fire

Plot	No	Species	Nitrogen (kg.ha <sup>-1</sup> )				
			Stem	Branch	Leaf	Root	Total
1	1	<i>Dipterocarpus tuberculatus</i>	315.9017	118.5365	18.7565	54.6824	507.8771
	2	<i>Gluta usitata</i>	38.1802	13.1262	2.9528	7.0692	61.3285
	3	<i>Shorea obtusa</i>	37.0137	15.2007	2.3430	6.3867	60.9441
	4	<i>Canarium subulatum</i>	19.2895	5.4553	2.2640	4.0865	31.0953
	5	<i>Irvingia malayana</i>	6.8736	2.2866	0.5903	1.3210	11.0714
	6	<i>Aporosa villosa</i>	6.6225	1.4606	1.1163	1.6521	10.8515
	7	<i>Millettia leucantha</i>	3.9628	0.9994	0.5600	0.9081	6.4302
	8	<i>Garcinia cowa</i>	2.7237	0.9015	0.2185	0.5104	4.3541
	9	<i>Semecarpus albescens</i>	2.2718	0.5555	0.3355	0.5299	3.6928
	10	<i>Strychnos nux-vomica</i>	2.0141	0.3875	0.3908	0.5525	3.3448
	11	<i>Anneslea fragrans</i>	1.5731	0.4423	0.1827	0.3309	2.5290
	12	<i>Terminalia chebula</i>	1.0884	0.2682	0.1586	0.2523	1.7676
	13	<i>Terminalia alata</i>	0.9885	0.2555	0.1350	0.2269	1.6059
	14	<i>Flacourtia indica</i>	0.9480	0.2309	0.1403	0.2208	1.5399
	15	<i>Quercus kerrii</i>	0.6000	0.1538	0.0818	0.1330	0.9685
	16	<i>Dioecrescis erythroclada</i>	0.5024	0.1179	0.0783	0.1198	0.8184
	17	<i>Wendlandia tinctoria</i>	0.4696	0.0833	0.0984	0.1414	0.7926
	18	<i>Stereospermum colais</i>	0.4570	0.1008	0.0769	0.1136	0.7483
	19	<i>Bridelia pierrei</i>	0.2585	0.0450	0.0546	0.0761	0.4342
	20	<i>Glochidion velutinum</i>	0.1487	0.0322	0.0257	0.0382	0.2449
	21	<i>Memecylon plebejum</i>	0.1344	0.0311	0.0214	0.0323	0.2191
	22	<i>Diospyros ehretioides</i>	0.1178	0.0273	0.0186	0.0281	0.1918
	23	<i>Colona floribunda</i>	0.1072	0.0151	0.0261	0.0361	0.1844
	24	<i>Lagerstroemia macrocarpa</i>	0.0878	0.0162	0.0177	0.0249	0.1465
	25	<i>Albizia odoratissima</i>	0.0867	0.0152	0.0183	0.0255	0.1456
	26	<i>Catunaregam spathulifolia</i>	0.0754	0.0110	0.0181	0.0253	0.1297
	27	<i>Dalbergia cochinchinensis</i>	0.0499	0.0086	0.0106	0.0145	0.0835
	28	<i>Pterocarpus macrocarpus</i>	0.0339	0.0062	0.0069	0.0095	0.0564
	29	<i>Shorea siamensis</i>	0.0211	0.0028	0.0053	0.0073	0.0366
	30	<i>Lagerstroemia speciosa</i>	0.0143	0.0018	0.0037	0.0052	0.0250
	31	<i>Dalbergia dongnaiensis</i>	0.0121	0.0016	0.0031	0.0043	0.0211
	32	<i>Ulmus lancaefolia</i>	0.0105	0.0015	0.0025	0.0035	0.0180
	33	<i>Dillenia oborata</i>	0.0102	0.0012	0.0028	0.0039	0.0181
	34	<i>Manilkara littoralis</i>	0.0080	0.0011	0.0020	0.0027	0.0139
	35	<i>Antidesma acidum</i>	0.0065	0.0007	0.0018	0.0025	0.0115
	36	<i>Syzygium oblatum</i>	0.0028	0.0003	0.0008	0.0011	0.0050
		Total	442.67	160.78	30.72	79.58	713.75

**Table 3-10** (Continued)

Plot	No	Species	Nitrogen (kg.ha <sup>-1</sup> )				
			Stem	Branch	Leaf	Root	Total
2	1	<i>Dipterocarpus tuberculatus</i>	269.5453	98.5847	16.9679	47.3717	432.4696
	2	<i>Shorea obtusa</i>	58.5021	18.0543	6.6562	12.2680	95.4806
	3	<i>Gluta usitata</i>	43.2575	15.9712	2.8058	7.6292	69.6637
	4	<i>Dipterocarpus obtusifolius</i>	22.9727	8.8511	1.2792	3.9201	37.0231
	5	<i>Aporosa villosa</i>	11.5229	2.5114	1.9678	2.8865	18.8887
	6	<i>Canarium subulatum</i>	10.9253	2.7305	1.5623	2.5029	17.7210
	7	<i>Millettia leucantha</i>	2.7500	0.7704	0.3278	0.5892	4.4374
	8	<i>Irvingia malayana</i>	2.4394	0.6438	0.3187	0.5351	3.9371
	9	<i>Strychnos nux-vomica</i>	1.6910	0.3450	0.3101	0.4464	2.7925
	10	<i>Dioecrescis erythroclada</i>	0.5289	0.1311	0.0761	0.1204	0.8565
	11	<i>Terminalia chebula</i>	0.4913	0.1187	0.0736	0.1152	0.7988
	12	<i>Mitragyna rotundifolia</i>	0.4131	0.0995	0.0620	0.0956	0.6703
	13	<i>Dillenia oborata</i>	0.3980	0.0969	0.0589	0.0922	0.6460
	14	<i>Schleichera oleosa</i>	0.2983	0.0617	0.0539	0.0772	0.4911
	15	<i>Terminalia alata</i>	0.2848	0.0788	0.0339	0.0602	0.4578
	16	<i>Wendlandia tinctoria</i>	0.2761	0.0640	0.0440	0.0679	0.4521
	17	<i>Quercus kerrii</i>	0.2084	0.0486	0.0327	0.0492	0.3389
	18	<i>Stereospermum colais</i>	0.1810	0.0465	0.0246	0.0399	0.2920
	19	<i>Catunaregam tomentosa</i>	0.1415	0.0346	0.0208	0.0323	0.2291
	20	<i>Shorea siamensis</i>	0.1277	0.0224	0.0268	0.0373	0.2142
	21	<i>Bridelia pierrei</i>	0.0899	0.0192	0.0157	0.0228	0.1476
	22	<i>Carallia brachiata</i>	0.0833	0.0165	0.0158	0.0224	0.1379
	23	<i>Catunaregam spathulifolia</i>	0.0514	0.0098	0.0101	0.0142	0.0855
	24	<i>Dalbergia oliveri</i>	0.0516	0.0089	0.0109	0.0149	0.0863
	25	<i>Flacourtia indica</i>	0.0350	0.0064	0.0071	0.0097	0.0583
	26	<i>Anneslea fragrans</i>	0.0170	0.0027	0.0038	0.0052	0.0287
	27	<i>Dalbergia cana</i>	0.0136	0.0021	0.0031	0.0043	0.0231
	28	<i>Colona floribunda</i>	0.0134	0.0018	0.0034	0.0048	0.0234
	29	<i>Syzygium oblatum</i>	0.0092	0.0013	0.0022	0.0031	0.0159
	30	<i>Albizia odoratissima</i>	0.0090	0.0012	0.0022	0.0030	0.0154
	31	<i>Ulmus lancaefolia</i>	0.0063	0.0007	0.0017	0.0024	0.0112
	32	<i>Heteropanax fragraus</i>	0.0054	0.0007	0.0014	0.0019	0.0094
	33	<i>Lagerstroemia macrocarpa</i>	0.0034	0.0003	0.0010	0.0014	0.0061
	34	<i>Pterocarpus macrocarpus</i>	0.0027	0.0003	0.0007	0.0011	0.0048
	35	<i>Phyllanthus emblica</i>	0.0020	0.0002	0.0006	0.0008	0.0037
	36	<i>Alangium chinense</i>	0.0018	0.0002	0.0005	0.0008	0.0033
		Total	427.35	149.34	32.78	79.05	688.52

Table 3-10 (Continued)

