

## CHAPTER 3

### Potential Roles of Fragmented Forests on Succession in Pine Plantations

#### Abstract

The research was carried out at Boakaew Watershed Management Station, Chiang Mai province, in 2009. A plot, 40 x 40 m<sup>2</sup> in size, was used for vegetation sampling in each of fifteen fragmented forests remained in areas between 1,200-1,500 m altitude nearby pine plantations. Stem girth at breast height and height of all tree species were measured for calculating quantitative characteristics. Two plots, 5 x 5 m<sup>2</sup> in size, were used for studying natural regeneration. The forest type was lower montane forest. Species richness in whole fragmented forests was 103 tree species (82 genus and 44 families). Fagaceae was the most dominant family. The dominant trees in most fragmented forests were *Pinus kesiya* and *Castanopsis acuminatissima*, whereas some were dominated by *Schima wallichii* and *C. diversifolia*. Tree densities were greatly varied among the fragmented forests, 556-1,769 trees/ha with the total stem basal areas of 17.46-36.58 m<sup>2</sup>/ha. These implied to the variable forest conditions and plant community similarity among the forests. The forest varied from degraded to good forests. The Shannon-Wiener Index of species diversity was high, 5.28. Tree species in the families of Pinaceae, Juglandaceae and Bignoniaceae have seed dispersal by wind whereas those of heavy seeds are belong to Fagaceae, Lauraceae and Proteaceae which have seed dispersal by gravity force and animal. Differences in seed/fruit morphology are related to the their dispersal and spatial distribution of tree species, and have the high potential roles on plant succession in surrounding pine plantations.

#### 3.1 Introduction

The tropical forest biome of Southeast Asia has been recognized as one of the richest sites in biological diversity of the world. Deforestation, forest fragmentation and degradation are considered as serious problems in this region. Loss of tropical forests may have long term effects including change in regional climate especially rainfall pattern, biological productivity, acceleration of soil erosion, disruption of watershed stability, and increase in atmospheric temperature as well as further impacts on global climate dynamics.

Shifting cultivation, permanent agriculture and human settlement have reduced the natural forest to a series of fragmented forests of varying size in the highland watershed areas of northern Thailand. Some patches are still abundant while the others may be degrading through tree cutting and selective uses of non-wood products by local people. It may lead to the extinction of locally adapted populations as well as a reduction in the size of remnant populations. The decline of population size leads to genetic isolation of once contiguous populations and may result in an increase in the level of inbreeding (Murawski and Hamrick, 1992). Deforestation and forest fragmentation threat to genetic diversity by giving an impact to gene exchange depends upon pollen and seed dispersal (Bawa *et al.*, 1985; Bawa, 1993).

On the other hand, the fragmented forests remained in the highland watershed may be useful for the reforestation project. Forest plantation plays the key role in harmonizing long-term forest ecosystem restoration goals. Adjacent fragmented forests can disperse fruits or seeds of many species for succession in plantations to increase biodiversity enrichment, and thus the plantations can be developed to be a natural forest. Normally, seeds can be dispersed by gravity, and seeds of some plant species can increase distance from the sources by wind, water, animal and explosions and others (Schmidt, 2000). Seeds dispersal mechanisms should have a direct impact on the genetic structure of populations (Hamrick *et al.*, 1993). The morphology of fruits and seeds often reflects the mode of dispersal (Schmidt, 2000). Heavy seeds are the features of tree species in many families such as Proteaceae, Fagaceae, Lauraceae, etc., and influence on their spatial distribution and abundance (Sri-ngernyuang *et al.*, 2007). However, most of tree species in the tropics are dispersed by animals rather than wind, water or other forms of dispersal (Wunderle, 1997).

The purpose of this study is to investigate plant species diversity in fragmented lower montane (LMF) forests which may have the potential roles on natural succession in plantation forests as well as opened areas after shifting cultivation in highland watershed of northern Thailand.

## 3.2 Materials and Methods

### 3.2.1 Vegetation Sampling

A sampling plot (quadrat) of 40 x 40 m<sup>2</sup> was used for vegetation survey in each of fifteen fragmented forests. All plots were located using GPS and topographic map. Each plot was divided into 16, 10 x 10 m<sup>2</sup> subplots, and all woody trees and climbers with  $\geq 1.5$  m height were measured for gbh (stem girth at breast height, 1.3 m above ground), and tree height.

Two small plots of 5 x 5 m<sup>2</sup> in size were placed at the center of the big plot to investigate ground-covered species and natural regeneration by identifying species names and counting number of seedlings.

### 3.2.2 Calculation of Ecological Parameters

The data were calculated for ecological parameters of tree species and plant communities: frequency, density, dominance, important value index (IVI), similarity and species diversity index (Krebs, 1985), as well as the relation, resemblance function and clustering.

#### (1) Plant Frequency

$$\text{Frequency} = \frac{\text{Number of occupied quadrats}}{\text{Number of all quadrats}} \times 100$$

$$\text{Relative frequency} = \frac{\text{Frequency of species } i}{\text{Sum of frequency values of all species}} \times 100$$

#### (2) Plant Density

$$\text{Density} = \frac{\text{Number of individuals of species } i}{\text{Number of all quadrats}} \quad (\text{trees/quadrat})$$

$$\text{Relative density} = \frac{\text{Number of individuals of species } i}{\text{Number of individuals of all species}} \times 100$$

### (3) Plant Dominance

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

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

### (4) Important Value Index (IVI)

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

$$\text{IVI} = \text{Relative frequency} + \text{Relative density} + \text{Relative dominance}$$

$$\text{Relative IVI} = \frac{\text{IVI of species } i}{\text{Sum of IVI of all species}} \times 100$$

### (5) Index of Species Diversity

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

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

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

### (6) Forest Condition Index (FCI)

The index of species diversity in a forest does not imply to forest condition since it is calculated from the sum of relative number of all tree species in the sampling plots without classification of each tree species into saplings, immature, mature and old trees. Different types of primary forests usually have different species diversity. Some forest types may be classified as species-poor ecosystems whereas the others are the species-rich ecosystems. Within the same forest type, species diversity is changed with different stages of plant succession and disturbance. The forests at the early and middle stages may have the higher diversity than that in the climax stage. The forest conditions as good, intermediate or poor are considered from the

relative number of small, intermediate and big trees. The poor forest usually has mainly small trees, whereas those forests of the more good conditions will have increasing the relative number of intermediate-size and big trees.

Assessment of forest communities as good, intermediate and poor conditions was carried out using the number of individual trees with different stem-girth classes. The intermediate-size and big trees were significant to the value of forest condition index than smaller trees. The stem-girth classes were divided into 0-25, 25-50, 50-75, 75-100, ....., respectively, and the FCI was calculated for each class. The index of forest condition is the sum value of the number of individual trees for all classes. The importance of  $n_1$  was 1/100, increased to 1/10 for  $n_2$  and to 1.0 for  $n_3$  to  $n_n$ .

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

Where

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

### (7) Index of Similarity

The similarity index is arithmetic comparison of those values common to two groups with the total value of both groups (Bray and Curtis, 1957).

$$\text{Similarity} = [2w/(a+b)]100$$

Where,

- W = sum of the lowest value of IVI in both community a and b
- a = sum of IVI in community a
- b = sum of IVI in community b

### (8) Forest Regeneration

The number of seedlings of various tree species and ground-covered species in each fragmented forest were counted in the two small plots (5 x 5 m<sup>2</sup>) which were placed at the center of the big plot to identify forest regeneration and number of ground-covered species.

## 3.3 Results

### 3.3.1 Plant Community Analysis of Fragmented Forests

#### 3.3.1.1 Species Composition, Diversity and Forest Conditions

##### (1) Species Richness and Composition

The total number of plant species existed in the forest is called species richness. In fifteen fragmented forests, totally 103 species in 82 genus and 44 families



were found (Table 3-1 and Table 3-2). Dominant tree species were mainly *P. kesiya*, *C. acuminatissima* and *S. wallichii*. Codominant tree species were *Q. brandisiana*, *C. diversifolia*, *L. elegans*, *Q. vestita*, *T. gymnanthera*, *H. nilagirica*, *E. spicata*, etc. The small trees included mainly *T. rufescens*, *W. tinctoria*, and *V. sprengelii*. Many rare species in the forests were observed such as *M. henryi*, *S. albiflorum*, *S. cumini*, *T. chebula*, *C. armata*, *R. ignea*, *B. alnoides*, *A. gomezianus*, *C. iners*, etc. Some are true rare species and the others are usually existed in more abundance in forests of lower areas. The dominant families were Fagaceae (13 species), Leguminosae (8), Lauraceae (8), Euphorbiaceae (7), Rubiaceae (6), and Theaceae (6).

The species richness is typically high in LMF. Khamyong and Seramethakun (1998) reported that the same forest type at Mt. Doi Suthep in area of 1,200-1,300 m altitude consisted of 72 species (54 genus and 34 families), and it was increased to be 188 species (124 genus and 57 families) as the sampling area was expanded between 800-1,500 m (Khamyong, 2009). Loarpansakul (2000) found that the forest at the Queen Sirikit botanic garden consisted of 97 tree species (in 68 genus and 42 families), and it was high as 184 tree species (129 genus and 61 families) for the fragmented forests in Pang Ma Pha district, Mae Hong Son province (Seanchanthong, 2005). The species richness of montane forest at Mt. Doi Inthanon was declined with higher altitude by lower air temperature and cloud covering nearly throughout a year. It was low as 47 species in upper montane (UMF) forest at Mt. Doi Inthanon summit (Khamyong *et al.*, 2004).

## (2) Species Diversity

Species diversity index in the whole fragmented forests by Shannon-Wiener Index (SWI) was calculated as 5.28 (Table 3-3), and varied among the fragmented forests with a range of 3.01-4.65. The patch sizes of fragmented forests were varied from small to big ones, and human disturbance through tree cutting was different among the patches. These indicated to some degradation of fragmented forests, and thus the SWI values were variable. The SWI of the whole fragmented forests was nearly the same with the lower montane forest at Doi Suthep-Pui National Park, 5.0-5.1 (Vanaprasert, 1985), and implied to the high species diversity of original forest of these fragmented forests.

