

## CHAPTER 2

### Tree Biomass in a Series of Pine Plantations and Fragmented Forests

#### Abstract

Biomass of tree species in a series of *Pinus kesiya* plantations and adjacent fragmented forests in Boakaew highland watershed, Chiang Mai province, were studied. The plantations included 14- to 34-year-old stands. Totally, sixty three sampling plots, 40 x 40 m<sup>2</sup> in size (three plots/age-class stand) were used. Stem diameter at 1.3 m above ground and height of all trees in each plot were measured. The tree biomass varied among plantations, 85.5 to 221.9 Mg.ha<sup>-1</sup>, separated to be 23.6-212.7 Mg.ha<sup>-1</sup> for *P. kesiya* as, and 8.1-94.1 Mg.ha<sup>-1</sup> for succession trees. The forest biomass of pine plantations was lower than fragmented forests, 117.39-253.3 Mg.ha<sup>-1</sup> (201.1 Mg.ha<sup>-1</sup> in average). The succession species had the important role on biomass stocks in plantations. The high proportion of biomass was allocated in stem component, followed by root, branch and leaf. The majority of these tree species were in the families of Fagaceae, Theaceae, Myrtaceae, Leguminosae, Euphorbiaceae, Rubiaceae and Lauraceae.

#### 2.1 Introduction

Forest clearing to agricultural land is the serious problem in highland watershed of northern Thailand. This resulted in deforestation and fragmentation. Loss of biodiversity due to the forest destruction is critical. Degrade of the watershed has been occurred caused by reducing water storage and higher surface runoff. The carbon storages in forest ecosystems have been decreased whereas the smaller amounts are accumulated in agricultural ecosystems. Moreover, the slash and burn agriculture usually leads to release organic carbon into atmospheric CO<sub>2</sub>. The CO<sub>2</sub> release into atmosphere may be higher due to reduction of ecosystem carbon storages which will further affect on increasing global warming.

Reforestation on highland watershed of Thailand is mainly planting a three needle pine species, *Pinus kesiya*. The total plantation area of about 1,500,000 ha was reported (Royal Forest Department, 1993). The plantation forest absorbs carbon dioxide and converts to organic compounds of carbohydrate which are accumulated in various plant organs. This process is very effective in reducing carbon dioxide in the atmosphere.

The plantation forests play the important role to store biomass carbon with variable amounts depending on tree species, age and growth rates, rainfall, season, site condition, etc. The carbon accumulations can be very effective in the young stand and will be reduced in the older stand (Ciesla, 1995).

The reforestation had been conducted at the Boakaew Watershed Management Station, Chiang Mai province, during 1975-1995 with the total area of 2,285 ha. A pine, *Pinus kesiya*, was planted in pure stands because this pine is a pioneer species which tolerates to harsh sites, poor soil and grass competition (Harcharik and Kunkle, 1978). It has good survival and fast growth rate (Bandaratillake, 1989). The aims of this research are to assess biomass accumulations of pine trees and succession tree

species grown in a series of pine plantations, and adjacent fragmented montane forests. The data are useful information for improving plantation techniques of reforestation.

## 2.2 Study Area

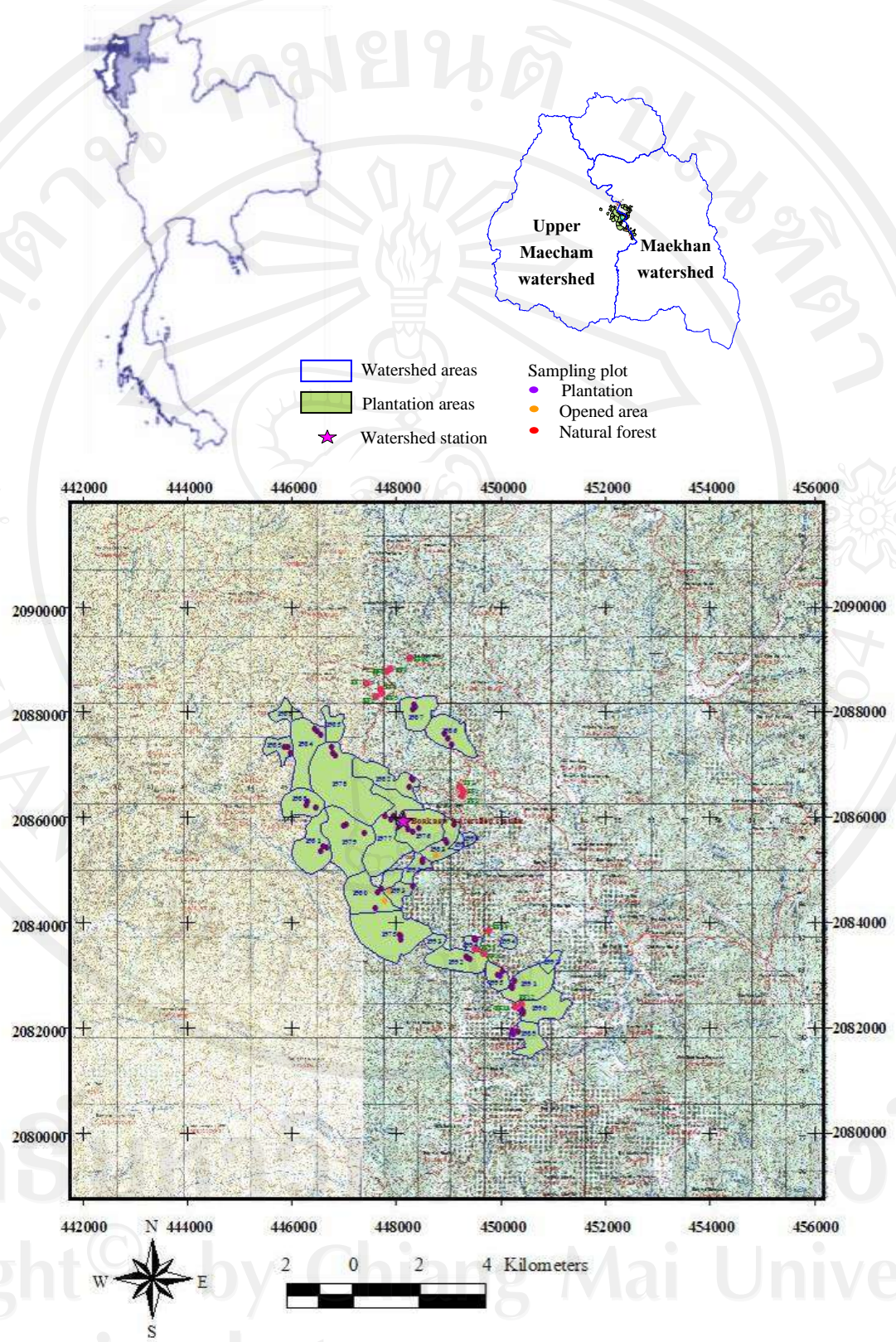
The research area was located in the Boakaew Watershed Management Station, (18<sup>o</sup>45'-21<sup>o</sup>00'N, 98<sup>o</sup>25'-98<sup>o</sup>40'E), Chiang Mai province, Thailand, about 82 km north of Chiang Mai province. The altitude of research site ranges from 1,200 to 1,600 m above mean sea level (Figure 2-1). The climate is cool throughout a year. Mean monthly temperature is 20.9 °C, with a maximum of 25.4 °C in April and minimum of 16.4 °C in December. Average annual rainfall is 1,894 mm. The forest type is pine-lower montane forest.

The local people utilize the natural forest, either wood or non-wood products. Some tree species were cut for house construction, and some pine trees were fallen for collecting cones, and sold to merchant. Many oaks were cut for making fire wood.

The main causes of deforestation in Boakaew Watershed Management Station were forest clearing for agriculture and shifting cultivation. Forest rehabilitation in this area used the native pioneer fast growing species including *Pinus kesiya*, *Prunus cerasoides*, *Docynia indica* and *Betula alnoides* planted in pure stands to recover the degraded watershed land during 1975-1995 with the area of 2,285 ha (Table 2-1). After 1995, the mixed plantation of local species was used.

**Table 2-1** Plantation areas of Boakaew Watershed Management Station

Planting Year	Age (year)	Area (ha)	Species	Spacing (m <sup>2</sup> )
1975	34	226	<i>Pinus kesiya</i>	4 x 4
1976	33	144	<i>Pinus kesiya</i>	4 x 4
1977	32	115	<i>Pinus kesiya</i> , <i>Docynia indica</i>	4 x 4
1978	31	229	<i>Pinus kesiya</i> , <i>Docynia indica</i>	4 x 4
1979	30	160	<i>Pinus kesiya</i> , <i>Docynia indica</i>	4 x 4
1980	29	146	<i>Pinus kesiya</i> , <i>Docynia indica</i>	4 x 4
1981	28	128	<i>Pinus kesiya</i> , <i>Docynia indica</i>	4 x 4
1982	27	80	<i>Pinus kesiya</i>	4 x 4
1983	26	72	<i>Pinus kesiya</i>	4 x 4
1984	25	64	<i>Pinus kesiya</i>	4 x 4
1985	24	96	<i>Pinus kesiya</i>	4 x 4
1986	23	88	<i>Pinus kesiya</i>	4 x 4
1987	22	80	<i>Pinus kesiya</i>	4 x 4
1988	21	84	<i>Pinus kesiya</i>	4 x 4
1989	20	69	<i>Pinus kesiya</i>	4 x 4
1990	19	96	<i>Pinus kesiya</i>	4 x 4
1991	18	96	<i>Pinus kesiya</i> , <i>Prunus cerasoides</i>	4 x 4
1992	17	96	<i>Pinus kesiya</i> , <i>Prunus cerasoides</i> , <i>Docynia indica</i>	4 x 4
1993	16	128	<i>Pinus kesiya</i> , <i>Prunus cerasoides</i> , <i>Docynia indica</i> , <i>Betula alnoides</i> , <i>Ternstroemia gymnanthera</i>	4 x 4
1994	15	48	<i>Pinus kesiya</i> , <i>Prunus cerasoides</i> , <i>Docynia indica</i> , <i>Betula alnoides</i> , <i>Mangifera sp.</i>	4 x 4
1995	14	40	<i>Pinus kesiya</i> , <i>Prunus cerasoides</i> , <i>Docynia indica</i> , <i>Betula alnoides</i> , <i>Mangifera sp.</i> , <i>Diospyros sp.</i>	4 x 4
Total		2,285		



**Figure 2-1** Location of research areas at Boakaew Watershed Management Station

## 2.3 Materials and Methods

### 2.3.1 Vegetation Sampling

Twenty-one age class pine plantations including 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33 and 34 years old were chosen. Three sampling plots (replications), 40 x 40 m<sup>2</sup> in size, were arranged in each age-class plantation. Totally, sixty three plots were used for growth and wood production studies of pine plantations. In each plot, stem girth at breast height (gbh) and tree height of pine and other trees were measured for calculating the forest biomass.

### 2.3.2 Physical Data of Sampling Plots

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

### 2.3.3 Tree Biomass of *Pinus kesiya* Plantations

The data of stem girth at breast height (gbh) and tree height of pine trees in a series of plantations were used for biomass calculation. Four sample pine trees were cut from four age-class plantations from the young to old plantations; 20, 26, 30 and 33 years old. The fallen trees were measured for biomass according to a stratified-clip technique. Finally, the collected data were used to adjust the allometric equation. (Sahunalu, 1995)

$$W = A (D^2H)^h$$

Where, W = biomass of stem, branch, leaf or root (dry weight per area)  
 D = diameter (cm)  
 H = tree height (m)  
 A, h = constant

### 2.3.4 Forest Biomass of Fragmented Forests

Biomass accumulations in adjacent fragmented forests and other succession broad-leaved trees in pine plantations are calculated using allometric equations of Tsutsumi *et al.* (1983);

$$\begin{array}{lll} W_S \text{ (stem)} & = & 0.0509 (D^2H)^{0.919} \quad R^2 = 0.978 \\ W_B \text{ (branch)} & = & 0.00893 (D^2H)^{0.977} \quad R^2 = 0.890 \\ W_L \text{ (leaf)} & = & 0.0140 (D^2H)^{0.669} \quad R^2 = 0.714 \\ W_R \text{ (root)} & = & 0.0313 (D^2H)^{0.805} \quad R^2 = 0.981 \end{array}$$

Where, W = biomass (kg)  
 D = diameter (cm)  
 H = height (m)

## 2.4 Results

### 2.4.1 Biomass of Pine Trees in a Series of Pine Plantations

#### (1) Pine Growths

The growths of pine trees in 21 age-class pine plantations of 14 to 34 years old at Boakaew Watershed Management Station were analyzed in mean and increment values of stem diameter at breast height (dbh) and tree height for each age-class stand (Table 2-2). The height and stem diameter growths were varied among different age plantations. However, they did not increase continuously with stand ages. The height and dbh of pine trees in some older stands were lower than the younger stands. Some plantations covered the good site with more fertile soil and higher moisture. In contrast, some grew on the steep upper/ridge slope which had shallow soil and dry site. Different densities of pine trees and succession tree species are another important factor affecting pine growths.

The mean height (H) and dbh of these stands were in ranges of 15.31-23.30 m and 24.24-35.37 cm, respectively. The annual height increment varied between 0.52-1.15 m with the mean of 0.81 m/yr, whereas the annual dbh increment was 0.94-2.24 cm, and 1.28 cm/yr of mean value.

**Table 2-2** Pine growths in a series of pine plantations with different stand ages

Ages (yrs)	Growths		Annual growth increment	
	H (m)	DBH (cm)	H (m/yr)	DBH (cm/yr)
14	16.13	31.35	1.15	2.24
15	15.31	28.69	1.02	1.91
16	17.59	27.61	1.10	1.73
17	15.87	26.44	0.93	1.56
18	17.14	29.33	0.95	1.63
19	17.32	26.08	0.91	1.37
20	17.07	27.03	0.85	1.35
21	19.01	26.98	0.91	1.28
22	17.11	25.72	0.78	1.17
23	18.41	25.70	0.80	1.12
24	18.23	24.24	0.76	1.01
25	18.47	25.25	0.74	1.01
26	19.72	29.81	0.76	1.15
27	20.26	26.46	0.75	0.98
28	18.68	33.44	0.67	1.19
29	15.13	28.53	0.52	0.98
30	19.58	32.79	0.65	1.09
31	21.49	35.37	0.69	1.14
32	20.46	32.32	0.64	1.01
33	23.30	34.52	0.71	1.05
34	21.47	32.10	0.63	0.94
Average			0.81	1.28



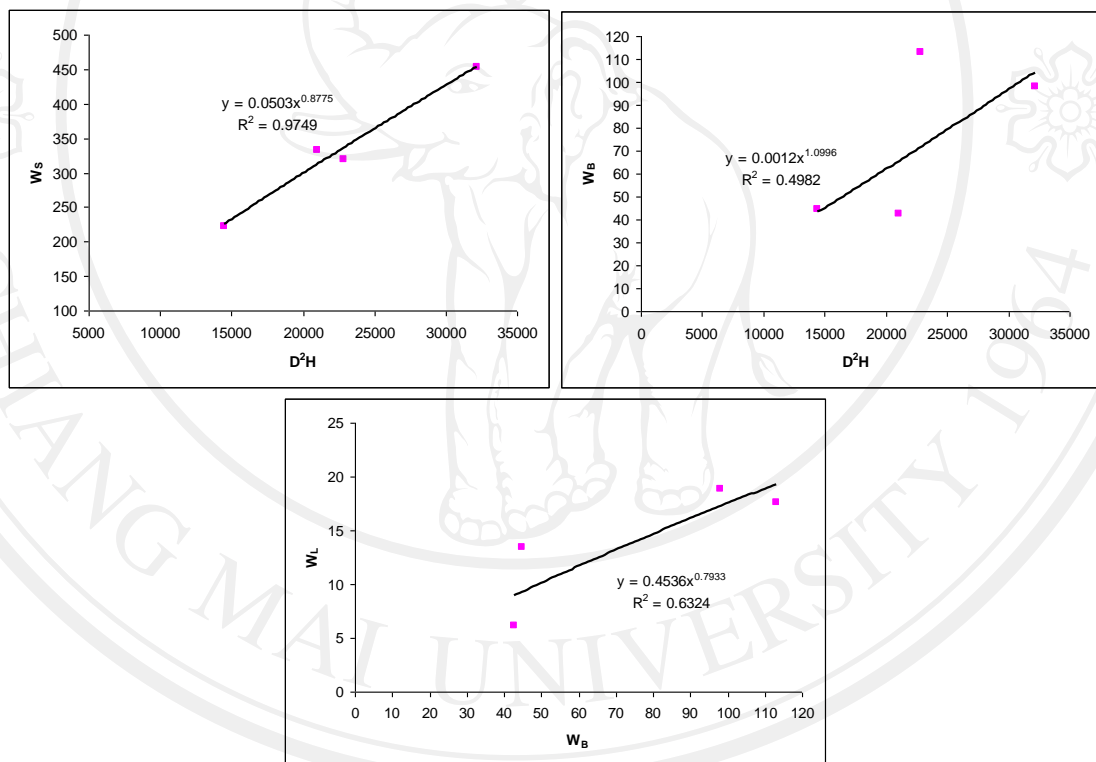
**Figure 2-2** Over views of pine plantations at Boakaew Watershed Management Station

## (2) Biomass of Pine Trees

Above-ground biomass of pine trees was calculated from allometric equations which were obtained by using four felling trees from different age-class plantations as following equations. The root biomass of pine trees was based on allometric equations of Tsutsumi *et al.* (1983).

$$\begin{aligned} W_S &= 0.0503 (D^2H)^{0.8775} & R^2 &= 0.9749 \\ W_B &= 0.0012 (D^2H)^{1.0996} & R^2 &= 0.4982 \\ W_L &= 0.4536 (W_B)^{0.7933} & R^2 &= 0.6324 \end{aligned}$$

Where,  
 W = biomass (kg)  
 D = diameter (cm)  
 H = height (m)



**Figure 2-3** Allometric equations of a above-ground biomass of pine

Similar to pine growths, the pine biomass in different age plantations did not increase continuously with stand ages. The values were 23.6 to 212.7 Mg.ha<sup>-1</sup>. The lowest amount was found in the 15-year-old stand, whereas the largest amount was occurred in the 33-year-old stand. The majority of pine biomass was allocated in the stem component, followed by root, branch and leaf (Table 2-3). The high fluctuation of pine biomass was observed among the pine plantations caused by many factors such as spacing of planting, tree densities, competition with succession trees, site conditions, etc.

**Table 2-3** Biomass of pine trees in a series of pine plantations

Age (year)	Tree biomass (Mg.ha <sup>-1</sup> )				
	Stem	Branch	Leaf	Root	Total
14	37.9	8.1	1.6	11.9	59.5
15	15.1	3.1	0.6	4.8	23.6
16	79.2	16.8	3.3	25.0	124.2
17	15.5	3.0	0.6	5.0	24.2
18	59.0	12.2	2.4	18.7	92.4
19	74.5	14.7	3.1	24.0	116.3
20	83.5	16.6	3.5	26.9	130.5
21	86.3	17.6	3.6	27.6	135.1
22	56.9	11.1	2.4	18.5	88.8
23	44.7	8.9	1.9	14.5	70.0
24	55.1	10.6	2.3	18.0	86.0
25	71.8	14.0	3.0	23.3	112.2
26	115.5	25.5	4.8	36.0	181.8
27	70.8	15.0	2.9	22.3	111.0
28	80.7	18.7	3.3	24.7	127.4
29	45.1	9.1	1.9	14.5	70.5
30	79.9	18.2	3.3	24.6	126.0
31	46.2	10.8	1.9	14.1	73.0
32	90.7	20.2	3.7	28.1	142.7
33	134.4	31.8	5.5	40.9	212.7
34	61.7	14.0	2.5	19.1	97.3

#### 2.4.2 Biomass of Succession Tree Species in a Series of Pine Plantations

The number of succession tree species in different age pine plantations was different, varying 16-69 species. The biomass amounts of these trees were calculated using the allometric equations of Tsutsumi *et al.* (1983).