Plot	No	Species	Nitrogen (kg.ha <sup>-1</sup> )				
			Stem	Branch	Leaf	Root	Total
1+2 (Total)	1	<i>Dipterocarpus tuberculatus</i>	292.723	108.560	17.862	51.027	601.346
	2	<i>Shorea obtusa</i>	47.7579	16.6275	4.4996	9.3273	99.3576
	3	<i>Gluta usitata</i>	40.7189	14.5487	2.8793	7.3492	83.7986
	4	<i>Canarium subulatum</i>	15.1074	4.0929	1.9131	3.2947	31.4085
	5	<i>Dipterocarpus obtusifolius</i>	11.4864	4.4255	0.6396	1.9601	23.6139
	6	<i>Aporosa villosa</i>	9.0727	1.9860	1.5420	2.2693	19.1542
	7	<i>Irvingia malayana</i>	4.6565	1.4652	0.4545	0.9280	9.6356
	8	<i>Millettia leucantha</i>	3.3564	0.8849	0.4439	0.7486	6.9980
	9	<i>Strychnos nux-vomica</i>	1.8525	0.3662	0.3505	0.4994	3.9641
	10	<i>Garcinia cowa</i>	1.3618	0.4507	0.1093	0.2552	2.8000
	11	<i>Semecarpus albescens</i>	1.1359	0.2778	0.1677	0.2650	2.3775
	12	<i>Anneslea fragrans</i>	0.7950	0.2225	0.0933	0.1681	1.6469
	13	<i>Terminalia chebula</i>	0.7899	0.1935	0.1161	0.1837	1.6526
	14	<i>Terminalia alata</i>	0.6367	0.1672	0.0845	0.1436	1.3314
	15	<i>Dioecrescis erythroclada</i>	0.5156	0.1245	0.0772	0.1201	1.0776
	16	<i>Flacourtia indica</i>	0.4915	0.1187	0.0737	0.1152	1.0291
	17	<i>Quercus kerrii</i>	0.4042	0.1012	0.0572	0.0911	0.8404
	18	<i>Wendlandia tinctoria</i>	0.3728	0.0736	0.0712	0.1047	0.8093
	19	<i>Stereospermum</i>	0.3190	0.0736	0.0508	0.0767	0.6694
	20	<i>Mitragyna rotundifolia</i>	0.2066	0.0497	0.0310	0.0478	0.4309
	21	<i>Dillenia obovata</i>	0.2041	0.0490	0.0308	0.0481	0.4276
	22	<i>Bridelia pierrei</i>	0.1742	0.0321	0.0352	0.0494	0.3769
	23	<i>Schleichera oleosa</i>	0.1491	0.0309	0.0269	0.0386	0.3164
	24	<i>Glochidion velutinum</i>	0.0744	0.0161	0.0129	0.0191	0.1583
	25	<i>Shorea siamensis</i>	0.0744	0.0126	0.0161	0.0223	0.1630
	26	<i>Catunaregam tomentosa</i>	0.0707	0.0173	0.0104	0.0161	0.1472
	27	<i>Memecylon plebejum</i>	0.0672	0.0155	0.0107	0.0162	0.1411
	28	<i>Catunaregam spathulifolia</i>	0.0634	0.0104	0.0141	0.0197	0.1405
	29	<i>Diospyros ehretioides</i>	0.0589	0.0136	0.0093	0.0140	0.1233
	30	<i>Colona floribunda</i>	0.0603	0.0084	0.0147	0.0204	0.1365
	31	<i>Albizia odoratissima</i>	0.0478	0.0082	0.0102	0.0143	0.1047
	32	<i>Lagerstroemia macrocarpa</i>	0.0456	0.0083	0.0093	0.0131	0.0990
	33	<i>Carallia brachiata</i>	0.0416	0.0082	0.0079	0.0112	0.0891
	34	<i>Dalbergia oliveri</i>	0.0318	0.0052	0.0070	0.0096	0.0697
	35	<i>Dalbergia cochinchinensis</i>	0.0249	0.0043	0.0053	0.0073	0.0540
	36	<i>Pterocarpus macrocarpus</i>	0.0183	0.0032	0.0038	0.0053	0.0396
	37	<i>Ulmus lancaefolia</i>	0.0084	0.0011	0.0021	0.0029	0.0192
	38	<i>Lagerstroemia speciosa</i>	0.0071	0.0009	0.0019	0.0026	0.0165
	39	<i>Dalbergia cana</i>	0.0068	0.0010	0.0016	0.0022	0.0151
	40	<i>Syzygium oblatum</i>	0.0060	0.0008	0.0015	0.0021	0.0138
	41	<i>Manilkara littoralis</i>	0.0040	0.0005	0.0010	0.0014	0.0091
	42	<i>Antidesma acidum</i>	0.0032	0.0004	0.0009	0.0013	0.0077
	43	<i>Heteropanax fragrans</i>	0.0027	0.0003	0.0007	0.0010	0.0062
	44	<i>Phyllanthus emblica</i>	0.0010	0.0001	0.0003	0.0004	0.0025
	45	<i>Alangium chinense</i>	0.0009	0.0001	0.0003	0.0004	0.0022
		Total	435.01	155.06	31.75	79.31	896.62

**Table 3-11** Biomass phosphorus amounts of tree species in DDF without fire

Plot	No	Species	Phosphorus (kg.ha <sup>-1</sup> )				
			Stem	Branch	Leaf	Root	Total
1	1	<i>Dipterocarpus tuberculatus</i>	47.6833	22.3654	1.5335	2.0635	73.6457
	2	<i>Gluta usitata</i>	5.7631	2.4766	0.2414	0.2668	8.7479
	3	<i>Shorea obtusa</i>	5.5870	2.8681	0.1916	0.2410	8.8876
	4	<i>Canarium subulatum</i>	2.9116	1.0293	0.1851	0.1542	4.2802
	5	<i>Irvingia malayana</i>	1.0375	0.4314	0.0483	0.0498	1.5671
	6	<i>Aporosa villosa</i>	0.9996	0.2756	0.0913	0.0623	1.4288
	7	<i>Millettia leucantha</i>	0.5982	0.1886	0.0458	0.0343	0.8668
	8	<i>Garcinia cowa</i>	0.4111	0.1701	0.0179	0.0193	0.6183
	9	<i>Semecarpus albescens</i>	0.3429	0.1048	0.0274	0.0200	0.4952
	10	<i>Strychnos nux-vomica</i>	0.3040	0.0731	0.0320	0.0208	0.4299
	11	<i>Anneslea fragrans</i>	0.2375	0.0834	0.0149	0.0125	0.3483
	12	<i>Terminalia chebula</i>	0.1643	0.0506	0.0130	0.0095	0.2374
	13	<i>Terminalia alata</i>	0.1492	0.0482	0.0110	0.0086	0.2170
	14	<i>Flacourtia indica</i>	0.1431	0.0436	0.0115	0.0083	0.2065
	15	<i>Quercus kerrii</i>	0.0906	0.0290	0.0067	0.0050	0.1313
	16	<i>Dioecrescis erythroclada</i>	0.0758	0.0222	0.0064	0.0045	0.1090
	17	<i>Wendlandia tinctoria</i>	0.0709	0.0157	0.0080	0.0053	0.1000
	18	<i>Stereospermum colais</i>	0.0690	0.0190	0.0063	0.0043	0.0986
	19	<i>Bridelia pierrei</i>	0.0390	0.0085	0.0045	0.0029	0.0548
	20	<i>Glochidion velutinum</i>	0.0224	0.0061	0.0021	0.0014	0.0321
	21	<i>Memecylon plebejum</i>	0.0203	0.0059	0.0017	0.0012	0.0291
	22	<i>Diospyros ehretioides</i>	0.0178	0.0051	0.0015	0.0011	0.0255
	23	<i>Colona floribunda</i>	0.0162	0.0028	0.0021	0.0014	0.0225
	24	<i>Lagerstroemia macrocarpa</i>	0.0132	0.0031	0.0014	0.0009	0.0187
	25	<i>Albizia odoratissima</i>	0.0131	0.0029	0.0015	0.0010	0.0184
	26	<i>Catunaregam spathulifolia</i>	0.0114	0.0021	0.0015	0.0010	0.0159
	27	<i>Dalbergia cochinchinensis</i>	0.0075	0.0016	0.0009	0.0005	0.0106
	28	<i>Pterocarpus macrocarpus</i>	0.0051	0.0012	0.0006	0.0004	0.0072
	29	<i>Shorea siamensis</i>	0.0032	0.0005	0.0004	0.0003	0.0044
	30	<i>Lagerstroemia speciosa</i>	0.0022	0.0003	0.0003	0.0002	0.0030
	31	<i>Dalbergia dongnaiensis</i>	0.0018	0.0003	0.0003	0.0002	0.0025
	32	<i>Ulmus lancaefolia</i>	0.0016	0.0003	0.0002	0.0001	0.0022
	33	<i>Dillenia oborata</i>	0.0015	0.0002	0.0002	0.0001	0.0021
	34	<i>Manilkara littoralis</i>	0.0012	0.0002	0.0002	0.0001	0.0017
	35	<i>Antidesma acidum</i>	0.0010	0.0001	0.0001	0.0001	0.0014
	36	<i>Syzygium oblatum</i>	0.0004	0.0001	0.0001	0.0000	0.0006
		Total	66.82	30.34	2.51	3.00	102.67