The SWI value is usually high in this forest. Khamyong and Seramethakun (1998) reported that the forest at Mt. Doi Suthep in area of 1,200-1,300 m altitude had the value of 4.5, and it was increased to be 6.1 as the sampling area was expanded (Khamyong, 2009). Laorpansakul (2000) found that SWI of the forest at the Queen Sirikit botanic garden was 5.67, and it was higher as 6.05 for the fragmented forests in Pang Ma Pha district, Mae Hong Son province (Seanchanthong, 2005). However, the SWI value of the upper montane forest at Mt. Doi Inthanon was lower as 4.26 (Khamyong *et al.*, 2004).

**Table 3-1** Species list, growth forms and seed/fruit characteristics of tree species in fragmented forests

	Thai names	Scientific names	Growth forms*	Fruit/Seed characteristics	Seed dispersal
1	ACTINIDIACEAE				
1	सानเห็บ San hep	<i>Saurauia roxburghii</i> Wall.	S	dry dehiscent fruit, a lot of small seeds	animal, wind
2	ANACARDIACEAE				
2	มะม่วงหาวแมงวาน Mamuang hua maeng wan	<i>Buchanania lanzan</i> Spreng.	T	fleshy fruit, one medium seed	animal, wind
3	รักใหญ่ Rak yai	<i>Gluta usitata</i> (Wall.) Ding Hou	T	dry indehiscent fruit, wing, one medium hard seed	wind
4	มะเหลียมหิน Ma liam hin	<i>Rhus javanica</i> L. var. <i>chinensis</i> (Mill.) T.Yamaz.	S	fleshy fruit, small seed	wind
5	รักขี้หนู Rak khi mu	<i>Semecarpus albescens</i> Kurz	T	fleshy fruit, one medium seed	gravity
3	AQUIFOLIACEAE				
6	เนาใน Nao nai	<i>Ilex umbellulata</i> Loes.	S	fleshy fruit, small seed	wind
4	ARALIACEAE				
7	หนวดปลาหมึก Nuat pla muek	<i>Schefflera bengalensis</i> Gamble	ES	fleshy fruit, small seed	wind
5	BETULACEAE				
8	กำลังเสือโคร่ง Kamlang suea khrong	<i>Betula alnoides</i> Buch.-Ham. ex G.Don.	T	dry indehiscent fruit, small seed, wing	wind
6	BIGNONIACEAE				
9	แคดอกขาว Khae khao	<i>Dolichandrone serrulata</i> (DC.) Seem	T	dry dehiscent fruit, a lot of small seeds, wing	wind
10	กาสลองค้ำ Kasalongkham	<i>Radermachera ignea</i> (Kurz) Steenis	T	dry dehiscent fruit, a lot of small seeds, wing	wind
11	แคทราย Khae sai	<i>Stereospermum neuranthum</i> Kurz	T	dry dehiscent fruit, a lot of small seeds, wing	wind
7	BOMBACACEAE				
12	จิวป่า Ngio pa	<i>Bombax anceps</i> Pierre var. <i>anceps</i>	T	dry dehiscent fruit, a lot of small seeds, hair	wind
8	BURSERACEAE				
13	มะเก็ม Ma koem	<i>Canarium subulatum</i> Guillaumin	T	fleshy fruit, one medium hard seed	animal
14	ตะคร้ำ Ta khram	<i>Garuga pinnata</i> Roxb.	T	fleshy fruit, small hard seed	animal
15	มะแฟน Ma faen	<i>Protium serratum</i> Engl.	T	fleshy fruit, small hard seed	animal
9	CAPRIFOLIACEAE				
16	อุ้นป่า Un pa	<i>Viburnum sambucinum</i> Blume var. <i>tomentosum</i> Hallier f.	S	fleshy fruit, one small hard seed	wind
10	CELASTRACEAE				
17	มะแตกเครือ Ma taek khrua	<i>Celastrus paniculata</i> Willd.	C	dry dehiscent fruit, small seed	explosions, wind
11	COMBRETACEAE				
18	สะแกวัลย์ Sakae wan	<i>Combretum punctatum</i> Blume	C	dry dehiscent fruit, medium seed, wing,	animal
19	สมอไทย Samo thai	<i>Terminalia chebula</i> Retz. var. <i>chebula</i>	T	fleshy fruit, one large seed	animal
12	COMPOSITAE				
20	ยาแก๊ Ya kae, Mahok ton	<i>Vernonia volkameriifolia</i> Wall. ex DC.	T	dry indehiscent fruit, achene, small seed, hair	wind

Table 3-1 (Continued)

	Thai names	Scientific names	Growth forms*	Fruit/Seed characteristics	Seed dispersal
13	DILLENACEAE				
	21 ส้านหึ่ง San hing	<i>Dillenia aurea</i> Sm.	T	fleshy fruit, one small seed	animal
14	DIPTEROCARPACEAE				
	22 พะยอม Phayom	<i>Shorea roxburghii</i> G.Don	T	dry indehiscent fruit, wing, one small seed	wind
15	EBENACEAE				
	23 กล้วยดำชี Kluai ruesi	<i>Diospyros glandulosa</i> Lace	S	fleshy fruit, small seed	animal
16	ELAEOCARPACEAE				
	24 มะมุนแดง Ma mun Daeng	<i>Elaeocarpus stipularis</i> Blume	T	fleshy fruit, small hard seed	animal
17	ERICACEAE				
	25 ดาราย Ta-chi-khoei, Dao rai	<i>Craibiodendron stellatum</i> (Pierre) W.W.Sm.	S	dry dehiscent fruit, a lot of small seeds, hard wing	wind
	26 ส้มปี้ Som pi	<i>Vaccinium sprengelii</i> (G.Don) Sleumer	S	dry dehiscent fruit, a lot of small seeds	animal, wind
18	EUPHORBIACEAE				
	27 เมาสร้อย Mao khao, Mao Soi	<i>Antidesma acidum</i> Retz.	S	fleshy fruit, small seed	animal, wind
	28 เหมือนดหลวง Mueat luang	<i>Aporosa villosa</i> (Wall. ex Lindl.) Baill.	T	fleshy fruit, one medium seed	animal, wind
	29 ไคร้มด Khrai mot	<i>Glochidion acuminatum</i> Mull.Arg. var. <i>siamense</i> Airy Shaw	S	dry dehiscent fruit, medium seed	animal, wind
	30 ผักขี้มด Phak khi mot	<i>Glochidion hirsutum</i> (Roxb.) Voigt	S	dry dehiscent fruit, medium seed	animal, wind
	31 มันปลา Man pla	<i>Glochidion sphaerogynum</i> (Mull.Arg.) Kurz	T	dry dehiscent fruit, medium seed	animal, wind
	32 มะกายคั๊ด Makai khat	<i>Mallotus philippensis</i> Mull.Arg.	S	fleshy fruit, one medium seed	animal, wind
	33 มะขามป้อม Ma kham pom	<i>Phyllanthus emblica</i> Linn.	T	fleshy fruit, small seed	animal, wind
19	FAGACEAE				
	34 ก่อเต็อย Ko dueai	<i>Castanopsis acuminatissima</i> (Blume) A.DC.	T	dry indehiscent fruit, large seed	animal, wind
	35 ก่อหรั่ง Ko rang	<i>Castanopsis armata</i> Spach	T	dry indehiscent fruit, large seed	animal
	36 ก่อแป้น Ko paen	<i>Castanopsis diversifolia</i> (Kurz) King	T	dry indehiscent fruit, large seed	animal
	37 ก่อดี Ko ti	<i>Castanopsis purpurea</i> Barnett	T	dry indehiscent fruit, large seed	animal
	38 ก่อหม่น Ko mon	<i>Lithocarpus elegans</i> (Bl.) Hatus ex Soep. var. <i>elegans</i>	T	dry indehiscent fruit, large seed	animal
	39 ก่อพวง Ko phuang	<i>Lithocarpus fenestratus</i> (Roxb.) Rehder	T	dry indehiscent fruit, large seed	animal
	40 ก่อต่างใหญ่ Ko dang yai	<i>Lithocarpus lindleyanus</i> (Wall.) A.Camus	T	dry indehiscent fruit, large seed	animal
	41 ก่อนก Ko nok	<i>Lithocarpus polystachyus</i> (A.DC.) Rehder	T	dry indehiscent fruit, large seed	animal
	42 ก่อหัวหมู Ko hua mu	<i>Lithocarpus sootepensis</i> (Craib) A.Camus	T	dry indehiscent fruit, large seed	animal
	43 ก่อหมาก Ko si siat	<i>Quercus brandisiana</i> Kurz	T	dry indehiscent fruit, large seed	animal
	44 ก่อแดง Ko daeng	<i>Quercus kingiana</i> Craib	T	dry indehiscent fruit, large seed	animal
	45 ก่อกระดุม Ko kradum	<i>Quercus semiserrata</i> Roxb.	T	dry indehiscent fruit, large seed	animal

Table 3-1 (Continued)