The results showed that the biomass in these pine plantations were different from 8.1 to 94.1 Mg.ha<sup>-1</sup>. Their biomass did not increase with plantation ages. It was the lowest in 20-year-old stand, 8.1 Mg.ha<sup>-1</sup>, and the highest amount was occurred in 31-year-old stand, 94.1 Mg.ha<sup>-1</sup>. The larger biomass of succession trees was due to existing bigger trees with high density. These succession tree species played the important role on plantation biomass stocks. The majority of their biomass was allocated in stem component, followed by root, branch and leaf (Table 2-4).

#### (3) Total Forest Biomass in a Series of Plantations

The total forest biomass in a series of 21 age-class pine plantations involved biomass of pine and succession broad-leaved trees. The amounts were varied between 70.5-248.2 Mg.ha<sup>-1</sup> (Table 2-5 and Figure 2-4). They did not increase with stand ages. It was the lowest in 15-year-old stand, and the highest amount was observed in 26-year-old stand. The low amounts were found in plantations with altitude above 500 m msl., and those in areas between 1,314-1,453 m msl. had the high total biomass. The majority of total biomass was allocated in stem component, followed by root, branch and leaf (Table 2-6).

The contribution of succession trees to total biomass can be considered from the percentage distribution. The percentages of succession tree biomass were different among pine plantations. It was the highest in 17-year-old stand, and the lowest in 33-

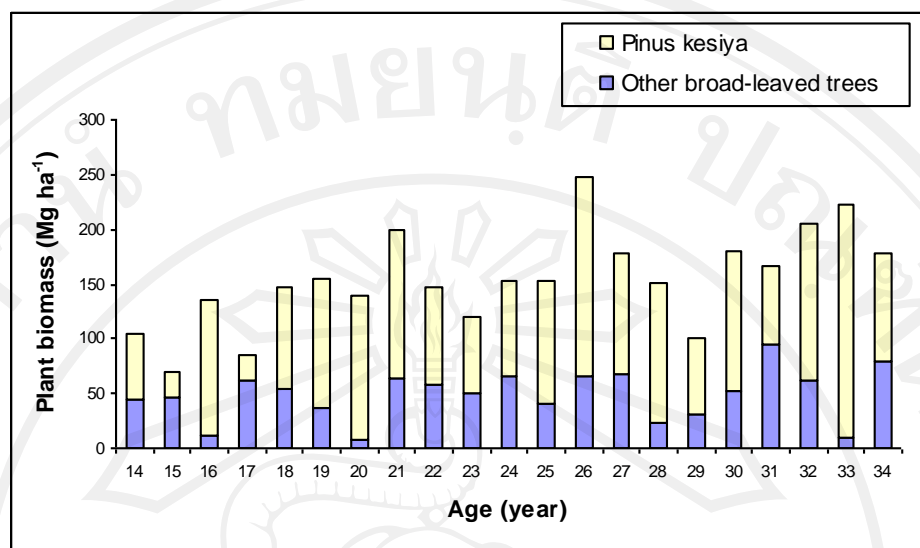


**Table 2-4** Biomass of succession trees in a series of pine plantations

Age (yrs)	Plant biomass (Mg.ha <sup>-1</sup> )				
	Stem	Branch	Leaf	Root	Total
14	28.8	5.0	1.2	9.8	44.8
15	29.9	5.9	1.2	9.9	46.9
16	7.1	1.1	0.3	2.5	11.1
17	39.1	7.2	1.6	13.4	61.3
18	34.6	5.4	1.4	12.3	53.8
19	24.1	4.1	1.0	8.3	37.6
20	5.2	0.8	0.2	1.8	8.1
21	41.0	7.8	1.7	13.7	64.3
22	37.8	5.0	1.6	14.1	58.6
23	31.9	5.2	1.3	11.3	49.7
24	41.5	10.8	1.7	12.5	66.6
25	26.1	5.1	1.1	8.7	41.0
26	41.6	10.3	1.7	12.7	66.4
27	43.4	7.6	1.8	14.7	67.5
28	15.1	2.8	0.6	5.0	23.5
29	19.3	3.6	0.8	6.4	30.1
30	33.5	7.4	1.4	10.8	53.1
31	59.8	12.5	2.5	19.3	94.1
32	39.4	9.7	1.6	12.0	62.7
33	5.9	0.9	0.2	2.2	9.2
34	50.8	10.5	2.1	16.4	79.9

**Table 2-5** Total forest biomass in a series of pine plantations

Ages (yrs)	Altitude (m)	Plant biomass				
		<i>Pinus kesiya</i>		Succession trees		Total
		(Mg ha <sup>-1</sup> )	%	(Mg ha <sup>-1</sup> )	%	(Mg ha <sup>-1</sup> )
14	1,410	59.5	57.0	44.8	43.0	104.4
15	1,561	23.6	33.5	46.9	66.5	70.5
16	1,655	124.2	91.8	11.1	8.2	135.3
17	1,561	24.2	28.3	61.3	71.7	85.5
18	1,389	92.4	63.2	53.8	36.8	146.2
19	1,393	116.3	75.6	37.6	24.4	153.9
20	1,361	130.5	94.2	8.1	5.8	138.6
21	1,314	135.1	67.8	64.3	32.2	199.4
22	1,202	88.8	60.3	58.6	39.7	147.4
23	1,204	70.0	58.5	49.7	41.5	119.6
24	1,368	86.0	56.4	66.6	43.6	152.5
25	1,362	112.2	73.2	41.0	26.8	153.2
26	1,463	181.8	73.2	66.4	26.8	248.2
27	1,358	111.0	62.2	67.5	37.8	178.5
28	1,410	127.4	84.4	23.5	15.6	150.9
29	1,606	70.5	70.1	30.1	29.9	100.6
30	1,376	126.0	70.4	53.1	29.6	179.1
31	1,409	73.0	43.7	94.1	56.3	167.1
32	1,362	142.7	69.5	62.7	30.5	205.4
33	1,453	212.7	95.8	9.2	4.2	221.9
34	1,393	97.3	54.9	79.9	45.1	177.2



**Figure 2-4** Total forest biomass in a series of pine plantations

year-old stand. The biomass of succession trees was 71.7% in the 17-year-old stand which had the highest total biomass while the 33-year-old stand, the lowest total forest biomass ecosystem, had the value of 4.2%.

In 14-year-old stand, among 35 species of succession trees, *Glochidion sphaerogynum* (16.11%) had the highest biomass, followed by *Schima wallichii* (8.72%), *Albizia chinensis* (5.67%), *Callicarpa arborea* (2.75%), *Litsea* sp. (2.51%), *Castonopsis diversifolia* (2.33%), *Ficus ribes* (1.92%), *Eriolaena candollei* (1.71%), etc.

In 15-year-old stand, there was 53 species of succession trees. *S. wallichii* (13.65%) had the highest biomass. The trees having the lower biomass were *C. acuminatissima* (11.45%), *Engelhardtia spicata* (6.75%), *Beilschmiedia gammieana* (6.73%), *Dillenia aurea* (5.19%), *Ternstroemia gymnanthera* (5.05%), *Helicia terminalis* (3.68%), *Phoebe paniculata* (3.11%), *Trichilla connaroides* (2.88%), etc.

In 16-year-old stand, 32 species of succession trees were existed. *S. wallichii* (3.51%) had the highest biomass, followed by *Canarium subulatum* (1.30%), *Wendlandia tinctoria* (1.25%), *Spatholobus parviflorus* (1.12%), etc.

In 17-year-old stand, the high number as 60 species of succession trees was found. *S. wallichii* (10.63%) had the highest biomass, followed by *Myrica esculenta* (8.81%), *E. spicata* (7.44%), *C. diversifolia* (7.03%), *Quercus semiserrata* (6.79%), *H. terminalis* (5.82%), *C. acuminatissima* (4.43%), *Phoebe cathia* (3.97%), *W. tinctoria* (3.71%), *Syzygium albiflorum* (3.20%), *Elaeocarpus sphaericus* (2.75%), etc.

In 18-year-old stand, among 45 species of succession trees, *C. purpurea* (7.35%) had the highest biomass, followed by *S. wallichii* (3.58%), *E. candollei* (3.45%), *C. acuminatissima* (3.24%), *Quercus vestita* (3.14%), *C. diversifolia* (3.00%), *W. tinctoria* (2.82%), *G. sphaerogynum* (2.67%), *Dalbergia assamica* (2.10%), *Acacia megaladena* (1.84%), etc.

In 19-year-old stand, existing succession trees were 37 species. *C. diversifolia* (6.50%) had the highest biomass, followed by *E. candollei* (4.39%), *C. purpurea*

(4.35%), *Albizia chinensis* (2.88%), *W. tinctoria* (2.53%), *T. gymnanthera* (1.61%), etc.

In 20-year-old stand, the number succession tree species the lowest among plantations as 16 species. *Bauhinia variegata* (3.33%) had the highest biomass, followed by *E. candollei* (2.86%), *S. albiflorum* (0.69%), *C. diversifolia* (0.48%), etc.

In 21-year-old stand, there was 40 species of succession trees. *S. wallichii* (11.22%) had the highest biomass, followed by *C. acuminatissima* (4.87%), *Anneslea fragrans* (4.75%), *S. albiflorum* (3.52%), *C. diversifolia* (3.10%), *Lithocarpus elegans* (2.54%), *W. tinctoria* (2.00%), *E. sphaericus* (1.84%), *M. esculenta* (1.05%), *Buchanania lanzan* (1.02%), etc.

In 22-year-old stand, the high number as 60 species of succession trees was found. *Q. brandisiana* (9.53%) had the highest biomass, followed by *Q. vestita* (4.67%), *L. polystachyus* (4.06%), *Dalbergia cultrata* (3.03%), *S. wallichii* (2.82%), *W. tinctoria* (2.47%), *Gluta obovata* (2.20%), *L. elegans* (2.13%), *Tristania rufescens* (1.69%), *L. sootepensis* (1.65%), *C. purpurea* (1.59%), *F. ribes* (1.28%), *A. fragrans* (1.22%), etc.

In 23-year-old stand, the succession tree species in this stand were 49 species. *Q. vestita* (16.79%) had the highest biomass, followed by *L. polystachyus* (10.89%), *S. wallichii* (4.00%), *L. sootepensis* (2.45%), *L. elegans* (1.81%), *Q. kingiana* (1.71%), etc.

In 24-year-old stand, existing succession tree species were 45 species. *C. diversifolia* (22.49%) had the highest biomass, followed by *S. wallichii* (7.61%), *E. sphaericus* (5.45%), *Sacrospermum arboreum* (3.71%), *S. cumini* (3.65%), *H. terminalis* (2.03%), *Erythrina subumbrans* (1.66%), etc.

In 25-year-old stand, succession tree species in this stand consisted of 38 species. *S. wallichii* (8.74%) had the highest biomass, followed by *C. diversifolia* (5.00%), *S. albiflorum* (4.66%), *C. purpurea* (3.17%), *A. fragrans* (2.42%), *C. acuminatissima* (2.16%), *W. tinctoria* (1.36%), etc.

In 26-year-old stand, it was 30 species of succession tree species existed in this plantation. *S. wallichii* (11.86%) had the highest biomass, followed by *Q. semiserrata* (4.65%), *C. diversifolia* (4.59%), *H. nilagirica* (2.98%), *S. albiflorum* (1.76%), *T. gymnanthera* (1.64%), *Stereospermum neuranthum* (1.57%), *S. cumini* (1.12%), *C. purpurea* (0.94%), *D. aurea* (0.82%), *P. paniculata* (0.78%), etc.

In 27-year-old stand, the number of succession tree species was high as 69 species. *S. wallichii* (25.30%) had also the highest biomass. The lower amounts were found for *C. diversifolia* (2.66%), *G. sphaerogynum* (2.53%), *P. paniculata* (2.38%), *Elaeocarpus sphaericus* (2.18%), *D. velutina* (1.76%), *Betula alnoides* (1.63%), *B. lanzan* (1.51%), *C. purpurea* (1.40%), *W. tinctoria* (1.07%), etc.

In 28-year-old stand, 34 species of succession tree species was composed in this stand. The tree species having the highest biomass was *S. wallichii* (13.93%). They were followed by *E. spicata* (1.66%), *G. sphaerogynum* (1.48%), *Markhamia stipulata* (0.82%), *C. diversifolia* (0.79%), etc.

In 29-year-old stand, among 31 species of succession tree species, *C. purpurea* (10.01%) had the highest biomass. The lower amounts were calculated for *S. wallichii* (8.46%), *H. terminalis* (5.98%), *A. fragrans* (3.67%), etc.

In 30-year-old stand, the total number of succession tree species was 35 species. *C. diversifolia* (12.15%) had the highest amount of biomass, followed by *S.*

*wallichii* (11.57%), *C. purpurea* (3.77%), *D. assamica* (2.92%), *E. spicata* (2.59%), *L. elegans* (2.15%), etc.

In 31-year-old stand, there was 38 succession tree species, and *C. diversifolia* (21.13%) had the highest amount of biomass. They were followed by *S. wallichii* (16.43%), *C. Acuminatissima* (7.09%), *S. Albiflorum* (4.14%), *W. tinctoria* (3.86%), *M. esculenta* (1.68%), *Olea salicifolia* (1.63%), *S. cumini* (1.63%), *H. terminalis* (1.56%), etc.

In 32-year-old stand, the total succession tree species in this stand was 33 species. *S. wallichii* (17.43%) had the highest biomass, and followed by *S. cumini* (6.58%), *C. acuminatissima* (4.93%), *P. paniculata* (1.95%), *Xanthophyllum virens* (1.44%), *E. sphaericus* (1.16%), *Magnolia henryi* (1.12%), *C. tribuloides* (0.91%), etc.

In 33-year-old stand, 52 species of succession tree species was existed. Wild banana, *M. acuminata* (1.80%), had the highest biomass, followed by *W. tinctoria* (1.36%), *Cimnnamomum iners* (1.01%), *A. chinensis* (0.58%), etc.

In the oldest stand of 34 years old, *C. purpurea* (23.01%) had the highest biomass among succession trees of 49 species. The lower amounts were found for *Q. vestita* (10.39%), *S. wallichii* (7.47%), *Q. brandisiana* (5.09%), *S. cumini* (2.45%), *W. tinctoria* (1.30%), *D. assamica* (1.19%), etc.

**Table 2-6** Biomass of tree species in a series of pine plantations

No	Species	Biomass (Mg.ha <sup>-1</sup> )					
		Stem	Branch	Leaf	Root	Total	%
	<b>14 year-old pine plantation</b>						
1	<i>Pinus kesiya</i>	37.9240	8.0933	1.5658	11.9308	59.5139	47.60
2	<i>Glochidion sphaerogynum</i>	12.8018	3.5858	0.4884	3.2722	20.1482	16.11
3	<i>Schima wallichii</i>	7.0486	2.1626	0.1826	1.5078	10.9016	8.72
4	<i>Albizia chinensis</i>	4.5853	1.4052	0.1162	0.9765	7.0833	5.67
5	<i>Callicarpa arborea</i>	2.2224	0.6693	0.0608	0.4901	3.4426	2.75
6	<i>Litsea sp.</i>	2.0068	0.5701	0.0701	0.4955	3.1425	2.51
7	<i>Castanopsis diversifolia</i>	1.8901	0.5869	0.0449	0.3914	2.9132	2.33
8	<i>Ficus ribes</i>	1.5534	0.4668	0.0421	0.3426	2.4049	1.92
9	<i>Eriolaena candollei</i>	1.3771	0.4115	0.0390	0.3082	2.1358	1.71
10	<i>Myrica esculenta</i>	1.1887	0.3495	0.0367	0.2761	1.8510	1.48
11	<i>Syzygium cumini</i>	1.1260	0.3503	0.0268	0.2330	1.7361	1.39
12	<i>Engelhardtia spicata</i>	1.0721	0.3038	0.0393	0.2684	1.6837	1.35
13	<i>Archidendron clypearia</i>	1.0752	0.3376	0.0241	0.2173	1.6541	1.32
14	<i>Ficus callosa</i>	0.9910	0.2731	0.0392	0.2594	1.5627	1.25
15	<i>Albizia odoratissima</i>	0.8271	0.2555	0.0199	0.1727	1.2752	1.02
16	<i>Phyllanthus emblica</i>	0.4488	0.1128	0.0267	0.1412	0.7294	0.58
17	<i>Phoebe lanceolata</i>	0.4084	0.1206	0.0119	0.0931	0.6339	0.51
18	<i>Grewia laevigata</i>	0.3955	0.1166	0.0116	0.0905	0.6142	0.49
19	<i>Litsea monopetala</i>	0.1546	0.0415	0.0069	0.0426	0.2455	0.20
20	<i>Colona flagrocarpa</i>	0.1220	0.0320	0.0059	0.0351	0.1951	0.16
21	<i>Memecylon celastrinum</i>	0.1204	0.0316	0.0058	0.0346	0.1925	0.15
22	<i>Ternstroemia gymnanthera</i>	0.1026	0.0262	0.0057	0.0312	0.1657	0.13
23	<i>Wendlandia tinctoria</i>	0.0900	0.0231	0.0048	0.0270	0.1449	0.12
24	<i>Eurya nitida</i>	0.0818	0.0218	0.0037	0.0228	0.1301	0.10
25	<i>Glochidion hirsutum</i>	0.0762	0.0189	0.0047	0.0245	0.1243	0.10
26	<i>Horsfieldia tomentosa</i>	0.0548	0.0137	0.0033	0.0174	0.0892	0.07
27	<i>Dolichandrone serrulata</i>	0.0518	0.0127	0.0034	0.0171	0.0851	0.07
28	<i>Aporosa villosa</i>	0.0516	0.0129	0.0031	0.0164	0.0840	0.07
29	<i>Syzygium albiflorum</i>	0.0347	0.0080	0.0029	0.0128	0.0585	0.05
30	<i>Flacourtia indica</i>	0.0197	0.0048	0.0013	0.0065	0.0323	0.03
31	<i>Congea tomentosa</i>	0.0174	0.0042	0.0012	0.0059	0.0287	0.02
32	<i>Flemingia lineata</i>	0.0082	0.0019	0.0007	0.0030	0.0139	0.01
33	<i>Stereospermum neuranthum</i>	0.0045	0.0010	0.0004	0.0018	0.0078	0.01
34	<i>Glochidion acuminatum</i>	0.0015	0.0003	0.0002	0.0008	0.0028	0.00
35	<i>Melastoma sanguineum</i>	0.0007	0.0001	0.0001	0.0003	0.0012	0.00
36	<i>Micromelum minutum</i>	0.0005	0.0001	0.0001	0.0002	0.0009	0.00
	Total	80	20	3	22	125	100

Table 2-6 (Continued)