**Table 3-11** (Continued)

Plot	No	Species	Phosphorus (kg.ha <sup>-1</sup> )				
			Stem	Branch	Leaf	Root	Total
2	1	<i>Dipterocarpus tuberculatus</i>	40.6861	18.6009	1.3873	1.7876	62.4619
	2	<i>Shorea obtusa</i>	8.8305	3.4065	0.5442	0.4629	13.2441
	3	<i>Gluta usitata</i>	6.5294	3.0134	0.2294	0.2879	10.0602
	4	<i>Dipterocarpus obtusifolius</i>	3.4676	1.6700	0.1046	0.1479	5.3901
	5	<i>Aporosa villosa</i>	1.7393	0.4739	0.1609	0.1089	2.4830
	6	<i>Canarium subulatum</i>	1.6491	0.5152	0.1277	0.0944	2.3865
	7	<i>Millettia leucantha</i>	0.4151	0.1454	0.0268	0.0222	0.6095
	8	<i>Irvingia malayana</i>	0.3682	0.1215	0.0261	0.0202	0.5359
	9	<i>Strychnos nux-vomica</i>	0.2552	0.0651	0.0254	0.0168	0.3625
	10	<i>Dioecrescis erythroclada</i>	0.0798	0.0247	0.0062	0.0045	0.1153
	11	<i>Terminalia chebula</i>	0.0742	0.0224	0.0060	0.0043	0.1069
	12	<i>Mitragyna rotundifolia</i>	0.0624	0.0188	0.0051	0.0036	0.0898
	13	<i>Dillenia oborata</i>	0.0601	0.0183	0.0048	0.0035	0.0867
	14	<i>Schleichera oleosa</i>	0.0450	0.0116	0.0044	0.0029	0.0640
	15	<i>Terminalia alata</i>	0.0430	0.0149	0.0028	0.0023	0.0629
	16	<i>Wendlandia tinctoria</i>	0.0417	0.0121	0.0036	0.0026	0.0599
	17	<i>Quercus kerrii</i>	0.0315	0.0092	0.0027	0.0019	0.0451
	18	<i>Stereospermum colais</i>	0.0273	0.0088	0.0020	0.0015	0.0396
	19	<i>Catunaregam tomentosa</i>	0.0214	0.0065	0.0017	0.0012	0.0308
	20	<i>Shorea siamensis</i>	0.0193	0.0042	0.0022	0.0014	0.0271
	21	<i>Bridelia pierrei</i>	0.0136	0.0036	0.0013	0.0009	0.0193
	22	<i>Carallia brachiata</i>	0.0126	0.0031	0.0013	0.0008	0.0178
	23	<i>Catunaregam spathulifolia</i>	0.0078	0.0018	0.0008	0.0005	0.0110
	24	<i>Dalbergia oliveri</i>	0.0078	0.0017	0.0009	0.0006	0.0109
	25	<i>Flacourtia indica</i>	0.0053	0.0012	0.0006	0.0004	0.0074
	26	<i>Anneslea fragrans</i>	0.0026	0.0005	0.0003	0.0002	0.0036
	27	<i>Dalbergia cana</i>	0.0021	0.0004	0.0003	0.0002	0.0029
	28	<i>Colona floribunda</i>	0.0020	0.0003	0.0003	0.0002	0.0028
	29	<i>Syzygium oblatum</i>	0.0014	0.0002	0.0002	0.0001	0.0019
	30	<i>Albizia odoratissima</i>	0.0014	0.0002	0.0002	0.0001	0.0019
	31	<i>Ulmus lancaefolia</i>	0.0009	0.0001	0.0001	0.0001	0.0013
	32	<i>Heteropanax fragraus</i>	0.0008	0.0001	0.0001	0.0001	0.0011
	33	<i>Lagerstroemia macrocarpa</i>	0.0005	0.0001	0.0001	0.0001	0.0007
	34	<i>Pterocarpus macrocarpus</i>	0.0004	0.0001	0.0001	0.0000	0.0006
	35	<i>Phyllanthus emblica</i>	0.0003	0.0000	0.0000	0.0000	0.0004
	36	<i>Alangium chinense</i>	0.0003	0.0000	0.0000	0.0000	0.0004
		Total	64.51	28.18	2.68	2.98	98.35

Table 3-11 (Continued)

Plot	No	Species	Phosphorus (kg.ha <sup>-1</sup> )				
			Stem	Branch	Leaf	Root	Total
1+2 (Total)	1	<i>Dipterocarpus tuberculatus</i>	44.1847	20.4831	1.4604	1.9255	83.3858
	2	<i>Shorea obtusa</i>	7.2087	3.1373	0.3679	0.3520	13.5331
	3	<i>Gluta usitata</i>	6.1462	2.7450	0.2354	0.2773	11.5554
	4	<i>Canarium subulatum</i>	2.2804	0.7722	0.1564	0.1243	4.1846
	5	<i>Dipterocarpus obtusifolius</i>	1.7338	0.8350	0.0523	0.0740	3.2861
	6	<i>Aporosa villosa</i>	1.3695	0.3747	0.1261	0.0856	2.4806
	7	<i>Irvingia malayana</i>	0.7029	0.2765	0.0372	0.0350	1.3061
	8	<i>Millettia leucantha</i>	0.5066	0.1670	0.0363	0.0282	0.9283
	9	<i>Strychnos nux-vomica</i>	0.2796	0.0691	0.0287	0.0188	0.5050
	10	<i>Garcinia cowa</i>	0.2056	0.0850	0.0089	0.0096	0.3835
	11	<i>Semecarpus albescens</i>	0.1715	0.0524	0.0137	0.0100	0.3125
	12	<i>Anneslea fragrans</i>	0.1200	0.0420	0.0076	0.0063	0.2207
	13	<i>Terminalia chebula</i>	0.1192	0.0365	0.0095	0.0069	0.2173
	14	<i>Terminalia alata</i>	0.0961	0.0315	0.0069	0.0054	0.1762
	15	<i>Dioecrescis erythroclada</i>	0.0778	0.0235	0.0063	0.0045	0.1417
	16	<i>Flacourtia indica</i>	0.0742	0.0224	0.0060	0.0043	0.1351
	17	<i>Quercus kerrii</i>	0.0610	0.0191	0.0047	0.0034	0.1112
	18	<i>Wendlandia tinctoria</i>	0.0563	0.0139	0.0058	0.0039	0.1022
	19	<i>Stereospermum neuranthum</i>	0.0482	0.0139	0.0041	0.0029	0.0874
	20	<i>Mitragyna rotundifolia</i>	0.0312	0.0094	0.0025	0.0018	0.0567
	21	<i>Dillenia oborata</i>	0.0308	0.0093	0.0025	0.0018	0.0561
	22	<i>Bridelia pierrei</i>	0.0263	0.0061	0.0029	0.0019	0.0475
	23	<i>Schleichera oleosa</i>	0.0225	0.0058	0.0022	0.0015	0.0407
	24	<i>Glochidion velutinum</i>	0.0112	0.0030	0.0011	0.0007	0.0204
	25	<i>Shorea siamensis</i>	0.0112	0.0024	0.0013	0.0008	0.0203
	26	<i>Catunaregam tomentosa</i>	0.0107	0.0033	0.0008	0.0006	0.0194
	27	<i>Memecylon plebejum</i>	0.0101	0.0029	0.0009	0.0006	0.0184
	28	<i>Catunaregam spathulifolia</i>	0.0096	0.0020	0.0012	0.0007	0.0173
	29	<i>Diospyros ehretioides</i>	0.0089	0.0026	0.0008	0.0005	0.0161
	30	<i>Colona floribunda</i>	0.0091	0.0016	0.0012	0.0008	0.0164
	31	<i>Albizia odoratissima</i>	0.0072	0.0015	0.0008	0.0005	0.0130
	32	<i>Lagerstroemia macrocarpa</i>	0.0069	0.0016	0.0008	0.0005	0.0124
	33	<i>Carallia brachiata</i>	0.0063	0.0016	0.0006	0.0004	0.0114
	34	<i>Dalbergia oliveri</i>	0.0048	0.0010	0.0006	0.0004	0.0086
	35	<i>Dalbergia cochinchinensis</i>	0.0038	0.0008	0.0004	0.0003	0.0068
	36	<i>Pterocarpus macrocarpus</i>	0.0028	0.0006	0.0003	0.0002	0.0050
	37	<i>Ulmus lancaefolia</i>	0.0013	0.0002	0.0002	0.0001	0.0023
	38	<i>Lagerstroemia speciosa</i>	0.0011	0.0002	0.0002	0.0001	0.0020
	39	<i>Dalbergia cana</i>	0.0010	0.0002	0.0001	0.0001	0.0018
	40	<i>Syzygium oblatum</i>	0.0009	0.0002	0.0001	0.0001	0.0016
	41	<i>Manilkara littoralis</i>	0.0006	0.0001	0.0001	0.0001	0.0011
	42	<i>Antidesma acidum</i>	0.0005	0.0001	0.0001	0.0000	0.0009
	43	<i>Heteropanax fragraus</i>	0.0004	0.0001	0.0001	0.0000	0.0007
	44	<i>Phyllanthus emblica</i>	0.0002	0.0000	0.0000	0.0000	0.0003
	45	<i>Alangium chinense</i>	0.0001	0.0000	0.0000	0.0000	0.0003
Total			65.66	29.26	2.60	2.99	123.45