	Thai names	Scientific names	Growth forms*	Fruit/Seed characteristics	Seed dispersal
20	46 ก้อแอบ GUTTIFERAE	Ko aep <i>Quercus vestita</i> Rehder & Wills.	T	dry indehiscent fruit, large seed	animal
21	47 ขี้ผึ้ง JUGLANDACEAE	Khi phueng <i>Garcinia merguensis</i> Wight	S	fleshy fruit, medium seed	animal, wind
	48 ฮ้อยจั้น	Hoi chan <i>Engelhardtia serrata</i> Blume	T	dry indehiscent fruit, wing, one small seed	wind
	49 คาหด	Kha hot <i>Engelhardtia spicata</i> Bl.	T	dry indehiscent fruit, wing, one small seed	wind
22	LABIATAE				
	50 ชำแป้น	Cha paen <i>Callicarpa arborea</i> Roxb.	S	dry dehiscent fruit, small seed	explosions, wind
	51 ดินนง	Tin nok <i>Vitex pinnata</i> L.	T	dry dehiscent fruit, small seed	explosions, wind
23	LAURACEAE				
	52 หน่วยนกงม	Nuai nok ngum <i>Beilschmiedia gammieana</i> King ex Hook.f.	T	fleshy fruit, small seed	gravity
	53 อมเขย	Opchoei <i>Cinnamomum iners</i> Reinw. ex Blume	T	fleshy fruit, one small seed	animal
	54 เทพทาร์	Thep tharo <i>Cinnamomum porrectum</i> (Roxb.) Kosterm.	T	fleshy fruit, small seed	animal
	55 ดองขาว	Tong khao <i>Lindera metcalifiana</i> Allen	T	fleshy fruit, small seed	animal
	56 หมี่เหม็น	Mi men <i>Litsea glutinosa</i> (Lour.) C.B.Robinson	T	fleshy fruit, one small hard seed	animal
	57 หมี่บ่ง	Mi bong <i>Litsea semecarpifolia</i> Hook.f.	T	fleshy fruit, small seed	animal
	58 สะทีบดง	Sa thip dong <i>Phoebe cathia</i> (D. Don) Kosterm.	T	fleshy fruit, small seed	animal
	59 สะทีบดำ	Sa thip <i>Phoebe paniculata</i> Nees	T	fleshy fruit, small seed	animal
24	LEGUMINOSAE				
	60 กางหลวง	Kang luang <i>Albizia chinensis</i> (Osbeck) Merr.	T	dry indehiscent fruit, medium seed	wind
	61 ก้างขี้มอด	Kang khi mot <i>Albizia odoratissima</i> (L.f.) Benth.	T	dry dehiscent fruit, small seed	explosions
	62 มะขามแป	Ma kham pae <i>Archidendron clypearia</i> (Jack) I.C.Nielsen	T	dry dehiscent fruit, small seed	wind
	63 เครือสะบ้า	Saba <i>Entada rheedii</i> Spreng.	C	dry dehiscent fruit, large seed	explosions
	64 บี้เครือ	Khruea pi <i>Dalbergia velutina</i> Benth.	C	dry dehiscent fruit, small seed	explosions
	65 เกิดดำ	Ket dam <i>Dalbergia cultrata</i> Graham ex Benth.	T	dry indehiscent fruit, medium seed	explosions
	66 ทองกลางป่า	Thong lang pa <i>Erythrina subumbrans</i> (Hassk.) Merr.	T	dry dehiscent fruit, small seed	explosions
	67 เครือไหล	Khruea lai <i>Milleitia pachycarpa</i> Benth.	C	dry dehiscent fruit, small seed	explosions
25	MAGNOLIACEAE				
	68 จำปีป่า	Champi pa <i>Magnolia henryi</i> Dunn	T	dry dehiscent fruit, small seed	explosions
26	MALVACEAE				
	69 ยาบใบมน	Yap bai mon <i>Kydia calycina</i> Roxb.	ST	dry dehiscent fruit, wing, small seed	wind



**Table 3-1 (Continued)**

	Thai names	Scientific names	Growth forms*	Fruit/Seed characteristics	Seed dispersal
27	MELASTOMATACEAE				
	70 อ้าหลวง A luang	<i>Melastoma malabathricum</i> L. subsp. <i>malabathricum</i>	S	dry dehiscent fruit, small seed	explosions, wind
28	MELIACEAE				
	71 ยมแดง Yom daeng	<i>Trichilla connaroides</i> (Wight & Arn.) Benth.	T	dry dehiscent fruit, small seed	wind
29	MORACEAE				
	72 หาด Hat nun	<i>Artocarpus gomezianus</i> Wall. ex Trecul	T	fleshy fruit, a lot of small seeds, hard seed	animal
	73 ไทร Sai	<i>Ficus</i> sp.	T	fleshy fruit, small seed	animal
30	MYRICACEAE				
	74 หมอนอ่อน Samet chun, Mon on	<i>Myrica esculenta</i> Buch.-Ham. ex D.Don	S	fleshy fruit, medium seed	animal
31	MYRSINACEAE				
	75 รังกะแต้ Rang ka thae	<i>Rapanea porteriana</i> (A.DC.) Mez	T	fleshy fruit, one small hard seed	wind
32	MYRTACEAE				
	76 มะห่า Maha	<i>Syzygium albiflorum</i> (Duthie & Kurz) Bahadur & R.C.Gaur	S	fleshy fruit, one medium seed	animal
	77 หว่า Wa	<i>Syzygium cumini</i> (L) Skeels	T	fleshy fruit, one medium seed	animal
	78 เคาะ Kho	<i>Tristania rufescens</i> (Hance) Peter G.Wilson & J.T.Waterh.	S	fleshy fruit, medium seed	wind
33	OLEACEAE				
	79 คำไก่ Kham kai	<i>Olea salicifolia</i> Wall. ex G.Don	ST	fleshy fruit, one small seed	wind
34	PINACEAE				
	80 สนสามใบ Son sam bai	<i>Pinus kesiya</i> Royle ex Gordon	T	dry indehiscent fruit, a lot of small seeds, wing	wind
35	PROTEACEAE				
	81 เหมือนคนตัวผู้ Mueat khon tua phu	<i>Helicia nilagirica</i> Bedd.	T	fleshy fruit, one medium seed	animal
	82 เหมือนคนตัวเมีย Mueat khon tua mea	<i>Helicia terminalis</i> (Kurz) Sleumer	ST	fleshy fruit, one medium seed	animal
36	RUBIACEAE				
	83 ข้าวจี Khao chi	<i>Canthium</i> sp.	C	fleshy fruit, medium seed	wind
	84 เค็ด Ma khet	<i>Catunaregam tomentosa</i> (Blume ex DC.) Tirveng.	S	fleshy fruit, medium seed	animal
	85 ค้ำออกหลวง Khammok luang	<i>Gardenia sootepensis</i> Hutch.	ST	fleshy fruit, a lot of small seeds, hard seed	wind
	86 แก้มขาว Kaem khao	<i>Mussaenda sanderiana</i> Roxb.	ScanS	fleshy fruit, a lot of small seeds, hard seed	wind
	87 ข้าวสารป่า Khao san pa	<i>Pavetta tomentosa</i> Roxb. ex Sm. var. <i>tomentosa</i>	S	fleshy fruit, small seed	wind
	88 แข้งกวาง Khaeng kwang	<i>Wendlandia tinctoria</i> (Roxb.) DC.	ST	dry dehiscent fruit, a lot of small seeds	explosions, wind
37	SAPOTACEAE				
	89 มะยาง Mayang	<i>Sarcosperma arboreum</i> Hook.f.	T	fleshy fruit, small seed	gravity
	90 นมนาง Nom nang	<i>Embelia subcoriacea</i> (C.B.Clarke) Mez	S	fleshy fruit, small seed	gravity

**Table 3-1 (Continued)**

	Thai names	Scientific names	Growth forms*	Fruit/Seed characteristics	Seed dispersal
38	STAPHYLEACEAE				
91	ม่วงกอม Muang kom	<i>Turpinia cochinchinensis</i> (Lour.) Merr.	ST	fleshy fruit, small hard seed	gravity
39	STERCULIACEAE				
92	ปอเลียง Po liang	<i>Eriolaena candollei</i> Wall.	T	dry dehiscent fruit, a lot of small seeds, wing	wind
93	ปอหู่ช้าง Po hu chang	<i>Pterospermum acerifolium</i> (L.) Willd.	T	dry dehiscent fruit, small seed	wind
40	STYRACACEAE				
94	กำยาน Kam yan	<i>Styrax benzoides</i> Craib	T	dry dehiscent fruit, one medium seed	wind
41	SYMPLOCACEAE				
95	เหมือดหอม Mueat hom	<i>Symplocos racemosa</i> Roxb.	ST	fleshy fruit, one medium hard seed	wind
42	THEACEAE				
96	สารภีป่า Saraphi pa	<i>Anneslea fragrans</i> Wall.	ST	fleshy fruit, small seed	gravity
97	แหพันชั้น Hae phan chan	<i>Eurya acuminata</i> D.C. var. <i>wallichiana</i> Dyer	ST	dry dehiscent fruit, small seed	animal, wind
98	แมงเม่านก Maeng mao nok	<i>Eurya nitida</i> Korth. var. <i>nitida</i>	ST	dry dehiscent fruit, small seed	animal, wind
99	เมี่ยง Miang phi	<i>Pyrenaria diospyricarpa</i> Kurz	T	dry dehiscent fruit, medium seed, hard seed	gravity
100	ทะโล้ Thalo	<i>Schima wallichii</i> (DC.) Korth.	T	dry dehiscent fruit, medium seed, narrow wing	wind
101	ไค้แดง Kai daeng	<i>Ternstroemia gymnanthera</i> (Wight & Arn.) Bedd.	T	fleshy fruit, small seed	wind
43	TILIACEAE				
102	ปอยยาม Po yap	<i>Colona flagrocarpa</i> (C.B.Clarke) Craib	ST	dry dehiscent fruit, wing, medium seed	wind
44	VITACEAE				
103	เครือส้มกวย Som kui	<i>Ampelocissus martinii</i> Planch.	C	fleshy fruit, small hard seed	wind