No	Species	Biomass (Mg.ha <sup>-1</sup> )					
		Stem	Branch	Leaf	Root	Total	%
	<b>15 year-old pine plantation</b>						
1	<i>Pinus kesiya</i>	15.0923	3.0537	0.6240	4.8361	23.6061	25.44
2	<i>Schima wallichii</i>	8.1536	2.4459	0.2355	1.8276	12.6626	13.65
3	<i>Castanopsis acuminatissima</i>	6.9255	2.2368	0.1384	1.3268	10.6275	11.45
4	<i>Engelhardtia spicata</i>	4.0409	1.2141	0.1117	0.8954	6.2622	6.75
5	<i>Beilschmiedia gammieana</i>	4.0639	1.3213	0.0823	0.7758	6.2434	6.73
6	<i>Dillenia aurea</i>	3.1330	1.0198	0.0633	0.5972	4.8134	5.19
7	<i>Ternstroemia gymnanthera</i>	3.0053	0.8740	0.0948	0.7084	4.6825	5.05
8	<i>Helicia terminalis</i>	2.2025	0.6586	0.0624	0.4930	3.4165	3.68
9	<i>Phoebe paniculata</i>	1.8273	0.5048	0.0746	0.4807	2.8874	3.11
10	<i>Trichilla connaroides</i>	1.7339	0.5455	0.0396	0.3513	2.6703	2.88
11	<i>Stereospermum neuranthum</i>	1.6079	0.4994	0.0381	0.3328	2.4782	2.67
12	<i>Elaeocarpus sphaericus</i>	1.0516	0.3226	0.0273	0.2248	1.6262	1.75
13	<i>Helicia nilagirica</i>	0.8725	0.2470	0.0307	0.2165	1.3667	1.47
14	<i>Dalbergia assamica</i>	0.8650	0.2679	0.0205	0.1796	1.3330	1.44
15	<i>Castanopsis diversifolia</i>	0.6804	0.2063	0.0183	0.1481	1.0531	1.14
16	<i>Glochidion sphaerogynum</i>	0.6041	0.1700	0.0240	0.1551	0.9532	1.03
17	<i>Lindera metcalfiana</i>	0.5836	0.1470	0.0356	0.1841	0.9502	1.02
18	<i>Memecylon celastrinum</i>	0.5401	0.1358	0.0342	0.1721	0.8821	0.95
19	<i>Pyrenaria diospyricarpa</i>	0.4631	0.1096	0.0362	0.1643	0.7733	0.83
20	<i>Eurya nitida</i>	0.4290	0.1134	0.0210	0.1228	0.6862	0.74
21	<i>Wendlandia tinctoria</i>	0.3849	0.1033	0.0174	0.1066	0.6122	0.66
22	<i>Magnolia henryi</i>	0.2773	0.0751	0.0120	0.0754	0.4399	0.47
23	<i>Diospyros glandulosa</i>	0.1898	0.0475	0.0122	0.0609	0.3104	0.33
24	<i>Eriolaena candollei</i>	0.1551	0.0431	0.0059	0.0399	0.2439	0.26
25	<i>Symplocos henschelii</i>	0.1478	0.0398	0.0067	0.0408	0.2351	0.25
26	<i>Glochidion acuminatum</i>	0.0984	0.0209	0.0134	0.0443	0.1770	0.19
27	<i>Vitex canescens</i>	0.1113	0.0303	0.0046	0.0298	0.1761	0.19
28	<i>Phoebe cathia</i>	0.0839	0.0215	0.0045	0.0253	0.1352	0.15
29	<i>Saurauia roxburghii</i>	0.0756	0.0186	0.0050	0.0249	0.1241	0.13
30	<i>Archidendron clypearia</i>	0.0554	0.0130	0.0047	0.0203	0.0933	0.10
31	<i>Albizia odoratissima</i>	0.0364	0.0088	0.0026	0.0123	0.0600	0.06
32	<i>Quercus semiserrata</i>	0.0333	0.0082	0.0022	0.0109	0.0545	0.06
33	<i>Turpinia cochinchinensis</i>	0.0297	0.0074	0.0018	0.0094	0.0483	0.05
34	<i>Melastoma sanguineum</i>	0.0164	0.0032	0.0030	0.0086	0.0312	0.03
35	<i>Rhus javanica</i>	0.0126	0.0029	0.0011	0.0047	0.0213	0.02
36	<i>Phyllanthus emblica</i>	0.0120	0.0028	0.0010	0.0044	0.0202	0.02
37	<i>Blumea balsamifera</i>	0.0038	0.0007	0.0007	0.0020	0.0071	0.01
38	<i>Micromelum minutum</i>	0.0026	0.0005	0.0004	0.0013	0.0049	0.01
39	<i>Mussaenda sanderiana</i>	0.0020	0.0004	0.0002	0.0009	0.0036	0.00
40	<i>Lepisanthes rubiginosa</i>	0.0017	0.0003	0.0003	0.0009	0.0033	0.00
41	<i>Fissistigma minuticalyx</i>	0.0007	0.0001	0.0001	0.0003	0.0012	0.00
42	<i>Ampelocissus martinii</i>	0.0004	0.0001	0.0001	0.0002	0.0008	0.00
43	<i>Litsea monopetala</i>	0.0004	0.0001	0.0001	0.0002	0.0007	0.00
44	<i>Eurya acuminata</i>	0.0003	0.0001	0.0001	0.0002	0.0007	0.00
45	<i>Cinnamomum iners</i>	0.0003	0.0001	0.0001	0.0002	0.0006	0.00
46	<i>Euodia roxburghiana</i>	0.0003	0.0001	0.0001	0.0002	0.0005	0.00
47	<i>Milletia pachycarpa</i>	0.0003	0.0000	0.0001	0.0002	0.0005	0.00
48	<i>Litsea cubeba</i>	0.0002	0.0000	0.0000	0.0001	0.0004	0.00
49	<i>Arytera littoralis</i>	0.0002	0.0000	0.0000	0.0001	0.0004	0.00
50	<i>Myrica esculenta</i>	0.0002	0.0000	0.0000	0.0001	0.0003	0.00
51	<i>Styrax benzoides</i>	0.0002	0.0000	0.0000	0.0001	0.0003	0.00
52	<i>Litsea glutinosa</i>	0.0002	0.0000	0.0000	0.0001	0.0003	0.00
53	<i>Viburnum sambucinum</i>	0.0001	0.0000	0.0000	0.0001	0.0002	0.00
54	<i>Buddleja asiatica</i>	0.0001	0.0000	0.0000	0.0000	0.0001	0.00
	Total	60	17	2	15	93	100

Table 2-6 (Continued)

No	Species	Biomass (Mg.ha <sup>-1</sup> )					
		Stem	Branch	Leaf	Root	Total	%
	<b>16 year-old pine plantation</b>						
1	<i>Pinus kesiya</i>	79.1621	16.7545	3.2695	25.0124	124.1985	88.58
2	<i>Schima wallichii</i>	3.1583	0.9185	0.1002	0.7455	4.9225	3.51
3	<i>Canarium subulatum</i>	1.1722	0.3483	0.0336	0.2648	1.8189	1.30
4	<i>Wendlandia tinctoria</i>	1.1116	0.3057	0.0456	0.2940	1.7569	1.25
5	<i>Spatholobus parviflorus</i>	1.0149	0.3041	0.0278	0.2249	1.5717	1.12
6	<i>Engelhardtia spicata</i>	0.9140	0.2693	0.0274	0.2104	1.4212	1.01
7	<i>Phoebe paniculata</i>	0.8729	0.2458	0.0317	0.2192	1.3696	0.98
8	<i>Vitex peduncularis</i>	0.6803	0.1926	0.0242	0.1693	1.0664	0.76
9	<i>Glochidion sphaerogynum</i>	0.2086	0.0531	0.0116	0.0638	0.3371	0.24
10	<i>Ampelocissus martinii</i>	0.2025	0.0537	0.0095	0.0572	0.3229	0.23
11	<i>Musa acuminata</i>	0.1965	0.0483	0.0130	0.0648	0.3226	0.23
12	<i>Eriolaena candollei</i>	0.2046	0.0579	0.0072	0.0508	0.3205	0.23
13	<i>Phoebe cathia</i>	0.1523	0.0420	0.0062	0.0401	0.2406	0.17
14	<i>Lindera metcalfiana</i>	0.0909	0.0227	0.0066	0.0301	0.1503	0.11
15	<i>Glochidion acuminatum</i>	0.0668	0.0127	0.0130	0.0361	0.1287	0.09
16	<i>Glochidion hirsutum</i>	0.0698	0.0172	0.0045	0.0228	0.1143	0.08
17	<i>Melastoma sanguineum</i>	0.0165	0.0032	0.0030	0.0086	0.0313	0.02
18	<i>Saurauia roxburghii</i>	0.0104	0.0022	0.0013	0.0045	0.0184	0.01
19	<i>Eurya nitida</i>	0.0101	0.0021	0.0014	0.0046	0.0182	0.01
20	<i>Litsea cubeba</i>	0.0090	0.0018	0.0015	0.0045	0.0169	0.01
21	<i>Litsea monopetala</i>	0.0083	0.0018	0.0010	0.0036	0.0147	0.01
22	<i>Archidendron clypearia</i>	0.0046	0.0009	0.0006	0.0021	0.0083	0.01
23	<i>Trichilla connaroides</i>	0.0040	0.0008	0.0007	0.0021	0.0075	0.01
24	<i>Rauvolfia cambodiana</i>	0.0033	0.0006	0.0007	0.0018	0.0064	0.00
25	<i>Blumea balsamifera</i>	0.0024	0.0004	0.0006	0.0014	0.0047	0.00
26	<i>Ficus callosa</i>	0.0026	0.0006	0.0003	0.0011	0.0046	0.00
27	<i>Pyrenaria diospyricarpa</i>	0.0022	0.0004	0.0004	0.0012	0.0042	0.00
28	<i>Colona flagrocarpa</i>	0.0015	0.0003	0.0003	0.0008	0.0029	0.00
29	<i>Viburnum sambucinum</i>	0.0005	0.0001	0.0001	0.0003	0.0010	0.00
30	<i>Mussaenda sanderiana</i>	0.0004	0.0001	0.0001	0.0002	0.0007	0.00
31	<i>Diospyros glandulosa</i>	0.0003	0.0001	0.0001	0.0002	0.0006	0.00
32	<i>Artocarpus lacucha</i>	0.0003	0.0001	0.0001	0.0002	0.0006	0.00
33	<i>Micromelum minutum</i>	0.0002	0.0000	0.0000	0.0001	0.0004	0.00
	Total	89	20	4	28	140	100

Table 2-6 (Continued)

No	Species	Biomass (Mg.ha <sup>-1</sup> )					
		Stem	Branch	Leaf	Root	Total	%
	<b>17 year-old pine plantation</b>						
1	<i>Pinus kesiya</i>	15.4927	2.9851	0.6412	5.0453	24.1644	21.25
2	<i>Schima wallichii</i>	7.7435	2.2487	0.2525	1.8428	12.0874	10.63
3	<i>Myrica esculenta</i>	6.4492	1.9238	0.1870	1.4552	10.0153	8.81
4	<i>Engelhardtia spicata</i>	5.4218	1.6188	0.1711	1.2483	8.4600	7.44
5	<i>Castanopsis diversifolia</i>	5.1426	1.5329	0.1509	1.1642	7.9906	7.03
6	<i>Quercus semiserrata</i>	5.0573	1.7507	0.0745	0.8442	7.7268	6.79
7	<i>Helicia terminalis</i>	4.1789	1.1431	0.1754	1.1172	6.6146	5.82
8	<i>Castanopsis acuminatissima</i>	3.2899	1.0946	0.0593	0.5975	5.0413	4.43
9	<i>Phoebe cathia</i>	2.9500	0.9836	0.0523	0.5324	4.5183	3.97
10	<i>Wendlandia tinctoria</i>	2.6589	0.7254	0.1147	0.7175	4.2164	3.71
11	<i>Syzygium albiflorum</i>	2.3487	0.7037	0.0648	0.5215	3.6387	3.20
12	<i>Elaeocarpus sphaericus</i>	2.0204	0.6152	0.0532	0.4368	3.1256	2.75
13	<i>Phyllanthus emblica</i>	1.6691	0.4118	0.1087	0.5459	2.7354	2.41
14	<i>Glochidion sphaerogynum</i>	0.9703	0.2450	0.0580	0.3041	1.5774	1.39
15	<i>Beilschmiedia gammieana</i>	0.8986	0.2544	0.0325	0.2243	1.4098	1.24
16	<i>Diospyros glandulosa</i>	0.8064	0.2086	0.0441	0.2418	1.3009	1.14
17	<i>Artocarpus lacucha</i>	0.8288	0.2560	0.0200	0.1732	1.2780	1.12
18	<i>Albizia chinensis</i>	0.6457	0.1963	0.0166	0.1390	0.9977	0.88
19	<i>Heterophragma sulfureum</i>	0.4666	0.1284	0.0190	0.1231	0.7371	0.65
20	<i>Trichilla connaroides</i>	0.3343	0.0890	0.0162	0.0948	0.5343	0.47
21	<i>Lithocarpus sp.</i>	0.3192	0.0853	0.0144	0.0887	0.5075	0.45
22	<i>Eurya nitida</i>	0.2855	0.0732	0.0157	0.0864	0.4608	0.41
23	<i>Albizia odoratissima</i>	0.2826	0.0805	0.0101	0.0698	0.4430	0.39
24	<i>Eriolaena candollei</i>	0.2416	0.0644	0.0111	0.0676	0.3848	0.34
25	<i>Dillenia aurea</i>	0.2389	0.0678	0.0086	0.0593	0.3746	0.33
26	<i>Phoebe paniculata</i>	0.2083	0.0557	0.0096	0.0582	0.3317	0.29
27	<i>Archidendron clypearia</i>	0.1888	0.0490	0.0100	0.0559	0.3037	0.27
28	<i>Garuga pinnata</i>	0.1891	0.0518	0.0078	0.0502	0.2989	0.26
29	<i>Temstroemia gymnanthera</i>	0.1782	0.0484	0.0076	0.0482	0.2824	0.25
30	<i>Erythrina subumbrans</i>	0.1539	0.0427	0.0058	0.0396	0.2420	0.21
31	<i>Litsea glutinosa</i>	0.1279	0.0315	0.0084	0.0420	0.2099	0.18
32	<i>Helicia nilagirica</i>	0.1318	0.0363	0.0052	0.0346	0.2079	0.18
33	<i>Glochidion acuminatum</i>	0.0943	0.0197	0.0143	0.0444	0.1726	0.15
34	<i>Symplocos sp.</i>	0.0877	0.0222	0.0051	0.0273	0.1423	0.13
35	<i>Memecylon celastrinum</i>	0.0760	0.0178	0.0063	0.0277	0.1278	0.11
36	<i>Pyrenaria diospyricarpa</i>	0.0740	0.0166	0.0075	0.0294	0.1275	0.11
37	<i>Kydia calycina</i>	0.0780	0.0208	0.0036	0.0218	0.1241	0.11
38	<i>Glochidion hirsutum</i>	0.0668	0.0160	0.0049	0.0232	0.1109	0.10
39	<i>Melastoma sanguineum</i>	0.0583	0.0115	0.0099	0.0295	0.1093	0.10
40	<i>Arytera littoralis</i>	0.0514	0.0118	0.0052	0.0201	0.0885	0.08
41	<i>Rhus succedanea</i>	0.0538	0.0134	0.0033	0.0171	0.0877	0.08
42	<i>Cinnamomum iners</i>	0.0476	0.0117	0.0032	0.0158	0.0782	0.07
43	<i>Docynia indica</i>	0.0408	0.0097	0.0030	0.0141	0.0676	0.06
44	<i>Ampelocissus martinii</i>	0.0414	0.0104	0.0025	0.0132	0.0675	0.06
45	<i>Sapindus rarak</i>	0.0219	0.0052	0.0016	0.0076	0.0363	0.03
46	<i>Blumea balsamifera</i>	0.0190	0.0037	0.0033	0.0097	0.0357	0.03
47	<i>Carallia brachiata</i>	0.0190	0.0046	0.0013	0.0063	0.0313	0.03
48	<i>Xanthophyllum virens</i>	0.0146	0.0035	0.0011	0.0050	0.0242	0.02
49	<i>Lindera metcalfiana</i>	0.0108	0.0024	0.0012	0.0045	0.0188	0.02
50	<i>Litsea sp.</i>	0.0064	0.0013	0.0009	0.0030	0.0116	0.01
51	<i>Alstonia scholaris</i>	0.0063	0.0013	0.0008	0.0029	0.0112	0.01
52	<i>Symplocos henschelii</i>	0.0059	0.0013	0.0007	0.0025	0.0103	0.01
53	<i>Ilex umbellulata</i>	0.0044	0.0010	0.0004	0.0018	0.0077	0.01
54	<i>Catunaregam tomentosa</i>	0.0031	0.0006	0.0004	0.0014	0.0055	0.00
55	<i>Anneslea fragrans</i>	0.0021	0.0004	0.0003	0.0009	0.0037	0.00
56	<i>Saurauia roxburghii</i>	0.0014	0.0003	0.0002	0.0006	0.0025	0.00
57	<i>Spondias bipinnata</i>	0.0009	0.0002	0.0001	0.0004	0.0016	0.00
58	<i>Rhus javanica</i>	0.0009	0.0002	0.0001	0.0004	0.0016	0.00
59	<i>Viburnum sambucinum</i>	0.0006	0.0001	0.0001	0.0003	0.0012	0.00
60	<i>Euodia roxburghiana</i>	0.0005	0.0001	0.0001	0.0003	0.0011	0.00
61	<i>Quercus brandisiana</i>	0.0002	0.0000	0.0000	0.0001	0.0003	0.00
	Total	73	20	3	18	114	100



Table 2-6 (Continued)

No	Species	Biomass (Mg.ha <sup>-1</sup> )					
		Stem	Branch	Leaf	Root	Total	%
	<b><u>18 year-old pine plantation</u></b>						
1	<i>Pinus kesiya</i>	59.0131	12.2247	2.4383	18.7499	92.4260	54.36
2	<i>Castanopsis purpurea</i>	7.9846	2.2926	0.2762	1.9482	12.5016	7.35
3	<i>Schima wallichii</i>	3.9100	1.1630	0.1180	0.8930	6.0840	3.58
4	<i>Eriolaena candollei</i>	3.7735	1.1297	0.1090	0.8482	5.8604	3.45
5	<i>Castanopsis acuminatissima</i>	3.5418	1.0399	0.1085	0.8218	5.5120	3.24
6	<i>Quercus vestita</i>	3.3894	0.9398	0.1340	0.8818	5.3451	3.14
7	<i>Castanopsis diversifolia</i>	3.2533	0.9333	0.1131	0.7953	5.0950	3.00
8	<i>Wendlandia tinctoria</i>	2.9592	0.7541	0.1682	0.9092	4.7908	2.82
9	<i>Glochidion sphaerogynum</i>	2.8761	0.7938	0.1172	0.7571	4.5443	2.67
10	<i>Dalbergia assamica</i>	2.2318	0.6011	0.1089	0.6291	3.5709	2.10
11	<i>Acacia megaladena</i>	2.0423	0.6678	0.0384	0.3812	3.1296	1.84
12	<i>Terstroemia gymnanthera</i>	1.1028	0.2996	0.0467	0.2973	1.7464	1.03
13	<i>Archidendron clypearia</i>	1.0403	0.2942	0.0370	0.2591	1.6306	0.96
14	<i>Albizia odoratissima</i>	0.9530	0.2934	0.0238	0.2013	1.4714	0.87
15	<i>Phoebe lanceolata</i>	0.9023	0.2575	0.0311	0.2211	1.4119	0.83
16	<i>Ficus ribes</i>	0.8732	0.2598	0.0248	0.1965	1.3542	0.80
17	<i>Castanopsis tribuloides</i>	0.8560	0.2541	0.0245	0.1934	1.3279	0.78
18	<i>Helicia terminalis</i>	0.7025	0.1977	0.0256	0.1768	1.1026	0.65
19	<i>Lithocarpus sootepensis</i>	0.6852	0.1881	0.0276	0.1807	1.0816	0.64
20	<i>Erythrina subumbrans</i>	0.5287	0.1533	0.0169	0.1254	0.8242	0.48
21	<i>Syzygium cumini</i>	0.5249	0.1478	0.0189	0.1316	0.8232	0.48
22	<i>Eurya nitida</i>	0.4910	0.1302	0.0230	0.1387	0.7829	0.46
23	<i>Syzygium albiflorum</i>	0.4708	0.1224	0.0249	0.1396	0.7578	0.45
24	<i>Phyllanthus emblica</i>	0.4482	0.1117	0.0278	0.1434	0.7311	0.43
25	<i>Diospyros glandulosa</i>	0.4421	0.1187	0.0198	0.1221	0.7027	0.41
26	<i>Stereospermum neuranthum</i>	0.3641	0.1011	0.0141	0.0941	0.5735	0.34
27	<i>Protium serratum</i>	0.3457	0.0969	0.0127	0.0874	0.5427	0.32
28	<i>Aporosa villosa</i>	0.3309	0.0831	0.0199	0.1045	0.5384	0.32
29	<i>Elaeocarpus sphaericus</i>	0.2976	0.0862	0.0094	0.0705	0.4638	0.27
30	<i>Engelhardtia spicata</i>	0.2964	0.0858	0.0094	0.0703	0.4619	0.27
31	<i>Gluta obovata</i>	0.2563	0.0668	0.0130	0.0749	0.4110	0.24
32	<i>Magnolia henryi</i>	0.2131	0.0584	0.0087	0.0565	0.3367	0.20
33	<i>Dillenia aurea</i>	0.2116	0.0580	0.0088	0.0563	0.3347	0.20
34	<i>Pterospermum acerifolium</i>	0.2072	0.0586	0.0073	0.0514	0.3244	0.19
35	<i>Symplocos sp.</i>	0.1955	0.0531	0.0082	0.0527	0.3094	0.18
36	<i>Anneslea fragrans</i>	0.1433	0.0396	0.0055	0.0372	0.2257	0.13
37	<i>Dolichandrone serrulata</i>	0.1169	0.0301	0.0062	0.0350	0.1882	0.11
38	<i>Docynia indica</i>	0.1177	0.0321	0.0048	0.0313	0.1859	0.11
39	<i>Callicarpa arborea</i>	0.0730	0.0189	0.0039	0.0217	0.1175	0.07
40	<i>Gmelina arborea</i>	0.0666	0.0176	0.0032	0.0190	0.1064	0.06
41	<i>Colona flagrocarpa</i>	0.0445	0.0114	0.0024	0.0133	0.0716	0.04
42	<i>Helicia nilagirica</i>	0.0399	0.0102	0.0022	0.0121	0.0644	0.04
43	<i>Vaccinium sprengelii</i>	0.0302	0.0073	0.0021	0.0102	0.0498	0.03
44	<i>Symplocos racemosa</i>	0.0272	0.0065	0.0020	0.0094	0.0450	0.03
45	<i>Schoepfia fragrans</i>	0.0266	0.0066	0.0016	0.0085	0.0433	0.03
46	<i>Styrax benzoides</i>	0.0094	0.0022	0.0008	0.0034	0.0157	0.01
	Total	108	26	4	31	170	100