**Table 3-12** Biomass potassium amounts of tree species in DDF without fire

Plot	No	Species	Potassium (kg.ha <sup>-1</sup> )				
			Stem	Branch	Leaf	Root	Total
1	1	<i>Dipterocarpus tuberculatus</i>	220.5351	89.4615	12.9762	27.8571	350.8299
	2	<i>Gluta usitata</i>	26.6541	9.9066	2.0428	3.6013	42.2048
	3	<i>Shorea obtusa</i>	25.8397	11.4722	1.6210	3.2536	42.1865
	4	<i>Canarium subulatum</i>	13.4662	4.1172	1.5663	2.0818	21.2315
	5	<i>Irvingia malayana</i>	4.7985	1.7257	0.4084	0.6729	7.6056
	6	<i>Aporosa villosa</i>	4.6232	1.1024	0.7723	0.8416	7.3395
	7	<i>Millettia leucantha</i>	2.7665	0.7543	0.3874	0.4626	4.3707
	8	<i>Garcinia cowa</i>	1.9014	0.6804	0.1512	0.2600	2.9930
	9	<i>Semecarpus albescens</i>	1.5860	0.4193	0.2321	0.2700	2.5073
	10	<i>Strychnos nux-vomica</i>	1.4061	0.2924	0.2704	0.2815	2.2503
	11	<i>Anneslea fragrans</i>	1.0982	0.3338	0.1264	0.1686	1.7270
	12	<i>Terminalia chebula</i>	0.7599	0.2024	0.1097	0.1285	1.2005
	13	<i>Terminalia alata</i>	0.6901	0.1928	0.0934	0.1156	1.0919
	14	<i>Flacourtia indica</i>	0.6618	0.1743	0.0970	0.1125	1.0456
	15	<i>Quercus kerrii</i>	0.4189	0.1161	0.0566	0.0677	0.6592
	16	<i>Dioecrescis erythroclada</i>	0.3507	0.0890	0.0542	0.0610	0.5549
	17	<i>Wendlandia tinctoria</i>	0.3278	0.0628	0.0681	0.0720	0.5307
	18	<i>Stereospermum colais</i>	0.3190	0.0761	0.0532	0.0579	0.5062
	19	<i>Bridelia pierrei</i>	0.1804	0.0340	0.0378	0.0388	0.2910
	20	<i>Glochidion velutinum</i>	0.1038	0.0243	0.0178	0.0195	0.1654
	21	<i>Memecylon plebejum</i>	0.0938	0.0234	0.0148	0.0165	0.1485
	22	<i>Diospyros ehretioides</i>	0.0822	0.0206	0.0129	0.0143	0.1300
	23	<i>Colona floribunda</i>	0.0748	0.0114	0.0180	0.0184	0.1226
	24	<i>Lagerstroemia macrocarpa</i>	0.0613	0.0122	0.0123	0.0127	0.0984
	25	<i>Albizia odoratissima</i>	0.0605	0.0114	0.0126	0.0130	0.0976
	26	<i>Catunaregam spathulifolia</i>	0.0526	0.0083	0.0125	0.0129	0.0863
	27	<i>Dalbergia cochinchinensis</i>	0.0348	0.0065	0.0073	0.0074	0.0560
	28	<i>Pterocarpus macrocarpus</i>	0.0236	0.0047	0.0047	0.0048	0.0379
	29	<i>Shorea siamensis</i>	0.0148	0.0021	0.0037	0.0037	0.0243
	30	<i>Lagerstroemia speciosa</i>	0.0100	0.0014	0.0026	0.0026	0.0165
	31	<i>Dalbergia dongnaiensis</i>	0.0085	0.0012	0.0021	0.0022	0.0140
	32	<i>Ulmus lancaefolia</i>	0.0073	0.0011	0.0017	0.0018	0.0120
	33	<i>Dillenia oborata</i>	0.0071	0.0009	0.0019	0.0020	0.0119
	34	<i>Manilkara littoralis</i>	0.0056	0.0008	0.0014	0.0014	0.0092
	35	<i>Antidesma acidum</i>	0.0045	0.0006	0.0012	0.0013	0.0076
	36	<i>Syzygium oblatum</i>	0.0020	0.0002	0.0005	0.0006	0.0033
		Total	309.03	121.34	21.25	40.54	492.17

**Table 3-12** (Continued)

Plot	No	Species	Potassium (kg.ha <sup>-1</sup> )				
			Stem	Branch	Leaf	Root	Total
2	1	<i>Dipterocarpus tuberculatus</i>	188.1731	74.4035	11.7388	24.1328	298.4482
	2	<i>Shorea obtusa</i>	40.8411	13.6259	4.6049	6.2497	65.3216
	3	<i>Gluta usitata</i>	30.1986	12.0537	1.9412	3.8866	48.0801
	4	<i>Dipterocarpus obtusifolius</i>	16.0376	6.6801	0.8850	1.9970	25.5996
	5	<i>Aporosa villosa</i>	8.0443	1.8954	1.3614	1.4705	12.7716
	6	<i>Canarium subulatum</i>	7.6271	2.0608	1.0808	1.2751	12.0437
	7	<i>Millettia leucantha</i>	1.9198	0.5814	0.2268	0.3001	3.0282
	8	<i>Irvingia malayana</i>	1.7030	0.4859	0.2205	0.2726	2.6820
	9	<i>Strychnos nux-vomica</i>	1.1805	0.2604	0.2146	0.2274	1.8829
	10	<i>Dioecrescis erythroclada</i>	0.3692	0.0989	0.0526	0.0613	0.5821
	11	<i>Terminalia chebula</i>	0.3430	0.0896	0.0509	0.0587	0.5422
	12	<i>Mitragyna rotundifolia</i>	0.2884	0.0751	0.0429	0.0487	0.4551
	13	<i>Dillenia oborata</i>	0.2778	0.0732	0.0407	0.0470	0.4387
	14	<i>Schleichera oleosa</i>	0.2082	0.0466	0.0373	0.0393	0.3314
	15	<i>Terminalia alata</i>	0.1988	0.0595	0.0235	0.0307	0.3125
	16	<i>Wendlandia tinctoria</i>	0.1928	0.0483	0.0304	0.0346	0.3061
	17	<i>Quercus kerrii</i>	0.1455	0.0367	0.0226	0.0251	0.2298
	18	<i>Stereospermum colais</i>	0.1264	0.0351	0.0170	0.0203	0.1988
	19	<i>Catunaregam tomentosa</i>	0.0988	0.0261	0.0144	0.0164	0.1557
	20	<i>Shorea siamensis</i>	0.0892	0.0169	0.0185	0.0190	0.1436
	21	<i>Bridelia pierrei</i>	0.0628	0.0145	0.0109	0.0116	0.0997
	22	<i>Carallia brachiata</i>	0.0581	0.0124	0.0109	0.0114	0.0929
	23	<i>Catunaregam spathulifolia</i>	0.0359	0.0074	0.0070	0.0072	0.0575
	24	<i>Dalbergia oliveri</i>	0.0360	0.0067	0.0075	0.0076	0.0579
	25	<i>Flacourtia indica</i>	0.0245	0.0049	0.0049	0.0050	0.0392
	26	<i>Anneslea fragrans</i>	0.0118	0.0020	0.0026	0.0027	0.0192
	27	<i>Dalbergia cana</i>	0.0095	0.0016	0.0022	0.0022	0.0154
	28	<i>Colona floribunda</i>	0.0094	0.0013	0.0024	0.0024	0.0155
	29	<i>Syzygium oblatum</i>	0.0064	0.0010	0.0016	0.0016	0.0105
	30	<i>Albizia odoratissima</i>	0.0063	0.0009	0.0015	0.0015	0.0102
	31	<i>Ulmus lancaefolia</i>	0.0044	0.0005	0.0012	0.0012	0.0074
	32	<i>Heteropanax fragraus</i>	0.0037	0.0005	0.0010	0.0010	0.0062
	33	<i>Lagerstroemia macrocarpa</i>	0.0023	0.0003	0.0007	0.0007	0.0040
	34	<i>Pterocarpus macrocarpus</i>	0.0019	0.0002	0.0005	0.0005	0.0032
	35	<i>Phyllanthus emblica</i>	0.0014	0.0002	0.0004	0.0004	0.0024
	36	<i>Alangium chinense</i>	0.0013	0.0001	0.0004	0.0004	0.0022
		Total	298.34	112.71	22.68	40.27	474.00

Table 3-12 (Continued)