**Note:** \* T = Tree, S = Shrub, ST = Shrubby Tree, ES = Epiphytic Shrub, ScanS = Scandent Shrub, C = Climber

**Tabl 3-2** Quantitative characteristics of tree species in fifteen fragmented forests

No	Species	No. of trees	Frequency (%)	Density (trees/ha)	Basal area (m <sup>2</sup> /ha)	Relative (%)			IVI	
						Frequency	Density	Dominance	(300)	(%)
1	<i>Pinus kesiya</i>	165	86.67	68.75	6.6655	3.05	5.90	24.10	33.05	11.02
2	<i>Castanopsis acuminatissima</i>	144	80.00	60.00	3.9070	2.82	5.15	14.12	22.09	7.36
3	<i>Tristania rufescens</i>	279	66.67	116.25	1.1333	2.35	9.97	4.097	16.42	5.47
4	<i>Schima wallichii</i>	150	80.00	62.50	1.9762	2.82	5.36	7.144	15.32	5.11
5	<i>Wendlandia tinctoria</i>	219	93.33	91.25	0.6723	3.29	7.83	2.431	13.54	4.51
6	<i>Vaccinium sprengelii</i>	206	66.67	85.83	0.5011	2.35	7.36	1.812	11.52	3.84
7	<i>Quercus brandisiana</i>	84	46.67	35.00	1.4602	1.64	3.00	5.279	9.92	3.31
8	<i>Castanopsis diversifolia</i>	59	53.33	24.58	1.6151	1.88	2.11	5.839	9.83	3.28
9	<i>Ternstroemia gymnanthera</i>	86	60.00	35.83	0.7368	2.11	3.07	2.664	7.85	2.62
10	<i>Helicia nilagirica</i>	71	66.67	29.58	0.7661	2.35	2.54	2.770	7.65	2.55
11	<i>Lithocarpus elegans</i>	70	60.00	29.17	0.7739	2.11	2.50	2.798	7.41	2.47
12	<i>Engelhardtia spicata</i>	62	60.00	25.83	0.7950	2.11	2.22	2.874	7.20	2.40
13	<i>Castanopsis purpurea</i>	42	60.00	17.50	0.9565	2.11	1.50	3.458	7.07	2.36
14	<i>Anneslea fragrans</i>	66	66.67	27.50	0.5384	2.35	2.36	1.946	6.65	2.22
15	<i>Quercus vestita</i>	68	60.00	28.33	0.4388	2.11	2.43	1.586	6.13	2.04
16	<i>Craibiodendron stellatum</i>	78	66.67	32.50	0.2233	2.35	2.79	0.807	5.94	1.98
17	<i>Dalbergia cultrata</i>	58	60.00	24.17	0.4551	2.11	2.07	1.645	5.83	1.94
18	<i>Phyllanthus emblica</i>	63	73.33	26.25	0.1004	2.58	2.25	0.363	5.20	1.73
19	<i>Glochidion sphaerogynum</i>	39	86.67	16.25	0.1060	3.05	1.39	0.383	4.83	1.61
20	<i>Semecarpus albescens</i>	48	60.00	20.00	0.2431	2.11	1.72	0.879	4.71	1.57
21	<i>Eurya nitida</i>	69	46.67	28.75	0.0859	1.64	2.47	0.311	4.42	1.47
22	<i>Styrax benzoides</i>	36	60.00	15.00	0.1426	2.11	1.29	0.515	3.91	1.30
23	<i>Aporosa villosa</i>	42	53.33	17.50	0.0916	1.88	1.50	0.331	3.71	1.24
24	<i>Phoebe paniculata</i>	43	40.00	17.92	0.1560	1.41	1.54	0.564	3.51	1.17
25	<i>Diospyros glandulosa</i>	27	46.67	11.25	0.0928	1.64	0.96	0.335	2.94	0.98
26	<i>Lithocarpus polystachyus</i>	22	40.00	9.17	0.1924	1.41	0.79	0.696	2.89	0.96
27	<i>Viburnum sambucinum</i>	37	40.00	15.42	0.0187	1.41	1.32	0.068	2.80	0.93
28	<i>Lithocarpus fenestratus</i>	17	33.33	7.08	0.2526	1.17	0.61	0.913	2.69	0.90
29	<i>Glochidion acuminatum</i>	48	26.67	20.00	0.0043	0.94	1.72	0.016	2.67	0.89
30	<i>Quercus semiserrata</i>	19	13.33	7.92	0.3406	0.47	0.68	1.231	2.38	0.79
31	<i>Helicia terminalis</i>	15	40.00	6.25	0.1130	1.41	0.54	0.408	2.35	0.78
32	<i>Dillenia aurea</i>	13	40.00	5.42	0.0599	1.41	0.46	0.216	2.09	0.70
33	<i>Syzygium gratum</i>	11	33.33	4.58	0.1210	1.17	0.39	0.437	2.00	0.67
34	<i>Stereospermum neuranthum</i>	16	33.33	6.67	0.0413	1.17	0.57	0.149	1.89	0.63
35	<i>Lithocarpus sootepensis</i>	17	20.00	7.08	0.0715	0.70	0.61	0.259	1.57	0.52
36	<i>Albizia odoratissima</i>	6	33.33	2.50	0.0490	1.17	0.21	0.177	1.57	0.52
37	<i>Pyrenaria diospyricarpa</i>	18	20.00	7.50	0.0189	0.70	0.64	0.068	1.42	0.47
38	<i>Lindera metcalifiana</i>	16	20.00	6.67	0.0375	0.70	0.57	0.135	1.41	0.47
39	<i>Phoebe cathia</i>	8	20.00	3.33	0.1054	0.70	0.29	0.381	1.37	0.46
40	<i>Albizia chinensis</i>	6	26.67	2.50	0.0522	0.94	0.21	0.189	1.34	0.45
41	<i>Elaeocarpus stipularis</i>	4	13.33	1.67	0.1975	0.47	0.14	0.714	1.33	0.44
42	<i>Eriolaena candollei</i>	11	20.00	4.58	0.0616	0.70	0.39	0.223	1.32	0.44
43	<i>Rhus javanica</i>	10	26.67	4.17	0.0016	0.94	0.36	0.006	1.30	0.43
44	<i>Rapanea porteriana</i>	11	20.00	4.58	0.0528	0.70	0.39	0.191	1.29	0.43
45	<i>Archidendron clypearia</i>	7	26.67	2.92	0.0272	0.94	0.25	0.098	1.29	0.43
46	<i>Beilschmiedia gammieana</i>	9	26.67	3.75	0.0055	0.94	0.32	0.020	1.28	0.43
47	<i>Engelhardtia serrata</i>	6	20.00	2.50	0.0982	0.70	0.21	0.355	1.27	0.42
48	<i>Syzygium albiflorum</i>	9	20.00	3.75	0.0563	0.70	0.32	0.204	1.23	0.41
49	<i>Turpinia cochinchinensis</i>	12	20.00	5.00	0.0177	0.70	0.43	0.064	1.20	0.40
50	<i>Litsea glutinosa</i>	5	26.67	2.08	0.0187	0.94	0.18	0.067	1.19	0.40
51	<i>Catunaregam tomentosa</i>	6	26.67	2.50	0.0032	0.94	0.21	0.011	1.16	0.39
52	<i>Callicarpa arborea</i>	10	6.67	4.17	0.1484	0.23	0.36	0.537	1.13	0.38
53	<i>Castanopsis armata</i>	1	6.67	0.42	0.2268	0.23	0.04	0.820	1.09	0.36
54	<i>Symplocos racemosa</i>	5	20.00	2.08	0.0460	0.70	0.18	0.166	1.05	0.35

Table 3-2 (Continued)

No	Species	No. of trees	Frequency (%)	Density (trees/ha)	Basal area (m <sup>2</sup> /ha)	Relative (%)			IVI	
						Frequency	Density	Dominance	(300)	(%)
55	<i>Terminalia chebula</i>	4	20.00	1.67	0.0470	0.70	0.14	0.170	1.02	0.34
56	<i>Ilex umbellulata</i>	7	20.00	2.92	0.0163	0.70	0.25	0.059	1.01	0.34
57	<i>Milletia pachycarpa</i>	7	20.00	2.92	0.0054	0.70	0.25	0.020	0.97	0.32
58	<i>Quercus kingiana</i>	6	20.00	2.50	0.0135	0.70	0.21	0.049	0.97	0.32
59	<i>Embelia subcoriacea</i>	4	20.00	1.67	0.0302	0.70	0.14	0.109	0.96	0.32
60	<i>Buchananian lanzan</i>	3	13.33	1.25	0.1024	0.47	0.11	0.370	0.95	0.32
61	<i>Erythrina subumbrans</i>	4	20.00	1.67	0.0193	0.70	0.14	0.070	0.92	0.31
62	<i>Ampelocissus martinii</i>	4	20.00	1.67	0.0124	0.70	0.14	0.045	0.89	0.30
63	<i>Gardenia sootepensis</i>	4	20.00	1.67	0.0107	0.70	0.14	0.039	0.89	0.30
64	<i>Vernonia volkameriifolia</i>	4	20.00	1.67	0.0079	0.70	0.14	0.028	0.88	0.29
65	<i>Saurauia roxburghii</i>	9	13.33	3.75	0.0072	0.47	0.32	0.026	0.82	0.27
66	<i>Bombax anceps</i>	2	13.33	0.83	0.0470	0.47	0.07	0.170	0.71	0.24
67	<i>Glochidion hirsutum</i>	6	13.33	2.50	0.0064	0.47	0.21	0.023	0.71	0.24
68	<i>Trichilla connaroides</i>	5	13.33	2.08	0.0086	0.47	0.18	0.031	0.68	0.23
69	<i>Mussaenda sandariana</i>	5	13.33	2.08	0.0020	0.47	0.18	0.007	0.66	0.22
70	<i>Magnolia henryi</i>	3	13.33	1.25	0.0170	0.47	0.11	0.061	0.64	0.21
71	<i>Dolichandrone serrulata</i>	3	13.33	1.25	0.0073	0.47	0.11	0.026	0.60	0.20
72	<i>Gordonia dalglieshiana</i>	2	13.33	0.83	0.0087	0.47	0.07	0.032	0.57	0.19
73	<i>Syzygium cumini</i>	2	13.33	0.83	0.0044	0.47	0.07	0.016	0.56	0.19
74	<i>Pavetta tomentosa</i>	2	13.33	0.83	0.0005	0.47	0.07	0.002	0.54	0.18
75	<i>Cinnamomum porrectum</i>	7	6.67	2.92	0.0003	0.23	0.25	0.001	0.49	0.16
76	<i>Pterospermum acerifolium</i>	6	6.67	2.50	0.0047	0.23	0.21	0.017	0.47	0.16
77	<i>Gmelina philippensis</i>	6	6.67	2.50	0.0003	0.23	0.21	0.001	0.45	0.15
78	<i>Litsea semecarpifolia</i>	3	6.67	1.25	0.0295	0.23	0.11	0.107	0.45	0.15
79	<i>Olea salicifolia</i>	4	6.67	1.67	0.0158	0.23	0.14	0.057	0.43	0.14
80	<i>Lithocarpus lindleyanus</i>	2	6.67	0.83	0.0245	0.23	0.07	0.089	0.39	0.13
81	<i>Sarcosperma arboreum</i>	3	6.67	1.25	0.0134	0.23	0.11	0.048	0.39	0.13
82	<i>Gluta usitata</i>	1	6.67	0.42	0.0274	0.23	0.04	0.099	0.37	0.12
83	<i>Garuga pinnata</i>	3	6.67	1.25	0.0061	0.23	0.11	0.022	0.36	0.12
84	<i>Antidesma ghaesembilla</i>	3	6.67	1.25	0.0021	0.23	0.11	0.008	0.35	0.12
85	<i>Betula alnoides</i>	1	6.67	0.42	0.0207	0.23	0.04	0.075	0.35	0.12
86	<i>Protium serratum</i>	3	6.67	1.25	0.0005	0.23	0.11	0.002	0.34	0.11
87	<i>Colona flagrocarpa</i>	2	6.67	0.83	0.0096	0.23	0.07	0.035	0.34	0.11
88	<i>Dalbergia velutina</i>	2	6.67	0.83	0.0055	0.23	0.07	0.020	0.33	0.11
89	<i>Shorea roxburghii</i>	2	6.67	0.83	0.0049	0.23	0.07	0.018	0.32	0.11
90	<i>Vitex pinnata</i>	1	6.67	0.42	0.0142	0.23	0.04	0.051	0.32	0.11
91	<i>Melastoma malabathricum</i>	2	6.67	0.83	0.0004	0.23	0.07	0.001	0.31	0.10
92	<i>Kydia calycina</i>	1	6.67	0.42	0.0086	0.23	0.04	0.031	0.30	0.10
93	<i>Radernachera ignea</i>	1	6.67	0.42	0.0064	0.23	0.04	0.023	0.29	0.10
94	<i>Cinnamomum iners</i>	1	6.67	0.42	0.0042	0.23	0.04	0.015	0.29	0.10
95	<i>Combretum punctatum</i>	1	6.67	0.42	0.0038	0.23	0.04	0.014	0.28	0.09
96	<i>Artocarpus gomezianus</i>	1	6.67	0.42	0.0038	0.23	0.04	0.014	0.28	0.09
97	<i>Schefflera bengalensis</i>	1	6.67	0.42	0.0032	0.23	0.04	0.012	0.28	0.09
98	<i>Ficus sp.</i>	1	6.67	0.42	0.0012	0.23	0.04	0.004	0.27	0.09
99	<i>Entada rheedii</i>	1	6.67	0.42	0.0011	0.23	0.04	0.004	0.27	0.09
100	<i>Canarium subulatum</i>	1	6.67	0.42	0.0009	0.23	0.04	0.003	0.27	0.09
101	<i>Horsfieldia tomentosa</i>	1	6.67	0.42	0.0007	0.23	0.04	0.003	0.27	0.09
102	<i>Celastrus paniculata</i>	1	6.67	0.42	0.0006	0.23	0.04	0.002	0.27	0.09
103	<i>Eurya acuminata</i>	1	6.67	0.42	0.0002	0.23	0.04	0.001	0.27	0.09
	Total	2,798	2,840	1,165	27.66	100	100	100	300	100