Table 2-6 (Continued)

No	Species	Biomass (Mg. ha <sup>-1</sup> )					
		Stem	Branch	Leaf	Root	Total	%
	<b>19 year-old pine plantation</b>						
1	<i>Pinus kesiya</i>	74.4960	14.7304	3.0814	24.0304	116.3382	68.01
2	<i>Castanopsis diversifolia</i>	7.1059	2.0440	0.2413	1.7230	11.1142	6.50
3	<i>Eriolaena candollei</i>	4.8068	1.4021	0.1555	1.1374	7.5019	4.39
4	<i>Castanopsis purpurea</i>	4.8271	1.5448	0.1105	0.9639	7.4462	4.35
5	<i>Albizia chinensis</i>	3.1652	0.9245	0.0984	0.7406	4.9288	2.88
6	<i>Wendlandia tinctoria</i>	2.7177	0.7320	0.1264	0.7561	4.3322	2.53
7	<i>Ternstroemia gymnanthera</i>	1.7786	0.5474	0.0449	0.3768	2.7476	1.61
8	<i>Gluta obovata</i>	1.2963	0.4119	0.0276	0.2560	1.9917	1.16
9	<i>Ficus ribes</i>	1.2478	0.3508	0.0457	0.3148	1.9592	1.15
10	<i>Schima wallichii</i>	1.1959	0.3541	0.0346	0.2716	1.8563	1.09
11	<i>Markhamia stipulata</i>	0.9316	0.2731	0.0283	0.2160	1.4491	0.85
12	<i>Syzygium cumini</i>	0.8614	0.2515	0.0266	0.2013	1.3410	0.78
13	<i>Phyllanthus emblica</i>	0.6090	0.1568	0.0330	0.1831	0.9818	0.57
14	<i>Dolichandrone serrulata</i>	0.5552	0.1538	0.0218	0.1442	0.8750	0.51
15	<i>Castanopsis acuminatissima</i>	0.5318	0.1598	0.0144	0.1173	0.8233	0.48
16	<i>Protium serratum</i>	0.5104	0.1420	0.0195	0.1313	0.8032	0.47
17	<i>Acacia megaladena</i>	0.4465	0.1248	0.0167	0.1137	0.7016	0.41
18	<i>Phoebe lanceolata</i>	0.4083	0.1190	0.0129	0.0961	0.6362	0.37
19	<i>Glochidion sphaerogynum</i>	0.3898	0.1008	0.0203	0.1156	0.6264	0.37
20	<i>Litsea monopetala</i>	0.3208	0.0933	0.0100	0.0753	0.4994	0.29
21	<i>Phoebe paniculata</i>	0.2534	0.0702	0.0099	0.0658	0.3992	0.23
22	<i>Elaeocarpus sphaericus</i>	0.2157	0.0612	0.0075	0.0532	0.3376	0.20
23	<i>Adinandra integerrima</i>	0.1744	0.0443	0.0099	0.0537	0.2822	0.16
24	<i>Albizia odoratissima</i>	0.1257	0.0345	0.0050	0.0332	0.1984	0.12
25	<i>Horsfieldia tomentosa</i>	0.0804	0.0198	0.0052	0.0262	0.1316	0.08
26	<i>Dalbergia velutina</i>	0.0752	0.0200	0.0035	0.0211	0.1198	0.07
27	<i>Xanthophyllum virens</i>	0.0733	0.0189	0.0039	0.0219	0.1180	0.07
28	<i>Stereospermum neuranthum</i>	0.0602	0.0157	0.0029	0.0174	0.0962	0.06
29	<i>Holarrhena pubescens</i>	0.0517	0.0131	0.0030	0.0160	0.0839	0.05
30	<i>Dillenia indica</i>	0.0510	0.0130	0.0028	0.0155	0.0823	0.05
31	<i>Pterospermum acerifolium</i>	0.0474	0.0122	0.0025	0.0141	0.0763	0.04
32	<i>Aporosa wallichii</i>	0.0393	0.0099	0.0023	0.0124	0.0639	0.04
33	<i>Helicia nilagirica</i>	0.0335	0.0085	0.0019	0.0104	0.0543	0.03
34	<i>Engelhardtia spicata</i>	0.0178	0.0041	0.0015	0.0065	0.0299	0.02
35	<i>Vaccinium sprengelii</i>	0.0110	0.0026	0.0009	0.0039	0.0183	0.01
36	<i>Syzygium albiflorum</i>	0.0075	0.0017	0.0007	0.0028	0.0128	0.01
37	<i>Cinnamomum iners</i>	0.0017	0.0004	0.0002	0.0008	0.0030	0.00
38	<i>Arytera littoralis</i>	0.0013	0.0002	0.0002	0.0007	0.0024	0.00
	Total	110	25	4	32	171	100

Table 2-6 (Continued)

No	Species	Biomass (Mg. ha <sup>-1</sup> )					
		Stem	Branch	Leaf	Root	Total	%
	<b>20 year-old pine plantation</b>						
1	<i>Pinus kesiya</i>	83.5436	16.6404	3.4550	26.8792	130.5181	91.77
2	<i>Bauhinia variegata</i>	3.0295	0.8748	0.1015	0.7296	4.7355	3.33
3	<i>Eriolaena candollei</i>	2.6125	0.7612	0.0827	0.6153	4.0716	2.86
4	<i>Syzygium albiflorum</i>	0.6332	0.1831	0.0206	0.1511	0.9880	0.69
5	<i>Castanopsis diversifolia</i>	0.4314	0.1195	0.0170	0.1123	0.6803	0.48
6	<i>Glochidion sphaerogynum</i>	0.4184	0.1238	0.0121	0.0951	0.6494	0.46
7	<i>Phyllanthus emblica</i>	0.2831	0.0763	0.0122	0.0772	0.4489	0.32
8	<i>Dolichandrone serrulata</i>	0.0252	0.0062	0.0016	0.0082	0.0411	0.03
9	<i>Syzygium cumini</i>	0.0120	0.0027	0.0012	0.0047	0.0206	0.01
10	<i>Arytera littoralis</i>	0.0100	0.0020	0.0016	0.0050	0.0186	0.01
11	<i>Aporosa villosa</i>	0.0075	0.0017	0.0007	0.0028	0.0128	0.01
12	<i>Wendlandia tinctoria</i>	0.0066	0.0015	0.0006	0.0025	0.0112	0.01
13	<i>Dillenia indica</i>	0.0057	0.0013	0.0005	0.0022	0.0098	0.01
14	<i>Litsea monopetala</i>	0.0043	0.0009	0.0005	0.0019	0.0077	0.01
15	<i>Phoebe paniculata</i>	0.0013	0.0003	0.0002	0.0006	0.0023	0.00
16	<i>Symplocos sp.</i>	0.0005	0.0001	0.0001	0.0002	0.0009	0.00
17	<i>Rhus javanica</i>	0.0003	0.0001	0.0001	0.0002	0.0006	0.00
	Total	91	19	4	29	142	100

Table 2-6 (Continued)

No	Species	Biomass (Mg. ha <sup>-1</sup> )					
		Stem	Branch	Leaf	Root	Total	%
	<b>21 year-old pine plantation</b>						
1	<i>Pinus kesiya</i>	86.3345	17.6393	3.5685	27.5749	135.1171	58.87
2	<i>Schima wallichii</i>	16.5973	5.0420	0.4611	3.6492	25.7497	11.22
3	<i>Castanopsis acuminatissima</i>	7.2103	2.1698	0.1970	1.5910	11.1681	4.87
4	<i>Anneslea fragrans</i>	7.0419	2.1482	0.1878	1.5247	10.9025	4.75
5	<i>Syzygium albiflorum</i>	5.2237	1.6988	0.1211	1.0261	8.0697	3.52
6	<i>Castanopsis diversifolia</i>	4.6384	1.4969	0.0955	0.8952	7.1260	3.10
7	<i>Lithocarpus elegans</i>	3.7664	1.1472	0.1011	0.8184	5.8332	2.54
8	<i>Wendlandia tinctoria</i>	2.8669	0.7627	0.1401	0.8163	4.5859	2.00
9	<i>Elaeocarpus sphaericus</i>	2.7046	0.7805	0.0931	0.6562	4.2344	1.84
10	<i>Myrica esculenta</i>	1.5605	0.4734	0.0411	0.3387	2.4136	1.05
11	<i>Buchanania lanzan</i>	1.4971	0.4382	0.0479	0.3518	2.3350	1.02
12	<i>Syzygium cumini</i>	1.0765	0.3064	0.0383	0.2664	1.6877	0.74
13	<i>Lithocarpus garrettianus</i>	1.0320	0.2785	0.0451	0.2821	1.6378	0.71
14	<i>Glochidion sphaerogynum</i>	0.9428	0.2501	0.0449	0.2674	1.5053	0.66
15	<i>Aporosa villosa</i>	0.6451	0.1664	0.0362	0.1955	1.0432	0.45
16	<i>Magnolia henryi</i>	0.6373	0.1869	0.0194	0.1478	0.9913	0.43
17	<i>Xanthophyllum virens</i>	0.4704	0.1402	0.0132	0.1053	0.7291	0.32
18	<i>Engelhardtia spicata</i>	0.3873	0.0998	0.0209	0.1163	0.6243	0.27
19	<i>Phoebe paniculata</i>	0.3374	0.0882	0.0169	0.0982	0.5407	0.24
20	<i>Albizia chinensis</i>	0.3201	0.0917	0.0109	0.0779	0.5006	0.22
21	<i>Symplocos sp.</i>	0.2579	0.0688	0.0118	0.0720	0.4104	0.18
22	<i>Engelhardtia serrata</i>	0.2189	0.0587	0.0098	0.0605	0.3480	0.15
23	<i>Dalbergia assamica</i>	0.2207	0.0622	0.0081	0.0556	0.3466	0.15
24	<i>Tristania rufescens</i>	0.1556	0.0375	0.0110	0.0529	0.2570	0.11
25	<i>Albizia odoratissima</i>	0.1528	0.0422	0.0061	0.0399	0.2409	0.10
26	<i>Phyllanthus emblica</i>	0.0915	0.0210	0.0080	0.0343	0.1548	0.07
27	<i>Diospyros glandulosa</i>	0.0907	0.0218	0.0064	0.0310	0.1499	0.07
28	<i>Holarrhena pubescens</i>	0.0883	0.0206	0.0072	0.0321	0.1483	0.06
29	<i>Styrax benzoides</i>	0.0648	0.0152	0.0051	0.0232	0.1084	0.05
30	<i>Gmelina arborea</i>	0.0607	0.0159	0.0030	0.0177	0.0973	0.04
31	<i>Vitex peduncularis</i>	0.0546	0.0128	0.0044	0.0197	0.0915	0.04
32	<i>Ampelocissus martinii</i>	0.0436	0.0104	0.0032	0.0151	0.0723	0.03
33	<i>Canarium subulatum</i>	0.0347	0.0082	0.0026	0.0122	0.0578	0.03
34	<i>Olea salicifolia</i>	0.0334	0.0079	0.0026	0.0118	0.0556	0.02
35	<i>Bombax anceps</i>	0.0338	0.0082	0.0023	0.0113	0.0556	0.02
36	<i>Eurya nitida</i>	0.0343	0.0087	0.0020	0.0106	0.0556	0.02
37	<i>Stereospermum neuranthum</i>	0.0307	0.0073	0.0023	0.0106	0.0509	0.02
38	<i>Canarium sp.</i>	0.0087	0.0020	0.0007	0.0032	0.0147	0.01
39	<i>Dalbergia foliacea</i>	0.0059	0.0013	0.0005	0.0023	0.0101	0.00
40	<i>Rapanea porteriana</i>	0.0023	0.0005	0.0004	0.0012	0.0044	0.00
41	<i>Beilschmiedia gammieana</i>	0.0005	0.0001	0.0001	0.0002	0.0009	0.00
	Total	147	36	5	41	230	100

Table 2-6 (Continued)

No	Species	Biomass (Mg. ha <sup>-1</sup> )					
		Stem	Branch	Leaf	Root	Total	%
	<b>22 year-old pine plantation</b>						
1	<i>Pinus kesiya</i>	56.8896	11.0522	2.3544	18.4974	88.7935	51.65
2	<i>Quercus brandisiana</i>	10.4777	3.0356	0.3544	2.5211	16.3888	9.53
3	<i>Quercus vestita</i>	5.0240	1.3269	0.2453	1.4388	8.0350	4.67
4	<i>Lithocarpus polystachyus</i>	4.4326	1.2349	0.1733	1.1455	6.9862	4.06
5	<i>Dalbergia cultrata</i>	3.3018	0.9202	0.1282	0.8512	5.2014	3.03
6	<i>Schima wallichii</i>	3.0928	0.8789	0.1078	0.7631	4.8427	2.82
7	<i>Wendlandia tinctoria</i>	2.6223	0.6676	0.1489	0.8058	4.2446	2.47
8	<i>Gluta obovata</i>	2.4318	0.7241	0.0739	0.5550	3.7849	2.20
9	<i>Lithocarpus elegans</i>	2.2916	0.6051	0.1115	0.6559	3.6642	2.13
10	<i>Tristania rufescens</i>	1.8007	0.4723	0.1001	0.5371	2.9102	1.69
11	<i>Lithocarpus sootepensis</i>	1.7659	0.4627	0.0899	0.5147	2.8333	1.65
12	<i>Castanopsis purpurea</i>	1.6954	0.4366	0.0914	0.5091	2.7325	1.59
13	<i>Ficus ribes</i>	1.3893	0.3757	0.0601	0.3780	2.2031	1.28
14	<i>Anneslea fragrans</i>	1.3159	0.3518	0.0613	0.3684	2.0975	1.22
15	<i>Erythrina subumbrans</i>	1.0519	0.3299	0.0237	0.2132	1.6186	0.94
16	<i>Litsea sp.</i>	1.0261	0.2985	0.0325	0.2422	1.5993	0.93
17	<i>Aporosa villosa</i>	0.8708	0.2122	0.0597	0.2917	1.4343	0.83
18	<i>Glochidion sphaerogynum</i>	0.7912	0.1995	0.0472	0.2483	1.2862	0.75
19	<i>Phyllanthus emblica</i>	0.7652	0.1827	0.0570	0.2664	1.2713	0.74
20	<i>Craibiodendron stellatum</i>	0.5625	0.1418	0.0339	0.1769	0.9151	0.53
21	<i>Ternstroemia gymnanthera</i>	0.5702	0.1493	0.0290	0.1662	0.9147	0.53
22	<i>Vaccinium sprengelii</i>	0.4345	0.1040	0.0319	0.1504	0.7209	0.42
23	<i>Shorea roxburghii</i>	0.4168	0.1064	0.0238	0.1279	0.6749	0.39
24	<i>Syzygium cumini</i>	0.3690	0.0933	0.0221	0.1157	0.6000	0.35
25	<i>Semecarpus albescens</i>	0.3490	0.0983	0.0131	0.0883	0.5488	0.32
26	<i>Ilex umbellulata</i>	0.3143	0.0876	0.0118	0.0804	0.4941	0.29
27	<i>Dalbergia assamica</i>	0.2985	0.0799	0.0134	0.0827	0.4745	0.28
28	<i>Eriolaena candollei</i>	0.2833	0.0818	0.0091	0.0676	0.4417	0.26
29	<i>Glochidion hirsutum</i>	0.2444	0.0560	0.0217	0.0923	0.4144	0.24
30	<i>Engelhardtia serrata</i>	0.2424	0.0598	0.0156	0.0791	0.3969	0.23
31	<i>Castanopsis diversifolia</i>	0.2491	0.0675	0.0107	0.0675	0.3948	0.23
32	<i>Canarium subulatum</i>	0.1946	0.0549	0.0069	0.0486	0.3050	0.18
33	<i>Diospyros glandulosa</i>	0.1916	0.0540	0.0069	0.0480	0.3003	0.17
34	<i>Pterospermum acerifolium</i>	0.1831	0.0503	0.0075	0.0485	0.2894	0.17
35	<i>Gardenia sootepensis</i>	0.1683	0.0423	0.0099	0.0527	0.2732	0.16
36	<i>Spondias bipinnata</i>	0.1346	0.0358	0.0062	0.0378	0.2144	0.12
37	<i>Stereospermum neuranthum</i>	0.1342	0.0359	0.0061	0.0373	0.2135	0.12
38	<i>Syzygium albiflorum</i>	0.0766	0.0199	0.0039	0.0225	0.1230	0.07
39	<i>Viburnum sambucinum</i>	0.0759	0.0193	0.0042	0.0232	0.1227	0.07
40	<i>Celastrus paniculata</i>	0.0681	0.0165	0.0047	0.0230	0.1123	0.07
41	<i>Lithocarpus lindleyanus</i>	0.0671	0.0168	0.0041	0.0213	0.1093	0.06
42	<i>Pavetta tomentosa</i>	0.0624	0.0144	0.0053	0.0231	0.1051	0.06
43	<i>Eurya nitida</i>	0.0618	0.0162	0.0030	0.0178	0.0988	0.06
44	<i>Vitex peduncularis</i>	0.0599	0.0157	0.0029	0.0173	0.0958	0.06
45	<i>Dillenia aurea</i>	0.0512	0.0132	0.0027	0.0152	0.0823	0.05
46	<i>Quercus semiserrata</i>	0.0494	0.0119	0.0034	0.0167	0.0815	0.05
47	<i>Antidesma acidum</i>	0.0405	0.0090	0.0042	0.0163	0.0700	0.04
48	<i>Symplocos racemosa</i>	0.0317	0.0080	0.0018	0.0099	0.0514	0.03
49	<i>Dolichandrone serrulata</i>	0.0308	0.0077	0.0018	0.0097	0.0500	0.03
50	<i>Beilschmiedia gammieana</i>	0.0301	0.0075	0.0018	0.0095	0.0489	0.03
51	<i>Ampelocissus martinii</i>	0.0289	0.0072	0.0017	0.0091	0.0470	0.03
52	<i>Engelhardtia spicata</i>	0.0204	0.0048	0.0016	0.0072	0.0340	0.02
53	<i>Helicia nilagirica</i>	0.0186	0.0045	0.0013	0.0062	0.0306	0.02
54	<i>Gluta usitata</i>	0.0157	0.0036	0.0013	0.0057	0.0263	0.02
55	<i>Catunaregam tomentosa</i>	0.0153	0.0037	0.0011	0.0052	0.0253	0.01
56	<i>Terminalia chebula</i>	0.0146	0.0033	0.0014	0.0057	0.0250	0.01
57	<i>Phoebe lanceolata</i>	0.0107	0.0025	0.0008	0.0038	0.0179	0.01
58	<i>Vangueria pubescens</i>	0.0084	0.0019	0.0008	0.0032	0.0142	0.01
59	<i>Antidesma sp.</i>	0.0057	0.0012	0.0007	0.0025	0.0101	0.01
60	<i>Xantolis cambodiana</i>	0.0029	0.0006	0.0003	0.0012	0.0051	0.00
61	<i>Smilax ovalifolia</i>	0.0012	0.0003	0.0002	0.0006	0.0023	0.00
	Total	109	25	5	33	172	100