Plot	No	Species	Potassium (kg.ha <sup>-1</sup> )				
			Stem	Branch	Leaf	Root	Total
1+2 (Total)	1	<i>Dipterocarpus tuberculatus</i>	204.3541	81.9325	12.3575	25.9949	410.2502
	2	<i>Shorea obtusa</i>	33.3404	12.5491	3.1129	4.7517	67.5352
	3	<i>Gluta usitata</i>	28.4264	10.9801	1.9920	3.7439	57.0972
	4	<i>Canarium subulatum</i>	10.5467	3.0890	1.3236	1.6784	21.2373
	5	<i>Dipterocarpus obtusifolius</i>	8.0188	3.3400	0.4425	0.9985	16.1244
	6	<i>Aporosa villosa</i>	6.3338	1.4989	1.0668	1.1561	12.8768
	7	<i>Irvingia malayana</i>	3.2508	1.1058	0.3144	0.4728	6.5403
	8	<i>Millettia leucantha</i>	2.3431	0.6678	0.3071	0.3814	4.7277
	9	<i>Strychnos nux-vomica</i>	1.2933	0.2764	0.2425	0.2544	2.6569
	10	<i>Garcinia cowa</i>	0.9507	0.3402	0.0756	0.1300	1.9047
	11	<i>Semecarpus albescens</i>	0.7930	0.2096	0.1161	0.1350	1.6030
	12	<i>Anneslea fragrans</i>	0.5550	0.1679	0.0645	0.0856	1.1149
	13	<i>Terminalia chebula</i>	0.5514	0.1460	0.0803	0.0936	1.1144
	14	<i>Terminalia alata</i>	0.4445	0.1262	0.0584	0.0731	0.8992
	15	<i>Dioecrescis erythroclada</i>	0.3600	0.0940	0.0534	0.0612	0.7266
	16	<i>Flacourtia indica</i>	0.3431	0.0896	0.0510	0.0587	0.6937
	17	<i>Quercus kerrii</i>	0.2822	0.0764	0.0396	0.0464	0.5673
	18	<i>Wendlandia tinctoria</i>	0.2603	0.0556	0.0493	0.0533	0.5418
	19	<i>Stereospermum neuranthum</i>	0.2227	0.0556	0.0351	0.0391	0.4507
	20	<i>Mitragyna rotundifolia</i>	0.1442	0.0375	0.0215	0.0244	0.2906
	21	<i>Dillenia obovata</i>	0.1425	0.0370	0.0213	0.0245	0.2882
	22	<i>Bridelia pierrei</i>	0.1216	0.0242	0.0243	0.0252	0.2521
	23	<i>Schleichera oleosa</i>	0.1041	0.0233	0.0186	0.0197	0.2124
	24	<i>Glochidion velutinum</i>	0.0519	0.0122	0.0089	0.0097	0.1063
	25	<i>Shorea siamensis</i>	0.0520	0.0095	0.0111	0.0114	0.1088
	26	<i>Catunaregam tomentosa</i>	0.0494	0.0130	0.0072	0.0082	0.0993
	27	<i>Memecylon plebejum</i>	0.0469	0.0117	0.0074	0.0082	0.0950
	28	<i>Catunaregam spathulifolia</i>	0.0443	0.0078	0.0098	0.0101	0.0937
	29	<i>Diospyros ehretioides</i>	0.0411	0.0103	0.0065	0.0071	0.0831
	30	<i>Colona floribunda</i>	0.0421	0.0063	0.0102	0.0104	0.0906
	31	<i>Albizia odoratissima</i>	0.0334	0.0062	0.0071	0.0073	0.0699
	32	<i>Lagerstroemia macrocarpa</i>	0.0318	0.0062	0.0065	0.0067	0.0662
	33	<i>Carallia brachiata</i>	0.0291	0.0062	0.0055	0.0057	0.0597
	34	<i>Dalbergia oliveri</i>	0.0222	0.0040	0.0048	0.0049	0.0465
	35	<i>Dalbergia cochinchinensis</i>	0.0174	0.0032	0.0037	0.0037	0.0361
	36	<i>Pterocarpus macrocarpus</i>	0.0128	0.0024	0.0026	0.0027	0.0265
	37	<i>Ulmus lancaefolia</i>	0.0059	0.0008	0.0015	0.0015	0.0127
	38	<i>Lagerstroemia speciosa</i>	0.0050	0.0007	0.0013	0.0013	0.0110
	39	<i>Dalbergia cana</i>	0.0047	0.0008	0.0011	0.0011	0.0100
	40	<i>Syzygium oblatum</i>	0.0042	0.0006	0.0010	0.0011	0.0091
	41	<i>Manilkara littoralis</i>	0.0028	0.0004	0.0007	0.0007	0.0060
	42	<i>Antidesma acidum</i>	0.0023	0.0003	0.0006	0.0006	0.0051
	43	<i>Heteropanax fragraus</i>	0.0019	0.0003	0.0005	0.0005	0.0041
	44	<i>Phyllanthus emblica</i>	0.0007	0.0001	0.0002	0.0002	0.0016
	45	<i>Alangium chinense</i>	0.0006	0.0001	0.0002	0.0002	0.0015
		Total	303.69	117.03	21.97	40.41	610.75

**Table 3-13** Biomass calcium amounts of tree species in DDF without fire

Plot	No	Species	Calcium (kg.ha <sup>-1</sup> )				
			Stem	Branch	Leaf	Root	Total
1	1	<i>Dipterocarpus tuberculatus</i>	452.9911	178.9231	17.6948	90.7934	740.4024
	2	<i>Gluta usitata</i>	54.7490	19.8131	2.7857	11.7376	89.0854
	3	<i>Shorea obtusa</i>	53.0762	22.9445	2.2104	10.6043	88.8354
	4	<i>Canarium subulatum</i>	27.6604	8.2344	2.1359	6.7851	44.8158
	5	<i>Irvingia malayana</i>	9.8564	3.4515	0.5569	2.1933	16.0581
	6	<i>Aporosa villosa</i>	9.4964	2.2048	1.0531	2.7431	15.4973
	7	<i>Millettia leucantha</i>	5.6824	1.5085	0.5283	1.5077	9.2270
	8	<i>Garcinia cowa</i>	3.9056	1.3607	0.2061	0.8475	6.3200
	9	<i>Semecarpus albescens</i>	3.2577	0.8386	0.3165	0.8799	5.2927
	10	<i>Strychnos nux-vomica</i>	2.8881	0.5848	0.3687	0.9174	4.7590
	11	<i>Anneslea fragrans</i>	2.2558	0.6676	0.1724	0.5494	3.6452
	12	<i>Terminalia chebula</i>	1.5608	0.4049	0.1496	0.4188	2.5341
	13	<i>Terminalia alata</i>	1.4175	0.3857	0.1274	0.3767	2.3072
	14	<i>Flacourtia indica</i>	1.3594	0.3485	0.1323	0.3665	2.2068
	15	<i>Quercus kerrii</i>	0.8604	0.2321	0.0772	0.2208	1.3904
	16	<i>Dioecrescis erythroclada</i>	0.7204	0.1780	0.0739	0.1989	1.1712
	17	<i>Wendlandia tinctoria</i>	0.6733	0.1257	0.0928	0.2348	1.1266
	18	<i>Stereospermum colais</i>	0.6553	0.1521	0.0726	0.1886	1.0686
	19	<i>Bridelia pierrei</i>	0.3706	0.0680	0.0515	0.1263	0.6164
	20	<i>Glochidion velutinum</i>	0.2133	0.0486	0.0243	0.0635	0.3496
	21	<i>Memecylon plebejum</i>	0.1927	0.0469	0.0202	0.0537	0.3134
	22	<i>Diospyros ehretioides</i>	0.1689	0.0412	0.0176	0.0466	0.2742
	23	<i>Colona floribunda</i>	0.1537	0.0227	0.0246	0.0599	0.2610
	24	<i>Lagerstroemia macrocarpa</i>	0.1259	0.0244	0.0167	0.0413	0.2083
	25	<i>Albizia odoratissima</i>	0.1243	0.0229	0.0172	0.0424	0.2068
	26	<i>Catunaregam spathulifolia</i>	0.1081	0.0165	0.0171	0.0420	0.1837
	27	<i>Dalbergia cochinchinensis</i>	0.0715	0.0129	0.0100	0.0241	0.1185
	28	<i>Pterocarpus macrocarpus</i>	0.0486	0.0093	0.0065	0.0157	0.0801
	29	<i>Shorea siamensis</i>	0.0303	0.0042	0.0050	0.0122	0.0517
	30	<i>Lagerstroemia speciosa</i>	0.0205	0.0027	0.0035	0.0086	0.0353
	31	<i>Dalbergia dongnaiensis</i>	0.0174	0.0024	0.0029	0.0071	0.0298
	32	<i>Ulmus lancaefolia</i>	0.0151	0.0023	0.0024	0.0057	0.0254
	33	<i>Dillenia oborata</i>	0.0146	0.0018	0.0026	0.0065	0.0255
	34	<i>Manilkara littoralis</i>	0.0115	0.0016	0.0019	0.0046	0.0196
	35	<i>Antidesma acidum</i>	0.0093	0.0011	0.0017	0.0042	0.0163
	36	<i>Syzygium oblatum</i>	0.0040	0.0005	0.0007	0.0019	0.0071
Total			634.77	242.69	28.98	132.13	1038.57