**Table 3-3** Species diversity index (SWI) of tree species in fifteen fragmented forests

No	Species	$p_i$	$\log_2 p_i$	$p_i * \log_2 p_i$
1	<i>Tristania rufescens</i>	0.0997	-3.3261	-0.3317
2	<i>Wendlandia tinctoria</i>	0.0783	-3.6754	-0.2877
3	<i>Vaccinium sprengelii</i>	0.0736	-3.7637	-0.2771
4	<i>Pinus kesiya</i>	0.0590	-4.0839	-0.2408
5	<i>Schima wallichii</i>	0.0536	-4.2214	-0.2263
6	<i>Castanopsis acuminatissima</i>	0.0515	-4.2803	-0.2203
7	<i>Ternstroemia gymnanthera</i>	0.0307	-5.0239	-0.1544
8	<i>Quercus brandisiana</i>	0.0300	-5.0579	-0.1518
9	<i>Craibiodendron stellatum</i>	0.0279	-5.1648	-0.1440
10	<i>Helicia nilagirica</i>	0.0254	-5.3004	-0.1345
11	<i>Lithocarpus elegans</i>	0.0250	-5.3209	-0.1331
12	<i>Eurya nitida</i>	0.0247	-5.3417	-0.1317
13	<i>Quercus vestita</i>	0.0243	-5.3627	-0.1303
14	<i>Anneslea fragrans</i>	0.0236	-5.4058	-0.1275
15	<i>Phyllanthus emblica</i>	0.0225	-5.4729	-0.1232
16	<i>Engelhardtia spicata</i>	0.0222	-5.4960	-0.1218
17	<i>Castanopsis diversifolia</i>	0.0211	-5.5675	-0.1174
18	<i>Dalbergia cultrata</i>	0.0207	-5.5922	-0.1159
19	<i>Glochidion acuminatum</i>	0.0172	-5.8652	-0.1006
20	<i>Semecarpus albescens</i>	0.0172	-5.8652	-0.1006
21	<i>Phoebe paniculata</i>	0.0154	-6.0239	-0.0926
22	<i>Castanopsis purpurea</i>	0.0150	-6.0579	-0.0909
23	<i>Aporosa villosa</i>	0.0150	-6.0579	-0.0909
24	<i>Glochidion sphaerogynum</i>	0.0139	-6.1648	-0.0859
25	<i>Viburnum sambucinum</i>	0.0132	-6.2407	-0.0825
26	<i>Styrax benzoides</i>	0.0129	-6.2803	-0.0808
27	<i>Diospyros glandulosa</i>	0.0096	-6.6953	-0.0646
28	<i>Lithocarpus polystachyus</i>	0.0079	-6.9907	-0.0550
29	<i>Quercus semiserrata</i>	0.0068	-7.2023	-0.0489
30	<i>Pyrenaria diospyricarpa</i>	0.0064	-7.2803	-0.0468
31	<i>Lithocarpus fenestratus</i>	0.0061	-7.3627	-0.0447
32	<i>Lithocarpus sootepensis</i>	0.0061	-7.3627	-0.0447
33	<i>Stereospermum neuranthum</i>	0.0057	-7.4502	-0.0426
34	<i>Lindera metcalfiana</i>	0.0057	-7.4502	-0.0426
35	<i>Helicia terminalis</i>	0.0054	-7.5433	-0.0404
36	<i>Dillenia aurea</i>	0.0046	-7.7497	-0.0360
37	<i>Turpinia cochinchinensis</i>	0.0043	-7.8652	-0.0337
38	<i>Eriolaena candollei</i>	0.0039	-7.9907	-0.0314
39	<i>Rapanea porteriana</i>	0.0039	-7.9907	-0.0314
40	<i>Syzygium gratum</i>	0.0039	-7.9907	-0.0314
41	<i>Callicarpa arborea</i>	0.0036	-8.1283	-0.0291
42	<i>Rhus javanica</i>	0.0036	-8.1283	-0.0291
43	<i>Syzygium albiflorum</i>	0.0032	-8.2803	-0.0266
44	<i>Saurauia roxburghii</i>	0.0032	-8.2803	-0.0266
45	<i>Beilschmiedia gammieana</i>	0.0032	-8.2803	-0.0266
46	<i>Phoebe cathia</i>	0.0029	-8.4502	-0.0242
47	<i>Milletia pachycarpa</i>	0.0025	-8.6428	-0.0216
48	<i>Cinnamomum porrectum</i>	0.0025	-8.6428	-0.0216
49	<i>Ilex umbellulata</i>	0.0025	-8.6428	-0.0216
50	<i>Archidendron clypearia</i>	0.0025	-8.6428	-0.0216
51	<i>Quercus kingiana</i>	0.0021	-8.8652	-0.0190
52	<i>Albizia odoratissima</i>	0.0021	-8.8652	-0.0190
53	<i>Albizia chinensis</i>	0.0021	-8.8652	-0.0190
54	<i>Gmelina philippensis</i>	0.0021	-8.8652	-0.0190

Table 3-3 (Continued)

No	Species	$p_i$	$\log_2 p_i$	$p_i^* \log_2 p_i$
55	<i>Catunaregam tomentosa</i>	0.0021	-8.8652	-0.0190
56	<i>Pterospermum acerifolium</i>	0.0021	-8.8652	-0.0190
57	<i>Glochidion hirsutum</i>	0.0021	-8.8652	-0.0190
58	<i>Engelhardtia serrata</i>	0.0021	-8.8652	-0.0190
59	<i>Mussaenda sanderiana</i>	0.0018	-9.1283	-0.0163
60	<i>Trichilla connaroides</i>	0.0018	-9.1283	-0.0163
61	<i>Litsea glutinosa</i>	0.0018	-9.1283	-0.0163
62	<i>Symplocos racemosa</i>	0.0018	-9.1283	-0.0163
63	<i>Olea salicifolia</i>	0.0014	-9.4502	-0.0135
64	<i>Gardenia sootepensis</i>	0.0014	-9.4502	-0.0135
65	<i>Erythrina subumbrans</i>	0.0014	-9.4502	-0.0135
66	<i>Embelia subcoriacea</i>	0.0014	-9.4502	-0.0135
67	<i>Elaeocarpus stipularis</i>	0.0014	-9.4502	-0.0135
68	<i>Vernonia volkameriifolia</i>	0.0014	-9.4502	-0.0135
69	<i>Ampelocissus martinii</i>	0.0014	-9.4502	-0.0135
70	<i>Terminalia chebula</i>	0.0014	-9.4502	-0.0135
71	<i>Dolichandrone serrulata</i>	0.0011	-9.8652	-0.0106
72	<i>Magnolia henryi</i>	0.0011	-9.8652	-0.0106
73	<i>Garuga pinnata</i>	0.0011	-9.8652	-0.0106
74	<i>Protium serratum</i>	0.0011	-9.8652	-0.0106
75	<i>Buchanania lanzan</i>	0.0011	-9.8652	-0.0106
76	<i>Sarcosperma arboreum</i>	0.0011	-9.8652	-0.0106
77	<i>Antidesma ghaesembilla</i>	0.0011	-9.8652	-0.0106
78	<i>Litsea semecarpifolia</i>	0.0011	-9.8652	-0.0106
79	<i>Lithocarpus lindleyanus</i>	0.0007	-10.4502	-0.0075
80	<i>Pavetta tomentosa</i>	0.0007	-10.4502	-0.0075
81	<i>Gordonia dalglieshiana</i>	0.0007	-10.4502	-0.0075
82	<i>Bombax anceps</i>	0.0007	-10.4502	-0.0075
83	<i>Colona flagrocarpa</i>	0.0007	-10.4502	-0.0075
84	<i>Dalbergia velutina</i>	0.0007	-10.4502	-0.0075
85	<i>Shorea roxburghii</i>	0.0007	-10.4502	-0.0075
86	<i>Syzygium cumini</i>	0.0007	-10.4502	-0.0075
87	<i>Melastoma malabathricum</i>	0.0007	-10.4502	-0.0075
88	<i>Castanopsis armata</i>	0.0004	-11.4502	-0.0041
89	<i>Radermachera ignea</i>	0.0004	-11.4502	-0.0041
90	<i>Betula alnoides</i>	0.0004	-11.4502	-0.0041
91	<i>Entada rheedii</i>	0.0004	-11.4502	-0.0041
92	<i>Vitex pinnata</i>	0.0004	-11.4502	-0.0041
93	<i>Ficus sp.</i>	0.0004	-11.4502	-0.0041
94	<i>Horsfieldia tomentosa</i>	0.0004	-11.4502	-0.0041
95	<i>Canarium subulatum</i>	0.0004	-11.4502	-0.0041
96	<i>Celastrus paniculata</i>	0.0004	-11.4502	-0.0041
97	<i>Kydia calycina</i>	0.0004	-11.4502	-0.0041
98	<i>Gluta usitata</i>	0.0004	-11.4502	-0.0041
99	<i>Combretum punctatum</i>	0.0004	-11.4502	-0.0041
100	<i>Schefflera bengalensis</i>	0.0004	-11.4502	-0.0041
101	<i>Artocarpus gomezianus</i>	0.0004	-11.4502	-0.0041
102	<i>Eurya acuminata</i>	0.0004	-11.4502	-0.0041
103	<i>Cinnamomum iners</i>	0.0004	-11.4502	-0.0041
Total		1.00	-864.27	-5.28
Shannon-Wiener Index				5.28