Table 2-6 (Continued)

No	Species	Biomass (Mg.ha <sup>-1</sup> )					
		Stem	Branch	Leaf	Root	Total	%
	<b>23 year-old pine plantation</b>						
1	<i>Pinus kesiya</i>	44.7385	8.9031	1.8507	14.4693	69.9617	49.31
2	<i>Quercus vestita</i>	15.3182	4.5783	0.4553	3.4701	23.8218	16.79
3	<i>Lithocarpus polystachyus</i>	9.9133	2.9180	0.3117	2.3094	15.4524	10.89
4	<i>Schima wallichii</i>	3.6537	1.0782	0.1093	0.8390	5.6802	4.00
5	<i>Lithocarpus sootepensis</i>	2.2154	0.6425	0.0765	0.5350	3.4694	2.45
6	<i>Lithocarpus elegans</i>	1.6218	0.4471	0.0667	0.4282	2.5638	1.81
7	<i>Quercus kingiana</i>	1.5118	0.3982	0.0746	0.4351	2.4198	1.71
8	<i>Tristania rufescens</i>	1.2206	0.3075	0.0776	0.3898	1.9955	1.41
9	<i>Phyllanthus emblica</i>	1.0418	0.2670	0.0598	0.3191	1.6877	1.19
10	<i>Castanopsis purpurea</i>	1.0629	0.3015	0.0383	0.2645	1.6672	1.18
11	<i>Protium serratum</i>	1.0137	0.2997	0.0297	0.2312	1.5744	1.11
12	<i>Stereospermum neuranthum</i>	0.8922	0.2769	0.0210	0.1845	1.3746	0.97
13	<i>Dalbergia assamica</i>	0.8282	0.2184	0.0403	0.2373	1.3242	0.93
14	<i>Albizia odoratissima</i>	0.8542	0.2584	0.0236	0.1879	1.3241	0.93
15	<i>Craibiodendron stellatum</i>	0.6856	0.1762	0.0406	0.2111	1.1136	0.78
16	<i>Vaccinium sprengelii</i>	0.6043	0.1473	0.0429	0.2043	0.9989	0.70
17	<i>Lithocarpus fenestratus</i>	0.5726	0.1543	0.0257	0.1576	0.9103	0.64
18	<i>Styrax benzoides</i>	0.3482	0.0915	0.0171	0.1003	0.5571	0.39
19	<i>Aporosa villosa</i>	0.3400	0.0852	0.0211	0.1082	0.5546	0.39
20	<i>Dillenia aurea</i>	0.3543	0.1037	0.0107	0.0822	0.5509	0.39
21	<i>Anneslea fragrans</i>	0.2508	0.0648	0.0135	0.0750	0.4041	0.28
22	<i>Clausena wallichii</i>	0.2410	0.0643	0.0109	0.0671	0.3833	0.27
23	<i>Wendlandia tinctoria</i>	0.2167	0.0535	0.0140	0.0707	0.3550	0.25
24	<i>Vangueria pubescens</i>	0.1868	0.0466	0.0113	0.0594	0.3042	0.21
25	<i>Syzygium cumini</i>	0.1377	0.0359	0.0069	0.0401	0.2207	0.16
26	<i>Castanopsis diversifolia</i>	0.1232	0.0326	0.0058	0.0349	0.1965	0.14
27	<i>Celastrus paniculata</i>	0.0991	0.0252	0.0056	0.0304	0.1603	0.11
28	<i>Gluta obovata</i>	0.0830	0.0197	0.0064	0.0294	0.1385	0.10
29	<i>Glochidion sphaerogynum</i>	0.0757	0.0179	0.0059	0.0268	0.1263	0.09
30	<i>Ziziphus oenoplia</i>	0.0471	0.0121	0.0025	0.0140	0.0757	0.05
31	<i>Glochidion hirsutum</i>	0.0349	0.0082	0.0029	0.0126	0.0585	0.04
32	<i>Symplocos racemosa</i>	0.0311	0.0076	0.0021	0.0103	0.0513	0.04
33	<i>Dalbergia foliacea</i>	0.0301	0.0075	0.0018	0.0095	0.0489	0.03
34	<i>Gluta usitata</i>	0.0276	0.0064	0.0023	0.0100	0.0463	0.03
35	<i>Dalbergia cultrata</i>	0.0268	0.0064	0.0019	0.0092	0.0444	0.03
36	<i>Flacourtia indica</i>	0.0246	0.0061	0.0015	0.0079	0.0402	0.03
37	<i>Cratoxylum sumatranum</i>	0.0235	0.0058	0.0015	0.0076	0.0385	0.03
38	<i>Colona flagrocarpa</i>	0.0202	0.0045	0.0020	0.0081	0.0347	0.02
39	<i>Ternstroemia gymnanthera</i>	0.0210	0.0052	0.0014	0.0069	0.0345	0.02
40	<i>Lithocarpus lindleyanus</i>	0.0181	0.0044	0.0012	0.0061	0.0297	0.02
41	<i>Antidesma acidum</i>	0.0115	0.0026	0.0011	0.0045	0.0196	0.01
42	<i>Dolichandrone serrulata</i>	0.0093	0.0021	0.0009	0.0037	0.0159	0.01
43	<i>Symplocos henschelii</i>	0.0079	0.0018	0.0007	0.0029	0.0134	0.01
44	<i>Semecarpus anacardium</i>	0.0067	0.0015	0.0006	0.0025	0.0114	0.01
45	<i>Cratoxylum formosum</i>	0.0066	0.0015	0.0006	0.0025	0.0112	0.01
46	<i>Terminalia chebula</i>	0.0048	0.0011	0.0005	0.0020	0.0083	0.01
47	<i>Catunaregam tomentosa</i>	0.0031	0.0007	0.0003	0.0013	0.0054	0.00
48	<i>Engelhardtia spicata</i>	0.0005	0.0001	0.0001	0.0003	0.0010	0.00
49	<i>Turpinia pomifera</i>	0.0005	0.0001	0.0001	0.0002	0.0009	0.00
50	<i>Syzygium albiflorum</i>	0.0005	0.0001	0.0001	0.0002	0.0009	0.00
	<b>Total</b>	<b>91</b>	<b>22</b>	<b>3</b>	<b>26</b>	<b>142</b>	<b>100</b>

Table 2-6 (Continued)

No	Species	Biomass (Mg. ha <sup>-1</sup> )					
		Stem	Branch	Leaf	Root	Total	%
<b>24 year-old pine plantation</b>							
1	<i>Pinus kesiya</i>	55.1258	10.5763	2.2819	17.9779	85.9620	46.17
2	<i>Castanopsis diversifolia</i>	27.3447	9.3747	0.4417	4.7077	41.8688	22.49
3	<i>Schima wallichii</i>	9.1970	2.9335	0.2081	1.8369	14.1755	7.61
4	<i>Elaeocarpus sphaericus</i>	6.5870	2.1057	0.1448	1.3036	10.1410	5.45
5	<i>Sarcosperma arboreum</i>	4.4996	1.4580	0.0891	0.8579	6.9046	3.71
6	<i>Syzygium cumini</i>	4.4468	1.5273	0.0676	0.7535	6.7952	3.65
7	<i>Helicia terminalis</i>	2.3852	0.6539	0.0982	0.6333	3.7707	2.03
8	<i>Erythrina subumbrans</i>	2.0056	0.6164	0.0500	0.4243	3.0963	1.66
9	<i>Glochidion sphaerogynum</i>	1.7264	0.5079	0.0522	0.3986	2.6851	1.44
10	<i>Ternstroemia gymnanthera</i>	1.1742	0.3440	0.0358	0.2726	1.8266	0.98
11	<i>Betula alnoides</i>	1.1546	0.3642	0.0253	0.2313	1.7754	0.95
12	<i>Engelhardtia serrata</i>	0.9461	0.2842	0.0259	0.2091	1.4652	0.79
13	<i>Styrax benzoides</i>	0.7770	0.2164	0.0304	0.2008	1.2245	0.66
14	<i>Magnolia henryi</i>	0.6788	0.2071	0.0172	0.1452	1.0483	0.56
15	<i>Engelhardtia spicata</i>	0.6677	0.2035	0.0170	0.1431	1.0313	0.55
16	<i>Dalbergia assamica</i>	0.3910	0.1109	0.0136	0.0966	0.6121	0.33
17	<i>Eurya nitida</i>	0.3016	0.0815	0.0149	0.0845	0.4826	0.26
18	<i>Dalbergia foliacea</i>	0.1620	0.0421	0.0082	0.0474	0.2597	0.14
19	<i>Phyllanthus emblica</i>	0.1340	0.0353	0.0067	0.0386	0.2145	0.12
20	<i>Callicarpa arborea</i>	0.1201	0.0329	0.0049	0.0319	0.1897	0.10
21	<i>Gmelina arborea</i>	0.0563	0.0147	0.0028	0.0164	0.0903	0.05
22	<i>Dolichandrone serrulata</i>	0.0477	0.0123	0.0025	0.0142	0.0766	0.04
23	<i>Gluta obovata</i>	0.0468	0.0115	0.0030	0.0152	0.0765	0.04
24	<i>Helicia nilagirica</i>	0.0377	0.0096	0.0021	0.0115	0.0609	0.03
25	<i>Stereospermum neuranthum</i>	0.0327	0.0082	0.0019	0.0102	0.0530	0.03
26	<i>Anneslea fragrans</i>	0.0312	0.0078	0.0018	0.0098	0.0507	0.03
27	<i>Wendlandia tinctoria</i>	0.0296	0.0069	0.0025	0.0109	0.0498	0.03
28	<i>Syzygium albiflorum</i>	0.0279	0.0067	0.0020	0.0096	0.0462	0.02
29	<i>Phoebe paniculata</i>	0.0267	0.0062	0.0023	0.0098	0.0450	0.02
30	<i>Holarrhena pubescens</i>	0.0187	0.0045	0.0013	0.0062	0.0307	0.02
31	<i>Diospyros glandulosa</i>	0.0114	0.0027	0.0009	0.0040	0.0190	0.01
32	<i>Turpinia pomifera</i>	0.0094	0.0022	0.0008	0.0034	0.0157	0.01
33	<i>Archidendron clypearia</i>	0.0066	0.0013	0.0010	0.0032	0.0121	0.01
34	<i>Pavetta tomentosa</i>	0.0031	0.0006	0.0005	0.0015	0.0057	0.00
35	<i>Symplocos sp.</i>	0.0013	0.0003	0.0002	0.0006	0.0023	0.00
36	<i>Melastoma sanguineum</i>	0.0009	0.0002	0.0002	0.0005	0.0017	0.00
37	<i>Rhus javanica</i>	0.0007	0.0001	0.0001	0.0004	0.0014	0.00
38	<i>Morinda tomentosa</i>	0.0006	0.0001	0.0001	0.0004	0.0012	0.00
39	<i>Pittosporum nepaulense</i>	0.0006	0.0001	0.0001	0.0003	0.0011	0.00
40	<i>Albizia odoratissima</i>	0.0005	0.0001	0.0001	0.0003	0.0011	0.00
41	<i>Olea salicifolia</i>	0.0005	0.0001	0.0001	0.0002	0.0009	0.00
42	<i>Canarium subulatum</i>	0.0004	0.0001	0.0001	0.0002	0.0007	0.00
43	<i>Vernonia volkameriifolia</i>	0.0003	0.0001	0.0001	0.0002	0.0006	0.00
44	<i>Acacia megaladena</i>	0.0003	0.0001	0.0001	0.0002	0.0006	0.00
45	<i>Lindera metcalfiana</i>	0.0002	0.0000	0.0000	0.0001	0.0004	0.00
46	<i>Litsea cubeba</i>	0.0001	0.0000	0.0000	0.0001	0.0002	0.00
Total		120	32	4	31	186	100

Table 2-6 (Continued)

No	Species	Biomass (Mg.ha <sup>-1</sup> )					
		Stem	Branch	Leaf	Root	Total	%
	<b>25 year-old pine plantation</b>						
1	<i>Pinus kesiya</i>	71.8476	14.0130	2.9731	23.3230	112.1567	65.03
2	<i>Schima wallichii</i>	9.7101	2.9162	0.2792	2.1742	15.0796	8.74
3	<i>Castanopsis diversifolia</i>	5.5669	1.6950	0.1508	1.2124	8.6252	5.00
4	<i>Syzygium albiflorum</i>	5.2517	1.8007	0.0853	0.9031	8.0407	4.66
5	<i>Castanopsis purpurea</i>	3.5760	1.1995	0.0615	0.6379	5.4749	3.17
6	<i>Anneslea fragrans</i>	2.6787	0.7845	0.0865	0.6309	4.1805	2.42
7	<i>Castanopsis acuminatissima</i>	2.4070	0.7292	0.0629	0.5222	3.7213	2.16
8	<i>Wendlandia tinctoria</i>	1.4353	0.3578	0.0883	0.4586	2.3400	1.36
9	<i>Helicia nilagirica</i>	0.9948	0.2688	0.0443	0.2729	1.5809	0.92
10	<i>Ternstroemia gymnanthera</i>	0.9175	0.2540	0.0363	0.2390	1.4469	0.84
11	<i>Glochidion sphaerogynum</i>	0.8980	0.2535	0.0326	0.2250	1.4090	0.82
12	<i>Styrax benzoides</i>	0.7189	0.1891	0.0353	0.2070	1.1503	0.67
13	<i>Betula alnoides</i>	0.6012	0.1820	0.0158	0.1306	0.9295	0.54
14	<i>Gluta obovata</i>	0.5193	0.1333	0.0285	0.1572	0.8383	0.49
15	<i>Ficus ribes</i>	0.4814	0.1326	0.0194	0.1267	0.7601	0.44
16	<i>Engelhardtia serrata</i>	0.4589	0.1289	0.0168	0.1158	0.7204	0.42
17	<i>Lithocarpus sootepensis</i>	0.3968	0.1086	0.0166	0.1058	0.6277	0.36
18	<i>Diospyros glandulosa</i>	0.3596	0.0991	0.0143	0.0942	0.5671	0.33
19	<i>Callicarpa arborea</i>	0.3351	0.0978	0.0103	0.0783	0.5214	0.30
20	<i>Engelhardtia spicata</i>	0.2488	0.0653	0.0124	0.0721	0.3986	0.23
21	<i>Tristania rufescens</i>	0.2393	0.0609	0.0135	0.0734	0.3871	0.22
22	<i>Dalbergia foliacea</i>	0.1551	0.0394	0.0088	0.0478	0.2510	0.15
23	<i>Dalbergia assamica</i>	0.1410	0.0374	0.0066	0.0398	0.2247	0.13
24	<i>Dillenia aurea</i>	0.1175	0.0321	0.0048	0.0313	0.1857	0.11
25	<i>Phyllanthus emblica</i>	0.0928	0.0227	0.0062	0.0308	0.1525	0.09
26	<i>Magnolia henryi</i>	0.0901	0.0242	0.0040	0.0248	0.1430	0.08
27	<i>Phoebe paniculata</i>	0.0823	0.0214	0.0042	0.0242	0.1321	0.08
28	<i>Phoebe cathia</i>	0.0739	0.0196	0.0034	0.0208	0.1177	0.07
29	<i>Eurya nitida</i>	0.0602	0.0157	0.0029	0.0174	0.0962	0.06
30	<i>Gluta usitata</i>	0.0544	0.0135	0.0035	0.0176	0.0890	0.05
31	<i>Symplocos sp.</i>	0.0312	0.0078	0.0018	0.0098	0.0507	0.03
32	<i>Dolichandrone serrulata</i>	0.0124	0.0029	0.0009	0.0044	0.0207	0.01
33	<i>Elaeocarpus sphaericus</i>	0.0097	0.0022	0.0008	0.0036	0.0165	0.01
34	<i>Aporosa villosa</i>	0.0084	0.0020	0.0007	0.0031	0.0142	0.01
35	<i>Olea salicifolia</i>	0.0020	0.0004	0.0002	0.0009	0.0036	0.00
36	<i>Acacia megaladena</i>	0.0005	0.0001	0.0001	0.0003	0.0010	0.00
37	<i>Archidendron clypearia</i>	0.0004	0.0001	0.0001	0.0002	0.0007	0.00
38	<i>Albizia odoratissima</i>	0.0003	0.0001	0.0001	0.0002	0.0006	0.00
39	<i>Pavetta tomentosa</i>	0.0002	0.0000	0.0001	0.0001	0.0005	0.00
	Total	111	26	4	32	172	100



Table 2-6 (Continued)

No	Species	Biomass (Mg.ha <sup>-1</sup> )					
		Stem	Branch	Leaf	Root	Total	%
	<b>26 year-old pine plantation</b>						
1	<i>Pinus kesiya</i>	115.5240	25.5026	4.7663	35.9664	181.7593	64.56
2	<i>Schima wallichii</i>	21.6117	6.7476	0.5305	4.4926	33.3824	11.86
3	<i>Quercus semiserrata</i>	8.5656	3.0662	0.1089	1.3381	13.0789	4.65
4	<i>Castanopsis diversifolia</i>	8.4180	2.7720	0.1648	1.5745	12.9292	4.59
5	<i>Helicia nilagirica</i>	5.4758	1.7910	0.1037	1.0238	8.3943	2.98
6	<i>Syzygium albiflorum</i>	3.2337	1.0687	0.0614	0.5980	4.9618	1.76
7	<i>Ternstroemia gymnanthera</i>	2.9911	0.9344	0.0728	0.6189	4.6172	1.64
8	<i>Stereospermum neuranthum</i>	2.8910	0.9663	0.0494	0.5168	4.4235	1.57
9	<i>Syzygium cumini</i>	2.0530	0.6716	0.0385	0.3829	3.1460	1.12
10	<i>Castanopsis purpurea</i>	1.7202	0.5564	0.0339	0.3279	2.6384	0.94
11	<i>Dillenia aurea</i>	1.4972	0.4801	0.0306	0.2904	2.2983	0.82
12	<i>Phoebe paniculata</i>	1.4240	0.4295	0.0383	0.3124	2.2042	0.78
13	<i>Elaeocarpus sphaericus</i>	0.7253	0.2079	0.0241	0.1755	1.1328	0.40
14	<i>Engelhardtia spicata</i>	0.7118	0.2011	0.0256	0.1778	1.1163	0.40
15	<i>Toona ciliata</i>	0.6529	0.1987	0.0167	0.1404	1.0086	0.36
16	<i>Helicia terminalis</i>	0.5168	0.1405	0.0221	0.1395	0.8189	0.29
17	<i>Dalbergia assamica</i>	0.4832	0.1314	0.0210	0.1308	0.7665	0.27
18	<i>Lithocarpus elegans</i>	0.4254	0.1137	0.0195	0.1187	0.6773	0.24
19	<i>Castanopsis acuminatissima</i>	0.3951	0.1129	0.0135	0.0965	0.6179	0.22
20	<i>Quercus vestita</i>	0.2001	0.0539	0.0092	0.0555	0.3187	0.11
21	<i>Wendlandia tinctoria</i>	0.1734	0.0445	0.0093	0.0521	0.2793	0.10
22	<i>Myrica esculenta</i>	0.1522	0.0423	0.0058	0.0392	0.2395	0.09
23	<i>Albizia chinensis</i>	0.1286	0.0353	0.0051	0.0338	0.2029	0.07
24	<i>Glochidion sphaerogynum</i>	0.1130	0.0281	0.0070	0.0362	0.1843	0.07
25	<i>Styrax benzoides</i>	0.0935	0.0252	0.0041	0.0256	0.1484	0.05
26	<i>Vaccinium sprengelii</i>	0.0688	0.0173	0.0042	0.0218	0.1120	0.04
27	<i>Magnolia elegans</i>	0.0191	0.0046	0.0014	0.0066	0.0317	0.01
28	<i>Eurya nitida</i>	0.0162	0.0038	0.0013	0.0058	0.0271	0.01
29	<i>Terminalia chebula</i>	0.0094	0.0022	0.0008	0.0034	0.0158	0.01
30	<i>Aporosa villosa</i>	0.0018	0.0004	0.0002	0.0008	0.0033	0.00
31	<i>Acacia megaladena</i>	0.0002	0.0000	0.0000	0.0001	0.0004	0.00
	Total	180	46	6	49	282	100