Table 3-13 (Continued)

Plot	No	Species	Calcium (kg.ha <sup>-1</sup> )				
			Stem	Branch	Leaf	Root	Total
2	1	<i>Dipterocarpus tuberculatus</i>	386.5178	148.8071	16.0075	78.6549	629.9872
	2	<i>Shorea obtusa</i>	83.8899	27.2518	6.2794	20.3695	137.7905
	3	<i>Gluta usitata</i>	62.0296	24.1074	2.6470	12.6674	101.4515
	4	<i>Dipterocarpus obtusifolius</i>	32.9420	13.3601	1.2068	6.5089	54.0178
	5	<i>Aporosa villosa</i>	16.5235	3.7908	1.8564	4.7927	26.9634
	6	<i>Canarium subulatum</i>	15.6664	4.1215	1.4738	4.1558	25.4175
	7	<i>Millettia leucantha</i>	3.9434	1.1629	0.3093	0.9782	6.3938
	8	<i>Irvingia malayana</i>	3.4981	0.9718	0.3007	0.8885	5.6590
	9	<i>Strychnos nux-vomica</i>	2.4248	0.5208	0.2926	0.7411	3.9794
	10	<i>Dioecrescis erythroclada</i>	0.7584	0.1979	0.0718	0.1999	1.2280
	11	<i>Terminalia chebula</i>	0.7045	0.1791	0.0695	0.1912	1.1443
	12	<i>Mitragyna rotundifolia</i>	0.5924	0.1502	0.0585	0.1588	0.9599
	13	<i>Dillenia oborata</i>	0.5707	0.1463	0.0555	0.1531	0.9256
	14	<i>Schleichera oleosa</i>	0.4277	0.0932	0.0508	0.1281	0.6999
	15	<i>Terminalia alata</i>	0.4084	0.1189	0.0320	0.1000	0.6594
	16	<i>Wendlandia tinctoria</i>	0.3960	0.0966	0.0415	0.1128	0.6469
	17	<i>Quercus kerrii</i>	0.2988	0.0733	0.0308	0.0818	0.4847
	18	<i>Stereospermum colais</i>	0.2596	0.0702	0.0232	0.0662	0.4192
	19	<i>Catunaregam tomentosa</i>	0.2029	0.0522	0.0196	0.0536	0.3282
	20	<i>Shorea siamensis</i>	0.1831	0.0338	0.0253	0.0620	0.3042
	21	<i>Bridelia pierrei</i>	0.1289	0.0289	0.0149	0.0378	0.2105
	22	<i>Carallia brachiata</i>	0.1194	0.0249	0.0149	0.0372	0.1963
	23	<i>Catunaregam spathulifolia</i>	0.0738	0.0148	0.0095	0.0235	0.1216
	24	<i>Dalbergia oliveri</i>	0.0740	0.0135	0.0103	0.0248	0.1225
	25	<i>Flacourtia indica</i>	0.0502	0.0097	0.0067	0.0162	0.0828
	26	<i>Anneslea fragrans</i>	0.0243	0.0041	0.0036	0.0087	0.0407
	27	<i>Dalbergia cana</i>	0.0195	0.0031	0.0030	0.0072	0.0327
	28	<i>Colona floribunda</i>	0.0193	0.0027	0.0032	0.0079	0.0331
	29	<i>Syzygium oblatum</i>	0.0132	0.0019	0.0021	0.0051	0.0224
	30	<i>Albizia odoratissima</i>	0.0128	0.0019	0.0021	0.0050	0.0218
	31	<i>Ulmus lancaefolia</i>	0.0090	0.0011	0.0016	0.0040	0.0158
	32	<i>Heteropanax fragraus</i>	0.0077	0.0010	0.0013	0.0032	0.0133
	33	<i>Lagerstroemia macrocarpa</i>	0.0048	0.0005	0.0009	0.0024	0.0086
	34	<i>Pterocarpus macrocarpus</i>	0.0038	0.0004	0.0007	0.0018	0.0068
	35	<i>Phyllanthus emblica</i>	0.0029	0.0003	0.0006	0.0014	0.0052
	36	<i>Alangium chinense</i>	0.0026	0.0003	0.0005	0.0013	0.0046
		Total	612.80	225.41	30.93	131.25	1,000.40

Table 3-13 (Continued)

Plot	No	Species	Calcium (kg.ha <sup>-1</sup> )				
			Stem	Branch	Leaf	Root	Total
1+2 (Total)	1	<i>Dipterocarpus tuberculatus</i>	419.7544	163.8651	16.8512	84.7242	874.1026
	2	<i>Shorea obtusa</i>	68.4831	25.0981	4.2449	15.4869	143.8871
	3	<i>Gluta usitata</i>	58.3893	21.9603	2.7164	12.2025	121.6965
	4	<i>Canarium subulatum</i>	21.6634	6.1779	1.8049	5.4704	45.3629
	5	<i>Dipterocarpus obtusifolius</i>	16.4710	6.6801	0.6034	3.2544	34.3372
	6	<i>Aporosa villosa</i>	13.0099	2.9978	1.4548	3.7679	27.5174
	7	<i>Irvingia malayana</i>	6.6772	2.2116	0.4288	1.5409	13.9538
	8	<i>Millettia leucantha</i>	4.8129	1.3357	0.4188	1.2430	10.0979
	9	<i>Strychnos nux-vomica</i>	2.6565	0.5528	0.3306	0.8293	5.6737
	10	<i>Garcinia cowa</i>	1.9528	0.6804	0.1031	0.4238	4.0632
	11	<i>Semecarpus albescens</i>	1.6289	0.4193	0.1583	0.4399	3.4253
	12	<i>Anneslea fragrans</i>	1.1401	0.3358	0.0880	0.2790	2.3813
	13	<i>Terminalia chebula</i>	1.1327	0.2920	0.1096	0.3050	2.3812
	14	<i>Terminalia alata</i>	0.9130	0.2523	0.0797	0.2383	1.9197
	15	<i>Dioecrescis erythroclada</i>	0.7394	0.1879	0.0728	0.1994	1.5529
	16	<i>Flacourtia indica</i>	0.7048	0.1791	0.0695	0.1914	1.4823
	17	<i>Quercus kerrii</i>	0.5796	0.1527	0.0540	0.1513	1.2129
	18	<i>Wendlandia tinctoria</i>	0.5346	0.1111	0.0672	0.1738	1.1545
	19	<i>Stereospermum neuranthum</i>	0.4574	0.1112	0.0479	0.1274	0.9634
	20	<i>Mitragyna rotundifolia</i>	0.2962	0.0751	0.0293	0.0794	0.6212
	21	<i>Dillenia oborata</i>	0.2927	0.0740	0.0291	0.0798	0.6158
	22	<i>Bridelia pierrei</i>	0.2498	0.0485	0.0332	0.0821	0.5379
	23	<i>Schleichera oleosa</i>	0.2139	0.0466	0.0254	0.0641	0.4538
	24	<i>Glochidion velutinum</i>	0.1066	0.0243	0.0121	0.0317	0.2269
	25	<i>Shorea siamensis</i>	0.1067	0.0190	0.0151	0.0371	0.2319
	26	<i>Catunaregam tomentosa</i>	0.1014	0.0261	0.0098	0.0268	0.2123
	27	<i>Memecylon plebejum</i>	0.0963	0.0234	0.0101	0.0269	0.2030
	28	<i>Catunaregam spathulifolia</i>	0.0909	0.0157	0.0133	0.0328	0.1993
	29	<i>Diospyros ehretioides</i>	0.0844	0.0206	0.0088	0.0233	0.1776
	30	<i>Colona floribunda</i>	0.0865	0.0127	0.0139	0.0339	0.1926
	31	<i>Albizia odoratissima</i>	0.0686	0.0124	0.0096	0.0237	0.1489
	32	<i>Lagerstroemia macrocarpa</i>	0.0653	0.0125	0.0088	0.0218	0.1412
	33	<i>Carallia brachiata</i>	0.0597	0.0124	0.0074	0.0186	0.1275
	34	<i>Dalbergia oliveri</i>	0.0457	0.0079	0.0066	0.0160	0.0992
	35	<i>Dalbergia cochinchinensis</i>	0.0357	0.0065	0.0050	0.0120	0.0770
	36	<i>Pterocarpus macrocarpus</i>	0.0262	0.0049	0.0036	0.0087	0.0565
	37	<i>Ulmus lancaefolia</i>	0.0120	0.0017	0.0020	0.0049	0.0270
	38	<i>Lagerstroemia speciosa</i>	0.0103	0.0014	0.0017	0.0043	0.0232
	39	<i>Dalbergia cana</i>	0.0097	0.0016	0.0015	0.0036	0.0213
	40	<i>Syzygium oblatum</i>	0.0086	0.0012	0.0014	0.0035	0.0194
	41	<i>Manilkara littoralis</i>	0.0058	0.0008	0.0009	0.0023	0.0128
	42	<i>Antidesma acidum</i>	0.0046	0.0006	0.0008	0.0021	0.0107
	43	<i>Heteropanax fragraus</i>	0.0038	0.0005	0.0007	0.0016	0.0087
	44	<i>Phyllanthus emblica</i>	0.0015	0.0002	0.0003	0.0007	0.0034
	45	<i>Alangium chinense</i>	0.0013	0.0001	0.0002	0.0006	0.0031
		Total	623.79	234.05	29.95	131.69	1,301.62