### (3) Forest Condition Index (FCI)

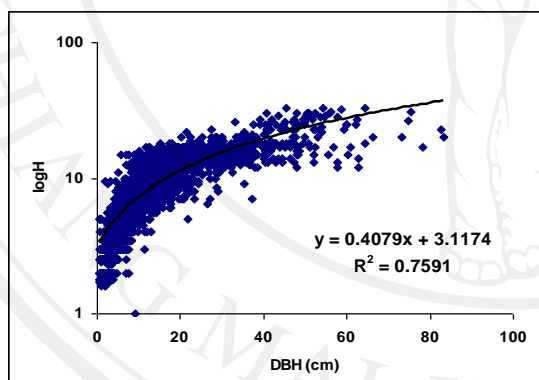
The indexes of forest conditions were different among fifteen fragmented forests, and varied from 31.39 to 69.42. The value of 50.16 was calculated for the whole fragmented forests (Table 3-4). These implied to the different conditions of fragmented forests caused by human disturbance through selective tree cutting. For the pine-montane forest in other areas, Seeloy-ounkeaw (2011) found that two community forests including utilization and conservation forests at Nong Tao villages, Mae Wang district, Chiang Mai province, had indexes of forest conditions of 50.16 and 54.45, respectively. The forest condition and ecological features in this conservation forest was good compared to utilization forest. Therefore, the FCI values below 54.45 in some fragmented forests implied to the degraded forest.

### (4) Growths and Size Class Distribution

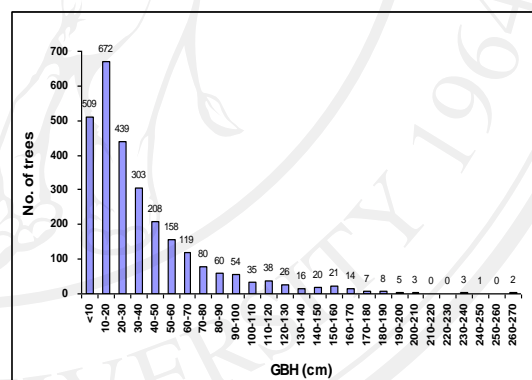
The number of tree individuals of different height classes and stem-girth classes in fragmented forests were presented in Table 3-5 to Table 3-8.

The relationship between diameter at breast height (dbh) and tree height (H) showed in semi-log curve (Figure 3-1), which was approximated by the relation,

$$y = 0.4079x + 3.1174 \quad (R^2 = 0.7591)$$



**Figure 3-1** The relation between dbh and tree height in fragmented forests



**Figure 3-2** The size class distribution of girth in fragmented forests

Size-class distribution can be used as indicators of changes in population structure and species composition (Newbery and Gartlan, 1996). Distribution curves that drop exponentially with increasing dbh (reverse-J-shaped) are characteristics of species with continuous regeneration. Most species in fragmented forests followed this pattern of distribution with plenty of individuals in the small size classes that indicated a good regeneration potential (Figure 3-2). Three pioneer species, *T. rufescens*, *W. tinctoria*, and *V. sprengelii* had the relative high density. The common species, *P. kesiya* and *C. acuminatissima* occurred in most fragmented forests.

**Table 3-4** Indexes of forest conditions (FCI) in fifteen fragmented forests

FF	Altitude (m)	Index of forest conditions with different stem-girth classes (cm)											FCI	
		<25	25-50	50-75	75-100	100-125	125-150	150-175	175-200	220-225	225-250	250-275		
1	1,222	0.91	5.40	18.50	6.67	7.00	11.00	3.00	0.00	0.00	0.00	0.00	0.00	52.48
2	1,234	1.40	5.99	18.83	8.33	9.00	4.00	0.00	0.00	0.00	0.00	0.00	0.00	47.55
3	1,250	0.83	6.08	27.83	12.83	8.00	4.67	0.00	2.00	0.00	0.00	0.00	0.00	62.25
4	1,253	0.78	2.08	15.83	10.50	8.00	5.00	3.00	4.00	0.00	0.00	0.00	0.00	49.20
5	1,259	0.61	4.98	29.00	15.50	6.50	4.00	2.00	0.00	1.00	0.00	0.00	0.00	63.60
6	1,300	0.25	2.60	13.00	13.00	4.00	3.50	2.00	2.00	0.00	1.00	0.00	0.00	41.35
7	1,345	1.47	4.12	11.50	10.00	4.20	3.00	5.00	0.00	0.00	0.00	0.00	0.00	39.29
8	1,390	0.79	3.58	19.25	3.00	4.50	3.50	4.00	1.00	0.00	0.00	0.00	0.00	39.62
9	1,395	1.14	3.80	13.33	8.10	3.40	3.00	3.00	1.20	0.00	1.00	0.00	0.00	37.97
10	1,436	0.98	3.41	13.00	4.67	4.33	2.00	3.00	0.00	0.00	0.00	0.00	0.00	31.39
11	1,440	1.40	9.12	28.97	13.83	4.00	2.33	1.33	1.00	0.00	0.00	0.00	0.00	61.99
12	1,470	0.65	7.53	30.75	16.50	5.00	3.00	5.00	0.00	0.00	1.00	0.00	0.00	69.42
13	1,545	0.74	4.37	25.67	12.00	3.00	2.00	3.00	2.00	1.00	1.00	2.00	0.00	56.77
14	1,556	1.59	5.17	23.67	11.00	4.00	2.83	2.50	1.00	0.00	0.00	0.00	0.00	51.76
15	1,586	0.71	2.42	23.17	12.17	4.33	1.00	2.00	1.00	1.00	0.00	0.00	0.00	47.80
Average		0.95	4.71	20.82	10.54	5.28	3.66	2.59	1.01	0.20	0.27	0.13	0.00	50.16



**Table 3-5** Number of tree individuals with different height classes in fifteen fragmented forests

No	Species	Number of tree individuals with different height classes (m) in 15 plots								Total	Total (%)
		<5	5-10	10-15	15-20	20-25	25-30	30-35			
1	<i>Tristania rufescens</i>	114	115	35	15	-	-	-	279	9.97	
2	<i>Wendlandia tinctoria</i>	52	156	12	-	-	-	-	219	7.83	
3	<i>Vaccinium sprengelii</i>	131	74	2	-	-	-	-	206	7.36	
4	<i>Pinus kesiya</i>	7	26	26	40	23	31	13	165	5.90	
5	<i>Schima wallichii</i>	26	35	34	51	4	-	-	150	5.36	
6	<i>Castanopsis acuminatissima</i>	8	42	60	31	4	-	-	144	5.15	
7	<i>Ternstroemia gymnanthera</i>	16	32	26	12	-	-	-	86	3.07	
8	<i>Quercus brandisiana</i>	21	22	21	21	-	-	-	84	3.00	
9	<i>Craibiodendron stellatum</i>	45	30	3	-	-	-	-	78	2.79	
10	<i>Helicia nilagirica</i>	14	40	16	1	-	-	-	71	2.54	
11	<i>Lithocarpus elegans</i>	17	21	15	16	1	-	-	70	2.50	
12	<i>Eurya nitida</i>	45	15	5	4	-	-	-	69	2.47	
13	<i>Quercus vestita</i>	27	25	12	5	-	-	-	68	2.43	
14	<i>Anneslea fragrans</i>	14	28	19	5	-	-	-	66	2.36	
15	<i>Phyllanthus emblica</i>	37	23	2	1	-	-	-	63	2.25	
16	<i>Engelhardtia spicata</i>	16	18	14	14	1	-	-	62	2.22	
17	<i>Castanopsis diversifolia</i>	11	12	15	18	3	-	-	59	2.11	
18	<i>Dalbergia cultrata</i>	24	20	5	9	-	-	-	58	2.07	
19	<i>Semecarpus albescens</i>	46	2	-	-	-	-	-	48	1.72	
20	<i>Glochidion acuminatum</i>	32	7	7	2	-	-	-	48	1.72	
21	<i>Phoebe paniculata</i>	17	16	3	7	-	-	-	43	1.54	
22	<i>Castanopsis purpurea</i>	3	15	15	9	-	-	-	42	1.50	
23	<i>Aporosa villosa</i>	28	14	1	-	-	-	-	42	1.50	
24	<i>Glochidion sphaerogynum</i>	13	22	3	1	-	-	-	39	1.39	
25	<i>Viburnum sambucinum</i>	31	6	1	-	-	-	-	37	1.32	
26	<i>Styrax benzoides</i>	15	15	5	1	1	-	-	36	1.29	
27	<i>Diospyros glandulosa</i>	12	9	4	2	-	-	-	27	0.96	
28	<i>Lithocarpus polystachyus</i>	6	9	6	2	-	-	-	22	0.79	
29	<i>Quercus semiserrata</i>	5	7	3	2	3	-	-	19	0.68	
30	<i>Pyrenaria diospyricarpa</i>	7	11	-	-	-	-	-	18	0.64	
31	<i>Lithocarpus fenestratus</i>	1	7	5	4	-	-	-	17	0.61	
32	<i>Lithocarpus sootepensis</i>	2.7	10	4	0.3	-	-	-	17	0.61	
33	<i>Stereospermum neuranthum</i>	7	8.8	0.3	-	-	-	-	16	0.57	
34	<i>Lindera metcalifiana</i>	9	4	1	2	-	-	-	16	0.57	
35	<i>Helicia terminalis</i>	1	8	4	2	-	-	-	15	0.54	
36	<i>Dillenia aurea</i>	4	7	1	3	-	-	-	13	0.46	
37	<i>Turpinia cochinchinensis</i>	7	4	1	-	-	-	-	12	0.43	
38	<i>Eriolaena candollei</i>	3	5	1	1	1	-	-	11	0.39	
39	<i>Rapanea porteriana</i>	2	4	5	-	-	-	-	11	0.39	
40	<i>Syzygium gratum</i>	-	5	4	3	-	-	-	11	0.39	
41	<i>Callicarpa arborea</i>	0.3	1.8	6	2	-	-	-	10	0.36	
42	<i>Rhus javanica</i>	10	-	-	-	-	-	-	10	0.36	
43	<i>Syzygium albiflorum</i>	5	2	1	1	-	-	-	9	0.32	
44	<i>Saurauia roxburghii</i>	7	2	-	-	-	-	-	9	0.32	
45	<i>Beilschmiedia gammieana</i>	5	4	-	-	-	-	-	9	0.32	
46	<i>Phoebe cathia</i>	1	5	-	1	1	-	-	8	0.29	
47	<i>Millettia pachycarpa</i>	5	-	-	2	-	-	-	7	0.25	
48	<i>Cinnamomum porrectum</i>	7	-	-	-	-	-	-	7	0.25	
49	<i>Ilex umbellulata</i>	3	3	1	-	-	-	-	7	0.25	
50	<i>Archidendron clypearia</i>	3	3	-	1	-	-	-	7	0.25	
51	<i>Quercus kingiana</i>	2	4	-	-	-	-	-	6	0.21	
52	<i>Albizia odoratissima</i>	-	3	1	2	-	-	-	6	0.21	
53	<i>Albizia chinensis</i>	2	1	2	1	-	-	-	6	0.21	