Table 2-6 (Continued)

No	Species	Biomass (Mg.ha <sup>-1</sup> )					
		Stem	Branch	Leaf	Root	Total	%
	<b>27 year-old pine plantation</b>						
1	<i>Pinus kesiya</i>	70.7777	15.0007	2.9230	22.3413	111.0427	52.94
2	<i>Schima wallichii</i>	34.1984	10.2120	0.9771	7.6815	53.0689	25.30
3	<i>Castanopsis diversifolia</i>	3.5928	1.0638	0.1064	0.8201	5.5832	2.66
4	<i>Glochidion sphaerogynum</i>	3.3873	0.9624	0.1219	0.8422	5.3137	2.53
5	<i>Phoebe paniculata</i>	3.2060	0.9447	0.0997	0.7425	4.9930	2.38
6	<i>Elaeocarpus sphaericus</i>	2.9415	0.8677	0.0875	0.6745	4.5713	2.18
7	<i>Dalbergia velutina</i>	2.2971	0.5969	0.1185	0.6766	3.6890	1.76
8	<i>Betula alnoides</i>	2.2169	0.6976	0.0492	0.4462	3.4099	1.63
9	<i>Buchanania lanzan</i>	2.0567	0.6455	0.0468	0.4173	3.1664	1.51
10	<i>Castanopsis purpurea</i>	1.8945	0.5683	0.0520	0.4197	2.9346	1.40
11	<i>Wendlandia tinctoria</i>	1.4164	0.3862	0.0605	0.3809	2.2439	1.07
12	<i>Lithocarpus elegans</i>	0.9259	0.2494	0.0414	0.2548	1.4715	0.70
13	<i>Syzygium albiflorum</i>	0.7646	0.2190	0.0271	0.1878	1.1984	0.57
14	<i>Styrax benzoides</i>	0.4895	0.1387	0.0188	0.1236	0.7706	0.37
15	<i>Albizia odoratissima</i>	0.4890	0.1456	0.0141	0.1102	0.7588	0.36
16	<i>Eurya nitida</i>	0.4292	0.1218	0.0165	0.1080	0.6755	0.32
17	<i>Helicia terminalis</i>	0.3892	0.1047	0.0178	0.1079	0.6195	0.30
18	<i>Quercus brandisiana</i>	0.3755	0.1103	0.0112	0.0865	0.5835	0.28
19	<i>Symplocos racemosa</i>	0.3442	0.0942	0.0141	0.0914	0.5439	0.26
20	<i>Castanopsis acuminatissima</i>	0.3251	0.0947	0.0101	0.0762	0.5060	0.24
21	<i>Cleidion spiciflorum</i>	0.2578	0.0708	0.0103	0.0677	0.4067	0.19
22	<i>Symplocos sp.</i>	0.2094	0.0565	0.0093	0.0574	0.3325	0.16
23	<i>Lithocarpus fenestratus</i>	0.1672	0.0438	0.0082	0.0483	0.2676	0.13
24	<i>Colona flagrocarpa</i>	0.1388	0.0383	0.0054	0.0362	0.2187	0.10
25	<i>Memecylon edule</i>	0.1171	0.0301	0.0063	0.0353	0.1888	0.09
26	<i>Syzygium cumini</i>	0.1119	0.0304	0.0047	0.0300	0.1770	0.08
27	<i>Mallotus paniculatus</i>	0.0885	0.0175	0.0148	0.0445	0.1652	0.08
28	<i>Markhamia pierrei</i>	0.0957	0.0257	0.0043	0.0264	0.1521	0.07
29	<i>Engelhardtia spicata</i>	0.0773	0.0198	0.0042	0.0234	0.1248	0.06
30	<i>Lithocarpus garrettianus</i>	0.0614	0.0160	0.0031	0.0180	0.0986	0.05
31	<i>Semecarpus albescens</i>	0.0574	0.0150	0.0028	0.0167	0.0919	0.04
32	<i>Helicia nilagirica</i>	0.0544	0.0136	0.0032	0.0172	0.0884	0.04
33	<i>Neolitsea zeylanica</i>	0.0340	0.0068	0.0056	0.0169	0.0633	0.03
34	<i>Myrica esculenta</i>	0.0356	0.0087	0.0025	0.0121	0.0589	0.03
35	<i>Anneslea fragrans</i>	0.0331	0.0083	0.0020	0.0104	0.0537	0.03
36	<i>Phoebe lanceolata</i>	0.0115	0.0024	0.0015	0.0051	0.0206	0.01
37	<i>Catunaregam tomentosa</i>	0.0083	0.0015	0.0019	0.0048	0.0164	0.01
38	<i>Phyllanthus emblica</i>	0.0077	0.0017	0.0009	0.0033	0.0137	0.01
39	<i>Archidendron clypearia</i>	0.0058	0.0011	0.0010	0.0030	0.0109	0.01
40	<i>Artocarpus sp.</i>	0.0054	0.0011	0.0007	0.0025	0.0098	0.00
41	<i>Blumea balsamifera</i>	0.0030	0.0006	0.0006	0.0016	0.0058	0.00
42	<i>Memecylon celastrinum</i>	0.0029	0.0006	0.0006	0.0016	0.0057	0.00
43	<i>Cinnamomum iners</i>	0.0029	0.0006	0.0006	0.0016	0.0056	0.00
44	<i>Litsea cubeba</i>	0.0028	0.0006	0.0005	0.0014	0.0052	0.00
45	<i>Mussaenda sanderiana</i>	0.0024	0.0004	0.0006	0.0014	0.0048	0.00
46	<i>Turpinia cochinchinensis</i>	0.0022	0.0005	0.0003	0.0010	0.0040	0.00
47	<i>Vernonia volkameriifolia</i>	0.0018	0.0004	0.0003	0.0009	0.0034	0.00
48	<i>Diospyros glandulosa</i>	0.0016	0.0003	0.0003	0.0009	0.0032	0.00
49	<i>Euodia roxburghiana</i>	0.0015	0.0003	0.0004	0.0010	0.0031	0.00
50	<i>Melastoma sanguineum</i>	0.0014	0.0003	0.0003	0.0007	0.0026	0.00
51	<i>Milletia pachycarpa</i>	0.0013	0.0002	0.0003	0.0008	0.0026	0.00
52	<i>Ternstroemia gymnanthera</i>	0.0011	0.0002	0.0002	0.0005	0.0020	0.00
53	<i>Rhus javanica</i>	0.0009	0.0002	0.0002	0.0005	0.0018	0.00
54	<i>Glochidion arborescens</i>	0.0009	0.0002	0.0002	0.0005	0.0017	0.00
55	<i>Albizia chinensis</i>	0.0008	0.0002	0.0002	0.0005	0.0017	0.00
56	<i>Lindera metcalfiana</i>	0.0007	0.0001	0.0002	0.0004	0.0014	0.00
57	<i>Canthium sp.</i>	0.0007	0.0001	0.0001	0.0003	0.0012	0.00
58	<i>Kydia calycina</i>	0.0007	0.0001	0.0001	0.0003	0.0012	0.00
59	<i>Engelhardtia serrata</i>	0.0006	0.0001	0.0001	0.0003	0.0011	0.00
60	<i>Acacia megaladena</i>	0.0005	0.0001	0.0001	0.0003	0.0009	0.00
61	<i>Magnolia henryi</i>	0.0005	0.0001	0.0001	0.0002	0.0009	0.00
62	<i>Artocarpus lacucha</i>	0.0005	0.0001	0.0001	0.0002	0.0009	0.00
63	<i>Viburnum sambucinum</i>	0.0005	0.0001	0.0001	0.0002	0.0009	0.00
64	<i>Acacia pennata</i>	0.0004	0.0001	0.0001	0.0003	0.0009	0.00
65	<i>Syzygium sp.</i>	0.0004	0.0001	0.0001	0.0002	0.0007	0.00
66	<i>Antidesma acidum</i>	0.0004	0.0001	0.0001	0.0002	0.0007	0.00
67	<i>Craibiodendron stellatum</i>	0.0003	0.0001	0.0001	0.0002	0.0006	0.00
68	<i>Antiaris toxicaria</i>	0.0002	0.0000	0.0000	0.0001	0.0004	0.00
69	<i>Gluta obovata</i>	0.0002	0.0000	0.0000	0.0001	0.0004	0.00
70	<i>Ficus callosa</i>	0.0001	0.0000	0.0000	0.0001	0.0002	0.00
	<b>Total</b>	<b>134</b>	<b>34</b>	<b>5</b>	<b>37</b>	<b>210</b>	<b>100</b>

Table 2-6 (Continued)

No	Species	Biomass (Mg.ha <sup>-1</sup> )					
		Stem	Branch	Leaf	Root	Total	%
	<b>28 year-old pine plantation</b>						
1	<i>Pinus kesiya</i>	80.6549	18.7481	3.3236	24.6853	127.4119	78.60
2	<i>Schima wallichii</i>	14.6188	4.4841	0.3673	3.1051	22.5753	13.93
3	<i>Engelhardtia spicata</i>	1.7227	0.5027	0.0551	0.4061	2.6866	1.66
4	<i>Glochidion sphaerogynum</i>	1.5366	0.4426	0.0522	0.3720	2.4033	1.48
5	<i>Markhamia stipulata</i>	0.8514	0.2389	0.0311	0.2150	1.3363	0.82
6	<i>Castanopsis diversifolia</i>	0.8177	0.2367	0.0272	0.1960	1.2777	0.79
7	<i>Entada rheedii</i>	0.7134	0.2183	0.0178	0.1517	1.1012	0.68
8	<i>Colona flagrocarpa</i>	0.5502	0.1655	0.0149	0.1210	0.8516	0.53
9	<i>Stereospermum neuranthum</i>	0.3582	0.1013	0.0128	0.0893	0.5616	0.35
10	<i>Castanopsis purpurea</i>	0.3532	0.1034	0.0107	0.0819	0.5492	0.34
11	<i>Erythrina subumbrans</i>	0.1333	0.0348	0.0068	0.0389	0.2137	0.13
12	<i>Gmelina arborea</i>	0.1215	0.0309	0.0070	0.0375	0.1970	0.12
13	<i>Dalbergia foliacea</i>	0.0942	0.0236	0.0057	0.0298	0.1533	0.09
14	<i>Vaccinium sprengelii</i>	0.0955	0.0257	0.0041	0.0261	0.1514	0.09
15	<i>Dalbergia assamica</i>	0.0757	0.0193	0.0042	0.0231	0.1224	0.08
16	<i>Phyllanthus emblica</i>	0.0576	0.0143	0.0037	0.0187	0.0943	0.06
17	<i>Albizia odoratissima</i>	0.0564	0.0147	0.0029	0.0165	0.0904	0.06
18	<i>Syzygium albiflorum</i>	0.0527	0.0135	0.0029	0.0160	0.0851	0.05
19	<i>Litsea cubeba</i>	0.0370	0.0078	0.0048	0.0166	0.0662	0.04
20	<i>Ficus ribes</i>	0.0351	0.0082	0.0029	0.0128	0.0591	0.04
21	<i>Diospyros glandulosa</i>	0.0152	0.0033	0.0018	0.0065	0.0268	0.02
22	<i>Musa acuminata</i>	0.0095	0.0022	0.0008	0.0035	0.0160	0.01
23	<i>Archidendron clypearia</i>	0.0082	0.0018	0.0008	0.0033	0.0142	0.01
24	<i>Phoebe paniculata</i>	0.0062	0.0013	0.0009	0.0030	0.0114	0.01
25	<i>Wendlandia tinctoria</i>	0.0044	0.0009	0.0007	0.0022	0.0081	0.01
26	<i>Vernonia volkamerifolia</i>	0.0044	0.0009	0.0006	0.0020	0.0079	0.00
27	<i>Horsfieldia tomentosa</i>	0.0029	0.0006	0.0003	0.0012	0.0051	0.00
28	<i>Rhus javanica</i>	0.0025	0.0005	0.0004	0.0012	0.0046	0.00
29	<i>Phoebe lanceolata</i>	0.0017	0.0003	0.0003	0.0008	0.0031	0.00
30	<i>Acacia megaladena</i>	0.0007	0.0001	0.0001	0.0003	0.0013	0.00
31	<i>Eriolaena candollei</i>	0.0007	0.0001	0.0001	0.0003	0.0012	0.00
32	<i>Melastoma sanguineum</i>	0.0006	0.0001	0.0001	0.0003	0.0012	0.00
33	<i>Litsea monopetala</i>	0.0005	0.0001	0.0001	0.0002	0.0009	0.00
34	<i>Syzygium cumini</i>	0.0005	0.0001	0.0001	0.0002	0.0009	0.00
35	<i>Aporosa villosa</i>	0.0005	0.0001	0.0001	0.0002	0.0009	0.00
	Total	103	25	4	30	162	100

Table 2-6 (Continued)

No	Species	Biomass (Mg.ha <sup>-1</sup> )					Total	
		Stem	Branch	Leaf	Root	Total		
	<b>29 year-old pine plantation</b>							
1	<i>Pinus kesiya</i>	45.0515	9.1112	1.8627	14.4525	70.4779	61.42	
2	<i>Castanopsis purpurea</i>	7.3915	2.2390	0.2125	1.6426	11.4856	10.01	
3	<i>Schima wallichii</i>	6.2814	1.9292	0.1614	1.3387	9.7108	8.46	
4	<i>Helicia terminalis</i>	4.3897	1.2572	0.1502	1.0704	6.8675	5.98	
5	<i>Anneslea fragrans</i>	2.7439	0.8901	0.0544	0.5226	4.2109	3.67	
6	<i>Quercus vestita</i>	1.2566	0.3705	0.0375	0.2886	1.9533	1.70	
7	<i>Castanopsis diversifolia</i>	1.0991	0.3394	0.0282	0.2326	1.6993	1.48	
8	<i>Helicia nilagirica</i>	0.9724	0.2875	0.0298	0.2241	1.5138	1.32	
9	<i>Toona ciliata</i>	0.7906	0.2333	0.0232	0.1806	1.2277	1.07	
10	<i>Myrica esculenta</i>	0.7127	0.1982	0.0277	0.1841	1.1228	0.98	
11	<i>Engelhardtia spicata</i>	0.5973	0.1766	0.0180	0.1371	0.9290	0.81	
12	<i>Wendlandia tinctoria</i>	0.4035	0.0975	0.0283	0.1369	0.6662	0.58	
13	<i>Eriolaena candollei</i>	0.4000	0.1148	0.0134	0.0968	0.6251	0.54	
14	<i>Erythrina subumbrans</i>	0.3883	0.1144	0.0115	0.0890	0.6032	0.53	
15	<i>Cycas pectinata</i>	0.2376	0.0633	0.0108	0.0663	0.3781	0.33	
16	<i>Acacia megaladena</i>	0.1508	0.0407	0.0066	0.0412	0.2393	0.21	
17	<i>Camellia pleurocarpa</i>	0.1226	0.0329	0.0055	0.0339	0.1949	0.17	
18	<i>Phyllanthus emblica</i>	0.1163	0.0300	0.0063	0.0348	0.1874	0.16	
19	<i>Ternstroemia gymnanthera</i>	0.1078	0.0293	0.0045	0.0290	0.1706	0.15	
20	<i>Tadehagi triquetrum</i>	0.0751	0.0196	0.0038	0.0220	0.1205	0.10	
21	<i>Lithocarpus elegans</i>	0.0505	0.0131	0.0026	0.0149	0.0810	0.07	
22	<i>Dalbergia foliacea</i>	0.0411	0.0105	0.0022	0.0125	0.0663	0.06	
23	<i>Morinda tomentosa</i>	0.0313	0.0078	0.0018	0.0098	0.0507	0.04	
24	<i>Pterospermum acerifolium</i>	0.0276	0.0069	0.0017	0.0088	0.0450	0.04	
25	<i>Glochidion sphaerogynum</i>	0.0195	0.0048	0.0013	0.0065	0.0321	0.03	
26	<i>Blumea balsamifera</i>	0.0145	0.0031	0.0017	0.0062	0.0255	0.02	
27	<i>Glochidion hirsutum</i>	0.0140	0.0033	0.0010	0.0048	0.0232	0.02	
28	<i>Catunaregam tomentosa</i>	0.0085	0.0019	0.0008	0.0034	0.0147	0.01	
29	<i>Antidesma acidum</i>	0.0084	0.0019	0.0007	0.0031	0.0142	0.01	
30	<i>Melastoma sanguineum</i>	0.0043	0.0009	0.0007	0.0021	0.0080	0.01	
31	<i>Litsea cubeba</i>	0.0007	0.0001	0.0001	0.0003	0.0013	0.00	
32	<i>Syzygium cumini</i>	0.0002	0.0000	0.0001	0.0001	0.0005	0.00	
	Total	74	18	3	21	115	100	

Table 2-6 (Continued)

No	Species	Biomass (Mg. ha <sup>-1</sup> )					
		Stem	Branch	Leaf	Root	Total	%
	<b>30 year-old pine plantation</b>						
1	<i>Pinus kesiya</i>	79.8944	18.2160	3.2939	24.6254	126.0296	61.56
2	<i>Castanopsis diversifolia</i>	16.2292	5.6744	0.2553	2.7237	24.8826	12.15
3	<i>Schima wallichii</i>	15.2228	4.4702	0.4662	3.5311	23.6903	11.57
4	<i>Castanopsis purpurea</i>	5.0055	1.5366	0.1245	1.0598	7.7264	3.77
5	<i>Dalbergia assamica</i>	3.8398	1.1412	0.1143	0.8745	5.9698	2.92
6	<i>Engelhardtia spicata</i>	3.4061	0.9981	0.1065	0.7956	5.3063	2.59
7	<i>Lithocarpus elegans</i>	2.8086	0.7931	0.1010	0.7023	4.4049	2.15
8	<i>Canarium subulatum</i>	0.5686	0.1715	0.0151	0.1244	0.8796	0.43
9	<i>Dolichandrone serrulata</i>	0.5151	0.1480	0.0172	0.1245	0.8048	0.39
10	<i>Myrica esculenta</i>	0.5123	0.1471	0.0169	0.1234	0.7997	0.39
11	<i>Sapindus rarak</i>	0.4067	0.1201	0.0119	0.0927	0.6314	0.31
12	<i>Albizia odoratissima</i>	0.3306	0.0931	0.0122	0.0834	0.5193	0.25
13	<i>Symplocos sp.</i>	0.3041	0.0882	0.0096	0.0719	0.4737	0.23
14	<i>Garuga pinnata</i>	0.2878	0.0832	0.0092	0.0685	0.4487	0.22
15	<i>Elaeocarpus sphaericus</i>	0.2255	0.0621	0.0090	0.0592	0.3558	0.17
16	<i>Wendlandia tinctoria</i>	0.1608	0.0406	0.0093	0.0500	0.2608	0.13
17	<i>Gluta obovata</i>	0.1515	0.0395	0.0076	0.0442	0.2428	0.12
18	<i>Blumea balsamifera</i>	0.1433	0.0396	0.0055	0.0372	0.2257	0.11
19	<i>Markhamia stipulata</i>	0.1372	0.0368	0.0062	0.0381	0.2183	0.11
20	<i>Colona flagrocarpa</i>	0.0993	0.0258	0.0051	0.0292	0.1594	0.08
21	<i>Gluta usitata</i>	0.0910	0.0233	0.0050	0.0276	0.1469	0.07
22	<i>Engelhardtia serrata</i>	0.0619	0.0162	0.0030	0.0178	0.0989	0.05
23	<i>Gmelina arborea</i>	0.0526	0.0134	0.0029	0.0161	0.0850	0.04
24	<i>Aporosa villosa</i>	0.0426	0.0109	0.0023	0.0128	0.0686	0.03
25	<i>Magnolia henryi</i>	0.0400	0.0099	0.0026	0.0130	0.0655	0.03
26	<i>Castanopsis acuminatissima</i>	0.0249	0.0062	0.0016	0.0080	0.0406	0.02
27	<i>Vaccinium sprengelii</i>	0.0231	0.0057	0.0015	0.0075	0.0378	0.02
28	<i>Erythrina subumbrans</i>	0.0227	0.0056	0.0014	0.0074	0.0371	0.02
29	<i>Acacia megaladena</i>	0.0207	0.0051	0.0014	0.0068	0.0340	0.02
30	<i>Symplocos racemosa</i>	0.0128	0.0029	0.0011	0.0048	0.0217	0.01
31	<i>Phyllanthus emblica</i>	0.0114	0.0025	0.0011	0.0046	0.0197	0.01
32	<i>Syzygium albiflorum</i>	0.0097	0.0022	0.0008	0.0036	0.0165	0.01
33	<i>Morinda tomentosa</i>	0.0031	0.0007	0.0003	0.0013	0.0054	0.00
34	<i>Phoebe paniculata</i>	0.0020	0.0004	0.0002	0.0009	0.0036	0.00
35	<i>Camellia pleurocarpa</i>	0.0011	0.0002	0.0002	0.0005	0.0020	0.00
36	<i>Lithocarpus sootepensis</i>	0.0005	0.0001	0.0001	0.0002	0.0009	0.00
	Total	131	34	5	35	205	100