**Table 3-14** Biomass magnesium amounts of tree species in DDF without fire

Plot	No	Species	Magnesium (kg.ha <sup>-1</sup> )				
			Stem	Branch	Leaf	Root	Total
1	1	<i>Dipterocarpus tuberculatus</i>	101.3270	44.7308	10.6169	10.3174	166.9920
	2	<i>Gluta usitata</i>	12.2465	4.9533	1.6714	1.3338	20.2050
	3	<i>Shorea obtusa</i>	11.8723	5.7361	1.3262	1.2050	20.1397
	4	<i>Canarium subulatum</i>	6.1872	2.0586	1.2815	0.7710	10.2983
	5	<i>Irvingia malayana</i>	2.2047	0.8629	0.3341	0.2492	3.6510
	6	<i>Aporosa villosa</i>	2.1242	0.5512	0.6319	0.3117	3.6190
	7	<i>Millettia leucantha</i>	1.2711	0.3771	0.3170	0.1713	2.1365
	8	<i>Garcinia cowa</i>	0.8736	0.3402	0.1237	0.0963	1.4338
	9	<i>Semecarpus albescens</i>	0.7287	0.2096	0.1899	0.1000	1.2282
	10	<i>Strychnos nux-vomica</i>	0.6460	0.1462	0.2212	0.1042	1.1177
	11	<i>Anneslea fragrans</i>	0.5046	0.1669	0.1034	0.0624	0.8374
	12	<i>Terminalia chebula</i>	0.3491	0.1012	0.0898	0.0476	0.5877
	13	<i>Terminalia alata</i>	0.3171	0.0964	0.0764	0.0428	0.5327
	14	<i>Flacourtia indica</i>	0.3041	0.0871	0.0794	0.0417	0.5123
	15	<i>Quercus kerrii</i>	0.1924	0.0580	0.0463	0.0251	0.3219
	16	<i>Dioecrescis erythroclada</i>	0.1611	0.0445	0.0443	0.0226	0.2726
	17	<i>Wendlandia tinctoria</i>	0.1506	0.0314	0.0557	0.0267	0.2644
	18	<i>Stereospermum colais</i>	0.1466	0.0380	0.0435	0.0214	0.2496
	19	<i>Bridelia pierrei</i>	0.0829	0.0170	0.0309	0.0144	0.1452
	20	<i>Glochidion velutinum</i>	0.0477	0.0122	0.0146	0.0072	0.0816
	21	<i>Memecylon plebejum</i>	0.0431	0.0117	0.0121	0.0061	0.0730
	22	<i>Diospyros ehretioides</i>	0.0378	0.0103	0.0106	0.0053	0.0639
	23	<i>Colona floribunda</i>	0.0344	0.0057	0.0148	0.0068	0.0616
	24	<i>Lagerstroemia macrocarpa</i>	0.0282	0.0061	0.0100	0.0047	0.0490
	25	<i>Albizia odoratissima</i>	0.0278	0.0057	0.0103	0.0048	0.0487
	26	<i>Catunaregam spathulifolia</i>	0.0242	0.0041	0.0102	0.0048	0.0433
	27	<i>Dalbergia cochinchinensis</i>	0.0160	0.0032	0.0060	0.0027	0.0279
	28	<i>Pterocarpus macrocarpus</i>	0.0109	0.0023	0.0039	0.0018	0.0189
	29	<i>Shorea siamensis</i>	0.0068	0.0011	0.0030	0.0014	0.0122
	30	<i>Lagerstroemia speciosa</i>	0.0046	0.0007	0.0021	0.0010	0.0083
	31	<i>Dalbergia dongnaiensis</i>	0.0039	0.0006	0.0017	0.0008	0.0070
	32	<i>Ulmus lancaefolia</i>	0.0034	0.0006	0.0014	0.0007	0.0060
	33	<i>Dillenia oborata</i>	0.0033	0.0004	0.0016	0.0007	0.0060
	34	<i>Manilkara littoralis</i>	0.0026	0.0004	0.0011	0.0005	0.0046
	35	<i>Antidesma acidum</i>	0.0021	0.0003	0.0010	0.0005	0.0038
	36	<i>Syzygium oblatum</i>	0.0009	0.0001	0.0004	0.0002	0.0017
		Total	141.99	60.67	17.39	15.01	235.06

**Table 3-14** (Continued)

Plot	No	Species	Magnesium (kg.ha <sup>-1</sup> )				
			Stem	Branch	Leaf	Root	Total
2	1	<i>Dipterocarpus tuberculatus</i>	86.4579	37.2018	9.6045	8.9381	142.2022
	2	<i>Shorea obtusa</i>	18.7648	6.8129	3.7676	2.3147	31.6601
	3	<i>Gluta usitata</i>	13.8751	6.0269	1.5882	1.4395	22.9296
	4	<i>Dipterocarpus obtusifolius</i>	7.3686	3.3400	0.7241	0.7396	12.1724
	5	<i>Aporosa villosa</i>	3.6960	0.9477	1.1138	0.5446	6.3022
	6	<i>Canarium subulatum</i>	3.5043	1.0304	0.8843	0.4722	5.8913
	7	<i>Millettia leucantha</i>	0.8821	0.2907	0.1856	0.1112	1.4695
	8	<i>Irvingia malayana</i>	0.7825	0.2429	0.1804	0.1010	1.3068
	9	<i>Strychnos nux-vomica</i>	0.5424	0.1302	0.1756	0.0842	0.9324
	10	<i>Dioecrescis erythroclada</i>	0.1696	0.0495	0.0431	0.0227	0.2849
	11	<i>Terminalia chebula</i>	0.1576	0.0448	0.0417	0.0217	0.2658
	12	<i>Mitragyna rotundifolia</i>	0.1325	0.0375	0.0351	0.0180	0.2232
	13	<i>Dillenia oborata</i>	0.1277	0.0366	0.0333	0.0174	0.2150
	14	<i>Schleichera oleosa</i>	0.0957	0.0233	0.0305	0.0146	0.1640
	15	<i>Terminalia alata</i>	0.0914	0.0297	0.0192	0.0114	0.1517
	16	<i>Wendlandia tinctoria</i>	0.0886	0.0241	0.0249	0.0128	0.1504
	17	<i>Quercus kerrii</i>	0.0668	0.0183	0.0185	0.0093	0.1130
	18	<i>Stereospermum colais</i>	0.0581	0.0175	0.0139	0.0075	0.0970
	19	<i>Catunaregam tomentosa</i>	0.0454	0.0130	0.0118	0.0061	0.0763
	20	<i>Shorea siamensis</i>	0.0410	0.0084	0.0152	0.0070	0.0716
	21	<i>Bridelia pierrei</i>	0.0288	0.0072	0.0089	0.0043	0.0493
	22	<i>Carallia brachiata</i>	0.0267	0.0062	0.0089	0.0042	0.0461
	23	<i>Catunaregam spathulifolia</i>	0.0165	0.0037	0.0057	0.0027	0.0286
	24	<i>Dalbergia oliveri</i>	0.0165	0.0034	0.0062	0.0028	0.0289
	25	<i>Flacourtia indica</i>	0.0112	0.0024	0.0040	0.0018	0.0195
	26	<i>Anneslea fragrans</i>	0.0054	0.0010	0.0022	0.0010	0.0096
	27	<i>Dalbergia cana</i>	0.0044	0.0008	0.0018	0.0008	0.0077
	28	<i>Colona floribunda</i>	0.0043	0.0007	0.0019	0.0009	0.0078
	29	<i>Syzygium oblatum</i>	0.0030	0.0005	0.0013	0.0006	0.0053
	30	<i>Albizia odoratissima</i>	0.0029	0.0005	0.0012	0.0006	0.0051
	31	<i>Ulmus lancaefolia</i>	0.0020	0.0003	0.0010	0.0005	0.0037
	32	<i>Heteropanax fragraus</i>	0.0017	0.0003	0.0008	0.0004	0.0031
	33	<i>Lagerstroemia macrocarpa</i>	0.0011	0.0001	0.0006	0.0003	0.0020
	34	<i>Pterocarpus macrocarpus</i>	0.0009	0.0001	0.0004	0.0002	0.0016
	35	<i>Phyllanthus emblica</i>	0.0007	0.0001	0.0003	0.0002	0.0012
	36	<i>Alangium chinense</i>	0.0006	0.0001	0.0003	0.0001	0.0011
		Total	137.07	56.35	18.56	14.91	226.90

Table 3-14 (Continued)