Table 3-5 (Continued)

No	Species	Number of tree individuals with different height classes (m) in 15 plots								
		<5	5-10	10-15	15-20	20-25	25-30	30-35	Total	Total (%)
54	<i>Gmelina philippensis</i>	6	-	-	-	-	-	-	6	0.21
55	<i>Catunaregam tomentosa</i>	6	-	-	-	-	-	-	6	0.21
56	<i>Pterospermum acerifolium</i>	5	1	-	-	-	-	-	6	0.21
57	<i>Glochidion hirsutum</i>	5	1	-	-	-	-	-	6	0.21
58	<i>Engelhardtia serrata</i>	2	-	2	2	-	-	-	6	0.21
59	<i>Mussaenda sanderiana</i>	5	-	-	-	-	-	-	5	0.18
60	<i>Trichilla connaroides</i>	2	3	-	-	-	-	-	5	0.18
61	<i>Litsea glutinosa</i>	2	2	-	-	1	-	-	5	0.18
62	<i>Symplocos racemosa</i>	1.3	3.3	0.3	-	-	-	-	5	0.18
63	<i>Olea salicifolia</i>	2	1	-	1	-	-	-	4	0.14
64	<i>Gardenia sootepensis</i>	1	1	1	1	-	-	-	4	0.14
65	<i>Erythrina subumbrans</i>	1	2	1	-	-	-	-	4	0.14
66	<i>Embelia subcoriacea</i>	2	1	-	1	-	-	-	4	0.14
67	<i>Elaeocarpus stipularis</i>	-	2	-	1	1	-	-	4	0.14
68	<i>Vernonia volkameriifolia</i>	3	1	-	-	-	-	-	4	0.14
69	<i>Ampelocissus martinii</i>	-	-	1	3	-	-	-	4	0.14
70	<i>Terminalia chebula</i>	1	1.3	1.3	0.3	-	-	-	4	0.14
71	<i>Dolichandrone serrulata</i>	-	2	1	-	-	-	-	3	0.11
72	<i>Magnolia henryi</i>	1	1	1	-	-	-	-	3	0.11
73	<i>Garuga pinnata</i>	-	3	-	-	-	-	-	3	0.11
74	<i>Protium serratum</i>	2	1	-	-	-	-	-	3	0.11
75	<i>Buchanania lanzan</i>	1	1	1	1	-	-	-	3	0.11
76	<i>Sarcosperma arboreum</i>	1	1	-	1	-	-	-	3	0.11
77	<i>Antidesma ghaesembilla</i>	3	-	-	-	-	-	-	3	0.11
78	<i>Litsea semecarpifolia</i>	-	-	1	2	-	-	-	3	0.11
79	<i>Lithocarpus lindleyanus</i>	1	-	-	1	-	-	-	2	0.07
80	<i>Pavetta tomentosa</i>	2	-	-	-	-	-	-	2	0.07
81	<i>Gordonia dalglieshiana</i>	0.3	1.7	-	-	-	-	-	2	0.07
82	<i>Bombax anceps</i>	-	1	1	1	-	-	-	2	0.07
83	<i>Colona flagrocarpa</i>	-	2	-	-	-	-	-	2	0.07
84	<i>Dalbergia velutina</i>	1	-	1	-	-	-	-	2	0.07
85	<i>Shorea roxburghii</i>	1	1	-	-	-	-	-	2	0.07
86	<i>Syzygium cumini</i>	-	1	1	-	-	-	-	2	0.07
87	<i>Melastoma malabathricum</i>	2	-	-	-	-	-	-	2	0.07
88	<i>Castanopsis armata</i>	-	-	-	-	1	-	-	1	0.04
89	<i>Radermachera ignea</i>	-	-	1	-	-	-	-	1	0.04
90	<i>Betula alnoides</i>	-	-	1	-	-	-	-	1	0.04
91	<i>Entada rheedii</i>	-	-	-	1	-	-	-	1	0.04
92	<i>Vitex pinnata</i>	-	-	1	-	-	-	-	1	0.04
93	<i>Ficus sp.</i>	1	-	-	-	-	-	-	1	0.04
94	<i>Horsfieldia tomentosa</i>	-	1	-	-	-	-	-	1	0.04
95	<i>Canarium subulatum</i>	1	-	-	-	-	-	-	1	0.04
96	<i>Celastrus paniculata</i>	1	-	-	-	-	-	-	1	0.04
97	<i>Kydia calycina</i>	-	-	-	1	-	-	-	1	0.04
98	<i>Gluta usitata</i>	-	-	1	-	-	-	-	1	0.04
99	<i>Combretum punctatum</i>	-	-	1	-	-	-	-	1	0.04
100	<i>Schefflera bengalensis</i>	-	1	-	-	-	-	-	1	0.04
101	<i>Artocarpus gomezianus</i>	-	1	-	-	-	-	-	1	0.04
102	<i>Eurya acuminata</i>	1	-	-	-	-	-	-	1	0.04
103	<i>Cinnamomum iners</i>	-	-	1	-	-	-	-	1	0.04
Total		987	992	422	309	45	31	13	2,798	100
Total (%)		35.28	35.45	15.07	11.04	1.59	1.11	0.46	100	

**Table 3-6** Number of tree individuals with different height classes in each fragmented forest

FF	No	Species	Number of tree individuals with different height classes (m) (per plot)								Total	Total (%)
			<5	5-10	10-15	15-20	20-25	25-30	30-35			
1	1	<i>Wendlandia tinctoria</i>	21	27	-	-	-	-	-	-	48	25.1
	2	<i>Tristania rufescens</i>	27.5	15.5	-	-	-	-	-	-	43	22.5
	3	<i>Pinus kesiya</i>	-	1	4	8	9	8	-	-	30	15.7
	4	<i>Quercus vestita</i>	10	12	3	-	-	-	-	-	25	13.1
	5	<i>Helicia nilagirica</i>	3	8	1	-	-	-	-	-	12	6.3
	6	<i>Schima wallichii</i>	1	2	3	2	-	-	-	-	8	4.2
	7	<i>Dalbergia cultrata</i>	2	1	1	2	-	-	-	-	6	3.1
	8	<i>Craibiodendron stellatum</i>	4	1	-	-	-	-	-	-	5	2.6
	9	<i>Lithocarpus elegans</i>	1	1	0.7	0.3	-	-	-	-	3	1.6
	10	<i>Glochidion sphaerogynum</i>	-	3	-	-	-	-	-	-	3	1.6
	11	<i>Vaccinium sprengelii</i>	3	-	-	-	-	-	-	-	3	1.6
	12	<i>Castanopsis purpurea</i>	-	-	1	-	-	-	-	-	1	0.5
	13	<i>Castanopsis diversifolia</i>	-	-	1	-	-	-	-	-	1	0.5
	14	<i>Engelhardtia spicata</i>	-	1	-	-	-	-	-	-	1	0.5
	15	<i>Erythrina subumbrans</i>	-	-	1	-	-	-	-	-	1	0.5
	16	<i>Phyllanthus emblica</i>	1	-	-	-	-	-	-	-	1	0.5
			<b>Total</b>	74	73	15	12	9	8	-	191	100
		<b>Total (%)</b>	38.7	38.0	8.0	6.5	4.7	4.2	-	100		
2	1	<i>Tristania rufescens</i>	30	27	-	-	-	-	-	-	57	23.8
	2	<i>Vaccinium sprengelii</i>	34	2	-	-	-	-	-	-	36	15.0
	3	<i>Pinus kesiya</i>	2	7	3	20	3	-	-	-	35	14.6
	4	<i>Quercus vestita</i>	16	6	4	2	-	-	-	-	28	11.7
	5	<i>Lithocarpus elegans</i>	7.3	8.4	3.3	4	-	-	-	-	23	9.6
	6	<i>Schima wallichii</i>	1	2.5	4.5	4	-	-	-	-	12	5.0
	7	<i>Castanopsis purpurea</i>	-	7	2	-	-	-	-	-	9	3.8
	8	<i>Lithocarpus sootensis</i>	1	5	3	-	-	-	-	-	9	3.8
	9	<i>Wendlandia tinctoria</i>	2	3	2	-	-	-	-	-	7	2.9
	10	<i>Helicia nilagirica</i>	2	4	-	-	-	-	-	-	6	2.5
	11	<i>Myrica esculenta</i>	-	0.5	1.5	2	-	-	-	-	4	1.7
	12	<i>Albizia odoratissima</i>	-	-	1	1	-	-	-	-	2	0.8
	13	<i>Glochidion sphaerogynum</i>	1	-	1	-	-	-	-	-	2	0.8
	14	<i>Eurya nitida</i>	-	2	-	-	-	-	-	-	2	0.8
	15	<i>Anneslea fragrans</i>	1	1	-	-	-	-	-	-	2	0.8
	16	<i>Castanopsis acuminatissima</i>	1	-	-	-	-	-	-	-	1	0.4
	17	<i>Castanopsis diversifolia</i>	-	-	1	-	-	-	-	-	1	0.4
	18	<i>Betula alnoides</i>	-	-	1	-	-	-	-	-	1	0.4
	19	<i>Engelhardtia spicata</i>	1	-	-	-	-	-	-	-	1	0.4
	20	<i>Craibiodendron stellatum</i>	1	-	-	-	-	-	-	-	1	0.4
	21	<i>Semecarpus albens</i>	1	-	-	-	-	-	-	-	1	0.4
		<b>Total</b>	101	76	27	33	3	-	-	240	100	
		<b>Total (%)</b>	42.0	31.6	11.4	13.8	1.3	-	-	100		