Table 2-6 (Continued)

No	Species	Biomass (Mg.ha <sup>-1</sup> )					
		Stem	Branch	Leaf	Root	Total	%
	<b>31 year-old pine plantation</b>						
1	<i>Pinus kesiya</i>	46.1595	10.7715	1.9020	14.1200	72.9531	34.33
2	<i>Castanopsis diversifolia</i>	29.1029	9.1685	0.6836	5.9372	44.8923	21.13
3	<i>Schima wallichii</i>	22.5624	6.9305	0.5886	4.8293	34.9108	16.43
4	<i>Castanopsis acuminatissima</i>	9.7900	3.0938	0.2181	1.9649	15.0668	7.09
5	<i>Syzygium albiflorum</i>	5.7405	1.9681	0.0951	0.9916	8.7953	4.14
6	<i>Wendlandia tinctoria</i>	5.1281	1.3552	0.2476	1.4644	8.1954	3.86
7	<i>Myrica esculenta</i>	2.2948	0.6729	0.0702	0.5330	3.5710	1.68
8	<i>Olea salicifolia</i>	2.2571	0.7110	0.0498	0.4534	3.4712	1.63
9	<i>Syzygium cumini</i>	2.2599	0.7412	0.0427	0.4208	3.4646	1.63
10	<i>Helicia terminalis</i>	2.1132	0.5986	0.0762	0.5273	3.3154	1.56
11	<i>Elaeocarpus sphaericus</i>	1.2682	0.3639	0.0434	0.3087	1.9842	0.93
12	<i>Ternstroemia gymnanthera</i>	1.2056	0.3610	0.0348	0.2707	1.8721	0.88
13	<i>Dalbergia cultrata</i>	1.1147	0.3359	0.0298	0.2443	1.7247	0.81
14	<i>Canarium subulatum</i>	1.0034	0.3003	0.0276	0.2229	1.5541	0.73
15	<i>Docynia indica</i>	0.5970	0.1699	0.0206	0.1468	0.9344	0.44
16	<i>Symplocos sp.</i>	0.4981	0.1375	0.0196	0.1300	0.7852	0.37
17	<i>Phoebe paniculata</i>	0.4914	0.1404	0.0167	0.1198	0.7684	0.36
18	<i>Anneslea fragrans</i>	0.4763	0.1292	0.0202	0.1286	0.7543	0.35
19	<i>Phyllanthus emblica</i>	0.3475	0.0894	0.0186	0.1043	0.5599	0.26
20	<i>Rapanea porteriiana</i>	0.2771	0.0721	0.0141	0.0812	0.4445	0.21
21	<i>Eurya nitida</i>	0.2499	0.0691	0.0098	0.0650	0.3938	0.19
22	<i>Gluta obovata</i>	0.2392	0.0655	0.0101	0.0639	0.3788	0.18
23	<i>Engelhardtia spicata</i>	0.1624	0.0418	0.0088	0.0488	0.2618	0.12
24	<i>Diospyros glandulosa</i>	0.1364	0.0366	0.0061	0.0376	0.2168	0.10
25	<i>Helicia nilagirica</i>	0.1325	0.0354	0.0061	0.0370	0.2111	0.10
26	<i>Gochmatia decora</i>	0.1244	0.0341	0.0050	0.0329	0.1964	0.09
27	<i>Styrax benzoides</i>	0.0901	0.0242	0.0040	0.0248	0.1430	0.07
28	<i>Albizia odoratissima</i>	0.0879	0.0236	0.0039	0.0242	0.1397	0.07
29	<i>Betula alnoides</i>	0.0857	0.0229	0.0038	0.0237	0.1361	0.06
30	<i>Glochidion sphaerogynum</i>	0.0649	0.0171	0.0031	0.0186	0.1037	0.05
31	<i>Memecylon celastrinum</i>	0.0615	0.0151	0.0041	0.0204	0.1011	0.05
32	<i>Lithocarpus thomsonii</i>	0.0505	0.0131	0.0026	0.0149	0.0810	0.04
33	<i>Ardisia attenuata</i>	0.0419	0.0107	0.0023	0.0127	0.0676	0.03
34	<i>Turpinia pomifera</i>	0.0246	0.0061	0.0015	0.0079	0.0401	0.02
35	<i>Eriolaena candollei</i>	0.0055	0.0012	0.0005	0.0021	0.0094	0.00
36	<i>Ficus tinctoria</i>	0.0040	0.0009	0.0004	0.0016	0.0068	0.00
37	<i>Ficus maclellandii</i>	0.0006	0.0001	0.0001	0.0003	0.0011	0.00
38	<i>Acacia megaladena</i>	0.0005	0.0001	0.0001	0.0002	0.0009	0.00
39	<i>Erythrina subumbrans</i>	0.0002	0.0000	0.0000	0.0001	0.0003	0.00
	Total	136	39	4	33	213	100

Table 2-6 (Continued)

No	Species	Biomass (Mg.ha <sup>-1</sup> )					
		Stem	Branch	Leaf	Root	Total	%
	<b>32 year-old pine plantation</b>						
1	<i>Pinus kesiya</i>	90.6786	20.1999	3.7403	28.1297	142.7484	60.24
2	<i>Schima wallichii</i>	26.8296	8.4981	0.6022	5.3827	41.3126	17.43
3	<i>Syzygium cumini</i>	10.2056	3.6939	0.1238	1.5601	15.5833	6.58
4	<i>Castanopsis acuminatissima</i>	7.5933	2.3715	0.1744	1.5523	11.6916	4.93
5	<i>Phoebe paniculata</i>	3.0129	0.9890	0.0572	0.5614	4.6204	1.95
6	<i>Xanthophyllum virens</i>	2.2103	0.6835	0.0547	0.4643	3.4128	1.44
7	<i>Elaeocarpus sphaericus</i>	1.7699	0.5182	0.0542	0.4117	2.7541	1.16
8	<i>Magnolia henryi</i>	1.7233	0.5527	0.0360	0.3357	2.6476	1.12
9	<i>Castanopsis tribuloides</i>	1.4016	0.4285	0.0352	0.2986	2.1639	0.91
10	<i>Knema erratica</i>	1.2243	0.3876	0.0264	0.2435	1.8819	0.79
11	<i>Betula alnoides</i>	1.0244	0.3207	0.0232	0.2083	1.5765	0.67
12	<i>Albizia chinensis</i>	0.8411	0.2601	0.0201	0.1752	1.2966	0.55
13	<i>Engelhardtia spicata</i>	0.6299	0.1831	0.0197	0.1482	0.9809	0.41
14	<i>Erythrina subumbrans</i>	0.5668	0.1709	0.0151	0.1240	0.8768	0.37
15	<i>Myrica esculenta</i>	0.4031	0.1137	0.0145	0.1009	0.6322	0.27
16	<i>Glochidion sphaerogynum</i>	0.3303	0.0942	0.0117	0.0814	0.5175	0.22
17	<i>Symplocos sp.</i>	0.3101	0.0900	0.0097	0.0731	0.4829	0.20
18	<i>Anneslea fragrans</i>	0.2958	0.0856	0.0094	0.0702	0.4610	0.19
19	<i>Styrax benzoides</i>	0.2336	0.0629	0.0103	0.0641	0.3709	0.16
20	<i>Luvunga scandens</i>	0.1672	0.0467	0.0062	0.0426	0.2627	0.11
21	<i>Musa acuminata</i>	0.1056	0.0271	0.0057	0.0318	0.1702	0.07
22	<i>Syzygium sp.</i>	0.1047	0.0279	0.0050	0.0295	0.1671	0.07
23	<i>Gmelina arborea</i>	0.0505	0.0131	0.0026	0.0149	0.0810	0.03
24	<i>Eurya nitida</i>	0.0481	0.0124	0.0025	0.0143	0.0774	0.03
25	<i>Syzygium albiflorum</i>	0.0270	0.0060	0.0027	0.0107	0.0464	0.02
26	<i>Memecylon celastrinum</i>	0.0253	0.0063	0.0016	0.0081	0.0412	0.02
27	<i>Wendlandia tinctoria</i>	0.0201	0.0046	0.0018	0.0076	0.0341	0.01
28	<i>Phyllanthus emblica</i>	0.0133	0.0030	0.0012	0.0050	0.0225	0.01
29	<i>Olea salicifolia</i>	0.0099	0.0023	0.0008	0.0036	0.0165	0.01
30	<i>Syzygium sp.</i>	0.0084	0.0020	0.0007	0.0031	0.0142	0.01
31	<i>Milletia pachycarpa</i>	0.0047	0.0010	0.0006	0.0020	0.0083	0.00
32	<i>Litsea cubeba</i>	0.0022	0.0004	0.0005	0.0013	0.0044	0.00
33	<i>Albizia odoratissima</i>	0.0013	0.0003	0.0002	0.0006	0.0023	0.00
34	<i>Trichilla connaroides</i>	0.0005	0.0001	0.0001	0.0002	0.0009	0.00
	Total	152	40	5	40	237	100

Table 2-6 (Continued)

No	Species	Biomass (Mg.ha <sup>-1</sup> )					
		Stem	Branch	Leaf	Root	Total	%
	<b>33 year-old pine plantation</b>						
1	<i>Pinus kesiya</i>	134.4478	31.8321	5.5377	40.8794	212.6971	94.13
2	<i>Musa acuminata</i>	2.4686	0.5992	0.1711	0.8319	4.0709	1.80
3	<i>Wendlandia tinctoria</i>	2.0102	0.6557	0.0388	0.3780	3.0826	1.36
4	<i>Cinnamomum iners</i>	1.4796	0.4421	0.0412	0.3300	2.2930	1.01
5	<i>Albizia chinensis</i>	0.8436	0.2609	0.0202	0.1757	1.3003	0.58
6	<i>Magnolia henryi</i>	0.7459	0.2283	0.0189	0.1590	1.1521	0.51
7	<i>Mallotus barbatus</i>	0.3289	0.0888	0.0156	0.0916	0.5250	0.23
8	<i>Dalbergia oliveri</i>	0.0870	0.0233	0.0039	0.0240	0.1382	0.06
9	<i>Litsea cubeba</i>	0.0487	0.0107	0.0054	0.0203	0.0851	0.04
10	<i>Glochidion acuminatum</i>	0.0508	0.0120	0.0040	0.0181	0.0850	0.04
11	<i>Ilex umbellulata</i>	0.0451	0.0116	0.0024	0.0135	0.0726	0.03
12	<i>Melastoma sanguineum</i>	0.0240	0.0052	0.0027	0.0101	0.0420	0.02
13	<i>Grewia laevigata</i>	0.0203	0.0049	0.0015	0.0069	0.0336	0.01
14	<i>Ficus ribes</i>	0.0176	0.0038	0.0020	0.0074	0.0309	0.01
15	<i>Tadehagi triquetrum</i>	0.0161	0.0034	0.0021	0.0072	0.0288	0.01
16	<i>Artocarpus lacucha</i>	0.0162	0.0034	0.0020	0.0071	0.0288	0.01
17	<i>Laportea bulbifera</i>	0.0158	0.0035	0.0016	0.0064	0.0273	0.01
18	<i>Sapindus rarak</i>	0.0143	0.0031	0.0016	0.0060	0.0250	0.01
19	<i>Saurauia napaulensis</i>	0.0124	0.0024	0.0021	0.0063	0.0234	0.01
20	<i>Archidendron clypearia</i>	0.0119	0.0026	0.0012	0.0049	0.0207	0.01
21	<i>Horsfieldia tomentosa</i>	0.0119	0.0027	0.0011	0.0045	0.0201	0.01
22	<i>Phoebe cathia</i>	0.0111	0.0026	0.0010	0.0042	0.0189	0.01
23	<i>Ficus sp.</i>	0.0103	0.0023	0.0010	0.0040	0.0176	0.01
24	<i>Lindera metcalfiana</i>	0.0078	0.0016	0.0010	0.0035	0.0140	0.01
25	<i>Mussaenda sandariana</i>	0.0069	0.0014	0.0010	0.0032	0.0125	0.01
26	<i>Milletia pachycarpa</i>	0.0072	0.0016	0.0007	0.0029	0.0124	0.01
27	<i>Alangium chinensis</i>	0.0071	0.0016	0.0007	0.0029	0.0122	0.01
28	<i>Neolitsea zeylanica</i>	0.0057	0.0012	0.0009	0.0027	0.0105	0.00
29	<i>Myrica esculenta</i>	0.0038	0.0008	0.0005	0.0017	0.0068	0.00
30	<i>Trevesia palmata</i>	0.0037	0.0008	0.0004	0.0016	0.0066	0.00
31	<i>Litsea monopetala</i>	0.0034	0.0007	0.0004	0.0014	0.0058	0.00
32	<i>Aegialitis rotundifolia</i>	0.0032	0.0007	0.0004	0.0015	0.0058	0.00
33	<i>Nyssa javanica</i>	0.0026	0.0005	0.0006	0.0015	0.0052	0.00
34	<i>Schima wallichii</i>	0.0027	0.0005	0.0004	0.0013	0.0049	0.00
35	<i>Ardisia attenuata</i>	0.0027	0.0006	0.0004	0.0012	0.0048	0.00
36	<i>Bridelia retusa</i>	0.0024	0.0005	0.0004	0.0011	0.0043	0.00
37	<i>Sorbus granulosa</i>	0.0024	0.0005	0.0003	0.0011	0.0043	0.00
38	<i>Phoebe paniculata</i>	0.0023	0.0005	0.0003	0.0011	0.0042	0.00
39	<i>Ampelocissus martinii</i>	0.0021	0.0004	0.0003	0.0010	0.0038	0.00
40	<i>Rauvolfia cambodiana</i>	0.0013	0.0002	0.0003	0.0007	0.0024	0.00
41	<i>Desmodium megaphyllum</i>	0.0009	0.0002	0.0002	0.0005	0.0018	0.00
42	<i>Eurya nitida</i>	0.0010	0.0002	0.0001	0.0005	0.0018	0.00
43	<i>Tetrastigma quadrangulatum</i>	0.0009	0.0002	0.0001	0.0004	0.0016	0.00
44	<i>Canthium berberidifolium</i>	0.0008	0.0002	0.0002	0.0005	0.0016	0.00
45	<i>Rubus rugosus</i>	0.0008	0.0001	0.0001	0.0004	0.0015	0.00
46	<i>Terminalia chebula</i>	0.0007	0.0001	0.0001	0.0003	0.0012	0.00
47	<i>Macaranga kurzii</i>	0.0005	0.0001	0.0001	0.0002	0.0009	0.00
48	<i>Glochidion hirsutum</i>	0.0003	0.0001	0.0001	0.0002	0.0006	0.00
49	<i>Turpinia cochinchinensis</i>	0.0003	0.0001	0.0001	0.0002	0.0006	0.00
50	<i>Ficus hispida</i>	0.0003	0.0001	0.0001	0.0002	0.0005	0.00
51	<i>Gaultheria notabilis</i>	0.0002	0.0000	0.0000	0.0001	0.0004	0.00
52	<i>Stereospermum neuranthum</i>	0.0002	0.0000	0.0000	0.0001	0.0003	0.00
53	<i>Fraxinus floribunda</i>	0.0001	0.0000	0.0000	0.0001	0.0003	0.00
	Total	143	34	6	43	226	100



Table 2-6 (Continued)

No	Species	Biomass (Mg.ha <sup>-1</sup> )					
		Stem	Branch	Leaf	Root	Total	%
	<b>34 year-old pine plantation</b>						
1	<i>Pinus kesiya</i>	61.7223	13.9921	2.5452	19.0796	97.3392	45.11
2	<i>Castanopsis purpurea</i>	32.0607	9.7329	0.8652	6.9972	49.6560	23.01
3	<i>Quercus vestita</i>	14.5847	4.6461	0.3147	2.8823	22.4278	10.39
4	<i>Schima wallichii</i>	10.5074	3.4070	0.2095	2.0044	16.1284	7.47
5	<i>Quercus brandisiana</i>	7.0846	2.1339	0.1986	1.5716	10.9887	5.09
6	<i>Syzygium cumini</i>	3.4551	1.1680	0.0563	0.6041	5.2835	2.45
7	<i>Wendlandia tinctoria</i>	1.7521	0.4587	0.0877	0.5089	2.8075	1.30
8	<i>Dalbergia assamica</i>	1.6335	0.4697	0.0586	0.4009	2.5627	1.19
9	<i>Viburnum sambucinum</i>	0.8985	0.2760	0.0227	0.1907	1.3879	0.64
10	<i>Aporosa villosa</i>	0.7310	0.1910	0.0373	0.2137	1.1731	0.54
11	<i>Glochidion sphaerogynum</i>	0.5921	0.1642	0.0242	0.1554	0.9359	0.43
12	<i>Craibiodendron stellatum</i>	0.4504	0.1227	0.0198	0.1221	0.7150	0.33
13	<i>Lithocarpus elegans</i>	0.4221	0.1221	0.0140	0.1011	0.6594	0.31
14	<i>Albizia odoratissima</i>	0.3919	0.1046	0.0177	0.1091	0.6233	0.29
15	<i>Phyllanthus emblica</i>	0.3120	0.0729	0.0259	0.1138	0.5247	0.24
16	<i>Cycas pectinata</i>	0.2649	0.0711	0.0119	0.0733	0.4212	0.20
17	<i>Lithocarpus sootepensis</i>	0.2572	0.0738	0.0085	0.0621	0.4016	0.19
18	<i>Stereospermum colias</i>	0.2304	0.0656	0.0078	0.0564	0.3602	0.17
19	<i>Vaccinium sprengelii</i>	0.1628	0.0445	0.0070	0.0438	0.2581	0.12
20	<i>Glochidion hirsutum</i>	0.1562	0.0391	0.0094	0.0494	0.2541	0.12
21	<i>Eriolaena candollei</i>	0.1528	0.0391	0.0084	0.0464	0.2467	0.11
22	<i>Horsfieldia tomentosa</i>	0.0636	0.0167	0.0031	0.0182	0.1016	0.05
23	<i>Albizia chinensis</i>	0.0453	0.0117	0.0024	0.0136	0.0729	0.03
24	<i>Canarium subulatum</i>	0.0415	0.0106	0.0022	0.0125	0.0668	0.03
25	<i>Anneslea fragrans</i>	0.0344	0.0083	0.0024	0.0117	0.0569	0.03
26	<i>Pavetta tomentosa</i>	0.0284	0.0069	0.0020	0.0096	0.0468	0.02
27	<i>Helicia nilagirica</i>	0.0229	0.0055	0.0017	0.0079	0.0379	0.02
28	<i>Styrax benzoides</i>	0.0221	0.0054	0.0015	0.0074	0.0364	0.02
29	<i>Diospyros glandulosa</i>	0.0195	0.0048	0.0013	0.0065	0.0321	0.01
30	<i>Gluta usitata</i>	0.0195	0.0048	0.0013	0.0065	0.0321	0.01
31	<i>Antidesma acidum</i>	0.0162	0.0036	0.0015	0.0063	0.0276	0.01
32	<i>Dalbergia cultrata</i>	0.0143	0.0034	0.0010	0.0049	0.0236	0.01
33	<i>Phoebe paniculata</i>	0.0118	0.0026	0.0012	0.0047	0.0204	0.01
34	<i>Canthium sp.</i>	0.0115	0.0025	0.0013	0.0048	0.0201	0.01
35	<i>Engelhardtia spicata</i>	0.0105	0.0023	0.0011	0.0042	0.0181	0.01
36	<i>Protium serratum</i>	0.0051	0.0010	0.0008	0.0025	0.0095	0.00
37	<i>Dillenia aurea</i>	0.0046	0.0010	0.0005	0.0019	0.0080	0.00
38	<i>Syzygium albiflorum</i>	0.0038	0.0008	0.0006	0.0018	0.0070	0.00
39	<i>Rhus javanica</i>	0.0020	0.0004	0.0003	0.0010	0.0038	0.00
40	<i>Tristania rufescens</i>	0.0015	0.0003	0.0002	0.0007	0.0027	0.00
41	<i>Symplocos racemosa</i>	0.0014	0.0003	0.0002	0.0006	0.0025	0.00
42	<i>Schoepfia fragrans</i>	0.0013	0.0003	0.0002	0.0006	0.0023	0.00
43	<i>Litsea cubeba</i>	0.0013	0.0003	0.0002	0.0006	0.0023	0.00
44	<i>Maesa permollis</i>	0.0009	0.0002	0.0002	0.0005	0.0018	0.00
45	<i>Blumea balsamifera</i>	0.0010	0.0002	0.0001	0.0005	0.0018	0.00
46	<i>Castanopsis diversifolia</i>	0.0007	0.0001	0.0001	0.0003	0.0012	0.00
47	<i>Eurya nitida</i>	0.0005	0.0001	0.0001	0.0002	0.0009	0.00
48	<i>Celastrus paniculata</i>	0.0005	0.0001	0.0001	0.0002	0.0009	0.00
49	<i>Tadehagi triquetrum</i>	0.0004	0.0001	0.0001	0.0002	0.0007	0.00
50	<i>Engelhardtia serrata</i>	0.0003	0.0001	0.0001	0.0002	0.0006	0.00
	<b>Total</b>	<b>138</b>	<b>37</b>	<b>5</b>	<b>36</b>	<b>216</b>	<b>100</b>