Plot	No	Species	Magnesium (kg ha <sup>-1</sup> )				
			Stem	Branch	Leaf	Root	Total
1+2 (Total)	1	<i>Dipterocarpus tuberculatus</i>	93.8924	40.9663	10.1107	9.6277	196.0140
	2	<i>Shorea obtusa</i>	15.3186	6.2745	2.5469	1.7599	32.5464
	3	<i>Gluta usitata</i>	13.0608	5.4901	1.6298	1.3866	27.3376
	4	<i>Canarium subulatum</i>	4.8458	1.5445	1.0829	0.6216	10.2965
	5	<i>Dipterocarpus obtusifolius</i>	3.6843	1.6700	0.3620	0.3698	7.6978
	6	<i>Aporosa villosa</i>	2.9101	0.7494	0.8729	0.4282	6.3191
	7	<i>Irvingia malayana</i>	1.4936	0.5529	0.2573	0.1751	3.1517
	8	<i>Millettia leucantha</i>	1.0766	0.3339	0.2513	0.1412	2.2969
	9	<i>Strychnos nux-vomica</i>	0.5942	0.1382	0.1984	0.0942	1.3148
	10	<i>Garcinia cowa</i>	0.4368	0.1701	0.0618	0.0482	0.9135
	11	<i>Semecarpus albescens</i>	0.3644	0.1048	0.0950	0.0500	0.7816
	12	<i>Anneslea fragrans</i>	0.2550	0.0840	0.0528	0.0317	0.5391
	13	<i>Terminalia chebula</i>	0.2534	0.0730	0.0657	0.0347	0.5432
	14	<i>Terminalia alata</i>	0.2042	0.0631	0.0478	0.0271	0.4376
	15	<i>Dioecrescis erythroclada</i>	0.1654	0.0470	0.0437	0.0227	0.3541
	16	<i>Flacourtia indica</i>	0.1577	0.0448	0.0417	0.0217	0.3384
	17	<i>Quercus kerrii</i>	0.1296	0.0382	0.0324	0.0172	0.2756
	18	<i>Wendlandia tinctoria</i>	0.1196	0.0278	0.0403	0.0197	0.2700
	19	<i>Stereospermum neuranthum</i>	0.1023	0.0278	0.0287	0.0145	0.2203
	20	<i>Mitragyna rotundifolia</i>	0.0663	0.0188	0.0176	0.0090	0.1415
	21	<i>Dillenia obovata</i>	0.0655	0.0185	0.0174	0.0091	0.1406
	22	<i>Bridelia pierrei</i>	0.0559	0.0121	0.0199	0.0093	0.1256
	23	<i>Schleichera oleosa</i>	0.0478	0.0116	0.0152	0.0073	0.1046
	24	<i>Glochidion velutinum</i>	0.0239	0.0061	0.0073	0.0036	0.0524
	25	<i>Shorea siamensis</i>	0.0239	0.0048	0.0091	0.0042	0.0546
	26	<i>Catunaregam tomentosa</i>	0.0227	0.0065	0.0059	0.0030	0.0483
	27	<i>Memecylon plebejum</i>	0.0215	0.0059	0.0060	0.0031	0.0465
	28	<i>Catunaregam spathulifolia</i>	0.0203	0.0039	0.0080	0.0037	0.0473
	29	<i>Diospyros ehretioides</i>	0.0189	0.0051	0.0053	0.0026	0.0406
	30	<i>Colona floribunda</i>	0.0193	0.0032	0.0083	0.0039	0.0463
	31	<i>Albizia odoratissima</i>	0.0153	0.0031	0.0058	0.0027	0.0350
	32	<i>Lagerstroemia macrocarpa</i>	0.0146	0.0031	0.0053	0.0025	0.0331
	33	<i>Carallia brachiata</i>	0.0134	0.0031	0.0045	0.0021	0.0295
	34	<i>Dalbergia oliveri</i>	0.0102	0.0020	0.0040	0.0018	0.0233
	35	<i>Dalbergia cochinchinensis</i>	0.0080	0.0016	0.0030	0.0014	0.0180
	36	<i>Pterocarpus macrocarpus</i>	0.0059	0.0012	0.0022	0.0010	0.0132
	37	<i>Ulmus lancaefolia</i>	0.0027	0.0004	0.0012	0.0006	0.0065
	38	<i>Lagerstroemia speciosa</i>	0.0023	0.0003	0.0010	0.0005	0.0057
	39	<i>Dalbergia cana</i>	0.0022	0.0004	0.0009	0.0004	0.0051
	40	<i>Syzygium oblatum</i>	0.0019	0.0003	0.0009	0.0004	0.0047
	41	<i>Manilkara littoralis</i>	0.0013	0.0002	0.0006	0.0003	0.0031
	42	<i>Antidesma acidum</i>	0.0010	0.0001	0.0005	0.0002	0.0027
	43	<i>Heteropanax fragraus</i>	0.0009	0.0001	0.0004	0.0002	0.0021
	44	<i>Phyllanthus emblica</i>	0.0003	0.0000	0.0002	0.0001	0.0009
	45	<i>Alangium chinense</i>	0.0003	0.0000	0.0001	0.0001	0.0008
Total			139.53	58.51	17.97	14.96	292.68

**Table 3-15** Summarized data of nutrient amounts stored in biomass of tree species in DDF with and without fire

Nutrient	DDF with annual fire					DDF without fire				
	Stem	Branch	Leaf	Root	Total	Stem	Branch	Leaf	Root	Total
Carbon (Mg.ha <sup>-1</sup> )	34.3	11.1	0.9	6.3	52.6	41.0	14.2	1.0	7.2	63.4
Nitrogen (kg.ha <sup>-1</sup> )	363.8	121.3	31.0	69.3	585.4	435.0	155.1	31.8	79.3	896.6
Phosphorus (kg.ha <sup>-1</sup> )	54.9	22.9	2.5	2.6	82.9	65.7	29.3	2.6	3.0	123.5
Potassium (kg.ha <sup>-1</sup> )	254.0	91.6	21.4	35.3	402.3	303.7	117.0	22.0	40.4	610.7
Calcium (kg.ha <sup>-1</sup> )	521.7	183.1	29.2	115.1	849.1	623.8	234.1	30.0	131.7	1,301.6
Magnesium (kg.ha <sup>-1</sup> )	116.7	45.8	17.5	13.1	193.1	139.5	58.5	18.0	15.0	292.7

### 3.4 Discussion

The total tree biomass in DDF with annual fire was 106.6 Mg.ha<sup>-1</sup>, separated into stem, branch, leaf, and root components of 68.6, 22.9, 1.9 and 13.1 Mg.ha<sup>-1</sup>, respectively. The biomass carbon was calculated as 52.6 Mg.ha<sup>-1</sup> including amounts in stem, branch, leaf, and root of 34.3, 11.1, 0.9 and 6.3 Mg.ha<sup>-1</sup>, respectively.

The total tree biomass in non-fire DDF was higher than DDF with annual fire, 128.3 Mg.ha<sup>-1</sup>. The amounts allocated in stem, branch, leaf, and root were in the order of 82.1, 29.3, 2.0 and 15.0 Mg.ha<sup>-1</sup>, respectively. The stored carbon in biomass was 63.4 Mg.ha<sup>-1</sup> which accumulated in stem, branch, leaf, and root for 41.0, 14.2, 1.0 and 7.2 Mg.ha<sup>-1</sup>, respectively. The tree growths are thought to be reduced in DDF with annual fire. As a result, biomass and carbon storage in DDF without fire were higher than DDF with annual fire. Thus, forest fire protection could increase the carbon stocks in DDF.

Aboveground biomass of non-fire DDF was still lower than the average amount of DDF in Thailand (126.1±52.7 Mg.ha<sup>-1</sup>, in range of 28.5-260.5 Mg.ha<sup>-1</sup>, divided in stems, branch and leaves as 87.9±35.0, 37.0±17.7 and 1.3±0.3 Mg.ha<sup>-1</sup>, respectively) (Sahunalu and Jamroenprucksa, 1980), but similar to Phu Phan Royal Development Study Center, Sakon Nakhon Province which had a range of 84.0-123.4 Mg.ha<sup>-1</sup> (Pongboon, 2000). Many factors have influences on the variation such as tree species composition, topography, microclimate and forest fire.

The forest conditions are important factor of variable amounts of forest biomass. Wongin (2011) reported that the poor DDF on granitic rock at the Petrified Wood Forest Park in Tak province had the low biomass and stored carbon of 48.13 and 23.78 Mg.ha<sup>-1</sup>, whereas the poor DDF on sedimentary rock in the same forest park had also the low amounts of 55.29 and 27.27 Mg.ha<sup>-1</sup>, respectively (Niamphulthong, 2011).

Phonchaluen (2009) compared amounts of forest biomass and stored carbon in two DDF community forests at Ban Sai Thong, Pa Sak Sub-district, Lamphun province (Phonchaluen, 2009). One was 50-years preserved forest with intermediate forest condition, and newly established community forests with very poor condition. The biomass amounts in the former and newly established forests were 119.83 and 59.16 Mg.ha<sup>-1</sup>, respectively.