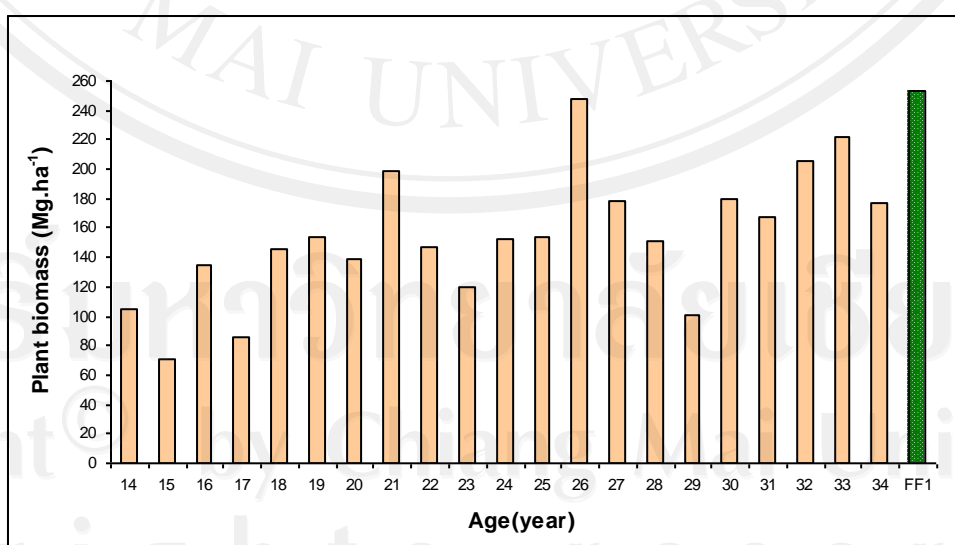
### 2.4.3 Biomass of Fragmented Forests

Biomass of tree species in fifteen fragmented forests were different, 117.3 to 253.3 Mg.ha<sup>-1</sup> (201.1 Mg.ha<sup>-1</sup> in average). It was the lowest in FF10, and the highest in FF1. The average amounts allocated in stem, branch, leaf and root components were 130.0, 40.5, 3.3 and 27.3 Mg.ha<sup>-1</sup>, respectively (Table 2-7 and Figure 2-5). The majority of biomass was stored in tree species of Fagaceae, Pinaceae and Theaceae families (Table 2-8).

Among 103 species in fifteen fragmented forests, *Pinus kesiya* had the highest amount of biomass. The trees having the lower amounts were *C. acuminatissima*, *S. wallichii*, *C. diversifolia*, *Q. brandisiana*, *T. rufescens*, etc.

**Table 2-7** Tree biomass in fragmented forests

Fragmented forest	Tree biomass (Mg.ha <sup>-1</sup> )				
	Stem	Branch	Leaf	Root	Total
FF1	164.2	51.7	3.9	33.5	253.3
FF2	109.2	32.5	3.4	25.0	170.0
FF3	154.1	46.9	4.3	33.7	239.0
FF4	148.5	47.4	3.3	29.5	228.7
FF5	132.3	40.9	3.5	28.2	204.8
FF6	128.6	41.3	2.8	25.3	198.0
FF7	106.0	32.9	2.8	22.4	164.1
FF8	115.5	36.4	2.8	23.7	178.4
FF9	124.6	39.6	3.0	25.3	192.4
FF10	75.6	23.3	2.1	16.3	117.3
FF11	132.6	39.7	3.9	30.0	206.3
FF12	156.4	48.3	4.1	33.3	242.1
FF13	153.7	49.3	3.5	30.5	236.9
FF14	127.4	39.0	3.4	27.5	197.4
FF15	121.4	37.7	3.0	25.4	187.5
Average	130.0	40.5	3.3	27.3	201.1



**Figure 2-5** Tree biomass in pine plantations compared to the 1<sup>st</sup> fragmented forest

Table 2-8 Biomass of tree species in fragmented forests

No	Species	Biomass (kg.ha <sup>-1</sup> )					
		Stem	Branch	Leaf	Root	Total	%
1	<i>Pinus kesiya</i>	43,144.10	14,206.01	811.23	8,001.09	66,162.43	32.90
2	<i>Castanopsis acuminatissima</i>	16,616.93	5,161.08	405.73	3,465.10	25,648.84	12.76
3	<i>Schima wallichii</i>	9,305.85	2,845.07	247.60	2,010.70	14,409.22	7.17
4	<i>Castanopsis diversifolia</i>	7,751.21	2,492.90	166.04	1,516.61	11,926.76	5.93
5	<i>Quercus brandisiana</i>	6,023.10	1,866.00	149.15	1,262.55	9,300.80	4.63
6	<i>Tristania rufescens</i>	4,153.23	1,177.48	156.19	1,045.10	6,531.99	3.25
7	<i>Castanopsis purpurea</i>	4,065.77	1,255.33	102.41	858.90	6,282.42	3.12
8	<i>Lithocarpus elegans</i>	3,567.99	1,068.64	104.34	803.96	5,544.92	2.76
9	<i>Engelhardtia spicata</i>	3,566.99	1,083.81	96.39	777.62	5,524.81	2.75
10	<i>Ternstroemia gymnanthera</i>	3,068.84	896.48	98.69	723.98	4,787.99	2.38
11	<i>Helicia terminalis</i>	2,632.42	785.40	79.33	599.61	4,096.76	2.04
12	<i>Anneslea fragrans</i>	2,079.71	603.04	68.25	496.16	3,247.17	1.61
13	<i>Dalbergia cultrata</i>	1,997.34	596.97	58.66	450.88	3,103.84	1.54
14	<i>Wendlandia tinctoria</i>	1,926.69	507.15	95.41	555.42	3,084.66	1.53
15	<i>Quercus vestita</i>	1,661.50	484.17	55.11	395.69	2,596.47	1.29
16	<i>Quercus semiserrata</i>	1,580.79	497.81	36.67	321.25	2,436.52	1.21
17	<i>Castanopsis armata</i>	1,126.39	392.68	16.06	185.36	1,720.49	0.86
18	<i>Vaccinium sprengelii</i>	1,109.12	286.52	61.12	333.87	1,790.62	0.89
19	<i>Elaeocarpus stipularis</i>	1,040.64	345.46	18.68	189.34	1,594.12	0.79
20	<i>Lithocarpus fenestratus</i>	1,011.33	294.04	32.60	239.77	1,577.74	0.78
21	<i>Glochidion acuminatum</i>	923.01	277.89	26.85	206.28	1,434.02	0.71
22	<i>Lithocarpus polystachyus</i>	725.66	210.10	24.13	173.92	1,133.81	0.56
23	<i>Phoebe paniculata</i>	686.48	196.30	24.17	168.70	1,075.65	0.53
24	<i>Styrax benzoides</i>	619.03	180.09	21.64	149.56	970.33	0.48
25	<i>Phoebe cathia</i>	598.62	195.44	12.18	113.81	920.04	0.46
26	<i>Callicarpa arborea</i>	592.47	168.84	20.59	145.70	927.60	0.46
27	<i>Craibiodendron stellatum</i>	559.46	148.72	27.15	159.03	894.36	0.44
28	<i>Syzygium gratum</i>	553.84	162.22	17.18	129.17	862.40	0.43
29	<i>Helicia nilagirica</i>	472.89	137.65	15.28	112.01	737.83	0.37
30	<i>Buchanania lanzan</i>	467.97	150.32	9.95	91.40	719.64	0.36
31	<i>Engelhardtia serrata</i>	448.85	138.69	11.08	94.23	692.85	0.34
32	<i>Glochidion sphaerogynum</i>	353.44	97.03	15.31	94.92	560.71	0.28
33	<i>Eurya nitida</i>	352.90	96.50	15.47	95.25	560.12	0.28
34	<i>Diospyros glandulosa</i>	350.09	99.55	12.67	87.06	549.38	0.27
35	<i>Phyllanthus emblica</i>	304.21	79.50	16.54	90.37	490.61	0.24
36	<i>Eriolaena candollei</i>	281.56	81.54	9.31	67.36	439.77	0.22
37	<i>Lithocarpus sootepensis</i>	258.28	68.38	12.36	73.44	412.46	0.21
38	<i>Dillenia aurea</i>	249.09	69.65	9.58	63.84	392.16	0.20
39	<i>Syzygium albiflorum</i>	230.69	67.66	7.22	53.81	359.38	0.18
40	<i>Aporosa villosa</i>	214.88	56.23	11.25	63.11	345.47	0.17
41	<i>Albizia odoratissima</i>	213.61	61.31	7.19	51.78	333.89	0.17
42	<i>Albizia chinensis</i>	211.13	61.25	6.75	50.03	329.16	0.16
43	<i>Terminalia chebula</i>	208.83	61.13	6.57	48.88	325.41	0.16
44	<i>Bombax anceps</i>	206.71	61.08	6.09	47.24	321.12	0.16
45	<i>Rapanea porteriiana</i>	185.98	51.02	7.61	49.26	293.87	0.15
46	<i>Lindera metcalfiana</i>	169.99	48.16	6.26	42.57	266.98	0.13
47	<i>Litsea semecarpifolia</i>	153.27	44.36	4.93	36.47	239.04	0.12
48	<i>Symplocos racemosa</i>	134.79	36.70	5.72	36.27	213.48	0.11
49	<i>Embelia subcoriacea</i>	132.52	39.96	3.65	29.20	205.33	0.10
50	<i>Lithocarpus lindleyanus</i>	118.35	35.78	3.13	25.79	183.05	0.09
51	<i>Stereospermum neuranthum</i>	113.03	29.21	6.09	33.82	182.15	0.09
52	<i>Gluta usitata</i>	108.86	32.75	2.93	23.94	168.47	0.08
53	<i>Archidendron clypearia</i>	107.12	30.49	3.88	26.61	168.09	0.08

Table 2-8 (Continued)

No	Species	Biomass (kg.ha <sup>-1</sup> )					
		Stem	Branch	Leaf	Root	Total	%
54	<i>Litsea glutinosa</i>	106.45	31.51	3.22	24.39	165.57	0.08
55	<i>Betula alnoides</i>	88.49	25.24	3.01	21.63	138.37	0.07
56	<i>Olea salicifolia</i>	70.83	20.02	2.59	17.76	111.20	0.06
57	<i>Erythrina subumbrans</i>	69.68	19.71	2.54	17.45	109.38	0.05
58	<i>Ampelocissus martinii</i>	68.77	18.54	3.00	18.80	109.11	0.05
59	<i>Sarcosperma arboreum</i>	62.62	18.08	2.06	15.00	97.76	0.05
60	<i>Vitex pinnata</i>	59.48	17.22	1.89	14.10	92.69	0.05
61	<i>Magnolia henryi</i>	54.60	15.04	2.16	14.28	86.08	0.04
62	<i>Ilex umbellulata</i>	48.49	12.63	2.51	14.26	77.88	0.04
63	<i>Gardenia sootepensis</i>	46.46	12.44	2.11	12.91	73.92	0.04
64	<i>Kydia calycina</i>	45.45	12.94	1.55	11.14	71.08	0.04
65	<i>Turpinia cochinchinensis</i>	44.46	11.37	2.56	13.65	72.03	0.04
66	<i>Viburnum sambucinum</i>	42.68	9.99	3.61	15.61	71.90	0.04
67	<i>Pyrenaria diospyricarpa</i>	42.67	10.18	3.17	14.87	70.89	0.04
68	<i>Quercus kingiana</i>	35.58	9.09	1.97	10.83	57.46	0.03
69	<i>Colona flagrocarpa</i>	31.21	8.31	1.42	8.73	49.67	0.02
70	<i>Milletia pachycarpa</i>	29.06	7.72	1.37	8.19	46.33	0.02
71	<i>Dalbergia velutina</i>	24.35	6.64	1.02	6.52	38.53	0.02
72	<i>Trichilla connaroides</i>	23.26	6.00	1.26	6.97	37.50	0.02
73	<i>Dolichandrone serrulata</i>	22.72	5.79	1.25	6.93	36.69	0.02
74	<i>Radernachera ignea</i>	22.50	6.13	0.93	6.02	35.57	0.02
75	<i>Gordonia dalglieshiana</i>	18.49	4.57	1.17	5.99	30.22	0.02
76	<i>Combretum punctatum</i>	16.56	4.42	0.74	4.60	26.33	0.01
77	<i>Syzygium cumini</i>	15.77	4.02	0.87	4.80	25.46	0.01
78	<i>Garuga pinnata</i>	15.77	3.93	0.96	5.02	25.69	0.01
79	<i>Shorea roxburghii</i>	15.71	4.17	0.73	4.42	25.04	0.01
80	<i>Cinnamomum iners</i>	15.08	4.01	0.70	4.24	24.02	0.01
81	<i>Vernonia volkameriifolia</i>	14.56	3.60	0.93	4.74	23.83	0.01
82	<i>Beilschmiedia gammieana</i>	13.56	3.30	0.96	4.59	22.41	0.01
83	<i>Saurauia roxburghii</i>	13.37	3.19	1.01	4.68	22.25	0.01
84	<i>Glochidion hirsutum</i>	13.18	3.13	1.02	4.65	21.98	0.01
85	<i>Artocarpus gomezianus</i>	10.75	2.79	0.54	3.15	17.24	0.01
86	<i>Pterospermum acerifolium</i>	8.81	2.09	0.68	3.11	14.69	0.01
87	<i>Semecarpus albescens</i>	7.96	1.68	1.07	3.59	14.29	0.01
88	<i>Entada rheedii</i>	6.32	1.59	0.37	1.98	10.25	0.01
89	<i>Schefflera bengalensis</i>	6.25	1.57	0.37	1.96	10.15	0.01
90	<i>Catunaregam tomentosa</i>	4.24	0.92	0.48	1.79	7.43	0.00
91	<i>Antidesma ghaesembilla</i>	3.99	0.91	0.35	1.51	6.76	0.00
92	<i>Mussaenda sanderiana</i>	3.50	0.78	0.36	1.41	6.05	0.00
93	<i>Rhus javanica</i>	2.57	0.54	0.34	1.15	4.60	0.00
94	<i>Ficus sp.</i>	2.31	0.54	0.18	0.82	3.85	0.00
95	<i>Canarium subulatum</i>	1.60	0.37	0.14	0.59	2.69	0.00
96	<i>Horsfieldia tomentosa</i>	1.55	0.36	0.13	0.58	2.61	0.00
97	<i>Protium serratum</i>	0.96	0.21	0.11	0.41	1.69	0.00
98	<i>Pavetta tomentosa</i>	0.86	0.18	0.10	0.37	1.51	0.00
99	<i>Celastrus paniculata</i>	0.79	0.17	0.08	0.32	1.37	0.00
100	<i>Melastoma malabathricum</i>	0.72	0.15	0.09	0.32	1.28	0.00
101	<i>Gmelina philippensis</i>	0.50	0.10	0.08	0.25	0.93	0.00
102	<i>Cinnamomum porrectum</i>	0.38	0.07	0.08	0.21	0.75	0.00
103	<i>Eurya acuminata</i>	0.29	0.06	0.04	0.13	0.53	0.00
Total		129,994	40,460	3,310	27,319	201,083	100



**Figure 2-6** Over views of fragmented forests at Boakaew Watershed Management Station

## 2.5 Discussion

The total biomass of tree species in a series of pine plantations included those of pine trees and succession tree species. There were no plantations of 1 to 13 years old in this watershed management station since the pine plantation project was terminated in 1995. Thereafter, tree planting is changed to re-enriched planting technique in deteriorated forest. For pine trees, the pine biomass in 14- to 34-year-old plantations did not increased with stand ages. The data are different from Miller (1989) who reports that biomass in stem, branch and foliages of *Pinus nigra* was increased with stand ages during 20 years after planting. Many factors including densities of pine and succession trees, site factors and forest fire influenced on pine growths in this study. These factors affected their growths and biomass allocation.

The densities of pine trees in different age plantations were different. At the beginning of planting, the planting space of tree species was 4 x 4 m<sup>2</sup>. However, mixed plantation was taken in 28- to 32-year-old stands by planting pine with *Docynia indica*. The mixed plantation of pine with *Prunus cerasoides* was done in 18-year-old stand. For 17-year-old stand, it was the mixture of pine, *Docynia indica* and *Prunus cerasoides*. More tree species were planted in the younger stands: 16-year-old stand; pine, *Docynia indica*, *Prunus cerasoides*, *Betula alnoides* and *Ternstroemia symnanthera*, 15-year-old stand; pine, *Docynia indica*, *Prunus cerasoides*, *Betula alnoides* and *Mangifera* sp., and 14-year-old stand; pine, *Docynia indica*, *Prunus cerasoides*, *Betula alnoides*, *Mangifera* sp. and *Diospyros* sp. The pine densities were thus lower in mixed plantations. The limit growing space in the forest is an important factor affecting tree size and growth (Bowen and Nambiar, 1989; Oliver and Larson, 1996). Standing dead pine trees were occurred in some plantations, and further affected on the density.

The site factor particularly soil fertility affects on tree growths in the plantation forest (Bowen and Nambiar, 1984). The other factors such as moisture and forest fire are also important (Fisher and Binkley, 2000). As will be described in Chapter 4, the soil fertility indicated by amounts of organic matter and available nutrients was not increased with plantation ages but had the high variations according site conditions.

The succession tree species have influenced on pine trees in plantations. In the young plantations, the succession trees may grow beneath pine canopy whereas in the older plantations the heights may be nearly the same or over the pine canopy. The litterfall of succession broad-leaved trees has influenced on soil properties such as acidity and releasing nutrients. In the mixed plantations, competition among tree species limit the stand development and tree growths (Oliver and Larson, 1996)

The highest amount of pine biomass in plantations was found in 33-year-old stand, 212.7, Mg.ha<sup>-1</sup>. It was lower than the most abundant fragmented forest in the watershed (FF12) (242.1 Mg.ha<sup>-1</sup>). In the 33-year-old stand, the biomass contribution of succession trees was 9.2 Mg.ha<sup>-1</sup>, and resulted in total stand biomass of 221.9 Mg.ha<sup>-1</sup>. Their highest biomass contribution was observed in 31-year-old stand, 94.1 Mg.ha<sup>-1</sup>. Therefore, the succession tree species had the important role on biomass stocks in pine plantations. These tree species were in the families of Fagaceae, Theaceae, Myrtaceae, Leguminosae, Euphorbiaceae, Rubiaceae and Lauraceae.