Table 3-6 (Continued)

FF	No	Species	Number of tree individuals with different height classes (m) (per plot)								Total	Total (%)
			<5	5-10	10-15	15-20	20-25	25-30	30-35			
3	1	<i>Phyllanthus emblica</i>	11	13	1	-	-	-	-	25	12.6	
	2	<i>Pinus kesiya</i>	-	5	2	5	5	2	-	19	9.5	
	3	<i>Schima wallichii</i>	1	3	6	7	-	-	-	17	8.5	
	4	<i>Lithocarpus fenestratus</i>	-	4	2	4	-	-	-	10	5.0	
	5	<i>Lithocarpus elegans</i>	1	1	3	5	-	-	-	10	5.0	
	6	<i>Dalbergia cultrata</i>	2	4	3	1	-	-	-	10	5.0	
	7	<i>Ternstroemia gymnanthera</i>	3.5	3.5	1.5	1.5	-	-	-	10	5.0	
	8	<i>Engelhardtia spicata</i>	1	6	2	1	-	-	-	10	5.0	
	9	<i>Stereospermum neuranthum</i>	3	7	-	-	-	-	-	10	5.0	
	10	<i>Callicarpa arborea</i>	-	2	6	2	-	-	-	10	5.0	
	11	<i>Castanopsis purpurea</i>	-	2	-	5	-	-	-	7	3.5	
	12	<i>Tristania rufescens</i>	0.5	6.5	-	-	-	-	-	7	3.5	
	13	<i>Glochidion sphaerogynum</i>	-	4	1	-	-	-	-	5	2.5	
	14	<i>Quercus vestita</i>	-	2	1	1	-	-	-	4	2.0	
	15	<i>Craibiodendron stellatum</i>	-	4	-	-	-	-	-	4	2.0	
	16	<i>Diospyros glandulosa</i>	-	3	-	-	-	-	-	3	1.5	
	17	<i>Wendlandia tinctoria</i>	-	3	1	-	-	-	-	3	1.5	
	18	<i>Castanopsis acuminatissima</i>	-	-	1	1	-	-	-	2	1.0	
	19	<i>Catunaregam tomentosa</i>	2	-	-	-	-	-	-	2	1.0	
	20	<i>Erythrina subumbrans</i>	-	2	-	-	-	-	-	2	1.0	
	21	<i>Colona flagrocarpa</i>	-	2	-	-	-	-	-	2	1.0	
	22	<i>Syzygium albiflorum</i>	1	1	-	-	-	-	-	2	1.0	
	23	<i>Semecarpus albescens</i>	2	-	-	-	-	-	-	2	1.0	
	24	<i>Litsea glutinosa</i>	1	1	-	-	-	-	-	2	1.0	
	25	<i>Helicia terminalis</i>	-	-	2	-	-	-	-	2	1.0	
	26	<i>Aporosa villosa</i>	2	-	-	-	-	-	-	2	1.0	
	27	<i>Engelhardtia serrata</i>	1	-	-	1	-	-	-	2	1.0	
	28	<i>Castanopsis diversifolia</i>	-	1	-	-	-	-	-	1	0.5	
	29	<i>Albizia odoratissima</i>	-	1	-	-	-	-	-	1	0.5	
	30	<i>Albizia chinensis</i>	-	-	1	-	-	-	-	1	0.5	
	31	<i>Styrax benzoïdes</i>	-	1	-	-	-	-	-	1	0.5	
	32	<i>Milletia pachycarpa</i>	-	-	-	1	-	-	-	1	0.5	
	33	<i>Bombax anceps</i>	-	1	1	-	-	-	-	1	0.5	
	34	<i>Ilex umbellulata</i>	1	-	-	-	-	-	-	1	0.5	
	35	<i>Eurya nitida</i>	-	1	-	-	-	-	-	1	0.5	
	36	<i>Ampelocissus martinii</i>	-	-	-	1	-	-	-	1	0.5	
	37	<i>Vaccinium sprengelii</i>	1	-	-	-	-	-	-	1	0.5	
	38	<i>Terminalia chebula</i>	-	-	-	-	-	-	-	1	0.5	
	39	<i>Phoebe paniculata</i>	1	-	-	-	-	-	-	1	0.5	
	40	<i>Beilschmiedia gammieana</i>	-	1	-	-	-	-	-	1	0.5	
	41	<i>Syzygium cumini</i>	-	1	-	-	-	-	-	1	0.5	
	42	<i>Helicia nilagirica</i>	-	-	1	-	-	-	-	1	0.5	
		Total	35	85	35	36	5	2	-	199	100	
		Total (%)	17.8	42.8	17.7	18.3	2.5	1.0	-	100		



Table 3-6 (Continued)

FF	No	Species	Number of tree individuals with different height classes (m) (per plot)								Total	Total (%)
			<5	5-10	10-15	15-20	20-25	25-30	30-35			
4	1	<i>Vaccinium sprengelii</i>	29	14	-	-	-	-	-	43	29.7	
	2	<i>Castanopsis acuminatissima</i>	1	4	8	3	-	-	-	16	11.0	
	3	<i>Pinus kesiya</i>	-	3	-	2	2	3	4	14	9.7	
	4	<i>Tristania rufescens</i>	8	2	2	-	-	-	-	12	8.3	
	5	<i>Craibiodendron stellatum</i>	10	2	-	-	-	-	-	12	8.3	
	6	<i>Anneslea fragrans</i>	5	4	1	2	-	-	-	12	8.3	
	7	<i>Quercus brandisiana</i>	-	-	3	3	-	-	-	6	4.1	
	8	<i>Ternstroemia gymnanthera</i>	2.5	2	1.5	-	-	-	-	6	4.1	
	9	<i>Styrax benzoides</i>	3	1	-	-	-	-	-	4	2.8	
	10	<i>Semecarpus albescens</i>	4	-	-	-	-	-	-	4	2.8	
	11	<i>Castanopsis purpurea</i>	-	-	3	-	-	-	-	3	2.1	
	12	<i>Schima wallichii</i>	2	1	-	-	-	-	-	3	2.1	
	13	<i>Lithocarpus polystachyus</i>	-	1	2	-	-	-	-	2	1.4	
	14	<i>Shorea roxburghii</i>	1	1	-	-	-	-	-	2	1.4	
	15	<i>Dalbergia cultrata</i>	1	-	-	-	-	-	-	1	0.7	
	16	<i>Pavetta tomentosa</i>	1	-	-	-	-	-	-	1	0.7	
	17	<i>Wendlandia tinctoria</i>	1	-	-	-	-	-	-	1	0.7	
	18	<i>Glochidion sphaerogynum</i>	1	-	-	-	-	-	-	1	0.7	
	19	<i>Myrica esculenta</i>	-	1	-	-	-	-	-	1	0.7	
	20	<i>Viburnum sambucinum</i>	1	-	-	-	-	-	-	1	0.7	
	Total		71	36	20	10	2	3	4	145	100	
	Total (%)		48.6	24.5	13.8	6.9	1.4	2.1	2.8	100		
5	1	<i>Tristania rufescens</i>	14	6.5	8.5	3	-	-	-	32	18.9	
	2	<i>Castanopsis acuminatissima</i>	-	3	12.5	9.5	-	-	-	25	14.8	
	3	<i>Vaccinium sprengelii</i>	6	17	1	-	-	-	-	24	14.2	
	4	<i>Anneslea fragrans</i>	1	10	7	-	-	-	-	18	10.7	
	5	<i>Quercus brandisiana</i>	-	1	1.5	9.5	-	-	-	12	7.1	
	6	<i>Craibiodendron stellatum</i>	3	8	-	-	-	-	-	11	6.5	
	7	<i>Semecarpus albescens</i>	4	2	3	-	-	-	-	9	5.3	
	8	<i>Castanopsis purpurea</i>	2	1	3	-	-	-	-	6	3.6	
	9	<i>Styrax benzoides</i>	-	1.5	1.5	1	-	-	-	4	2.4	
	10	<i>Wendlandia tinctoria</i>	-	3	1	-	-	-	-	4	2.4	
	11	<i>Pinus kesiya</i>	-	-	1	-	-	-	3	4	2.4	
	12	<i>Aporosa villosa</i>	3	1	-	-	-	-	-	4	2.4	
	13	<i>Dalbergia cultrata</i>	2	1	-	-	-	-	-	3	1.8	
	14	<i>Viburnum sambucinum</i>	1	2	-	-	-	-	-	3	1.8	
	15	<i>Lithocarpus polystachyus</i>	1	-	-	1	-	-	-	2	1.2	
	16	<i>Ternstroemia gymnanthera</i>	-	1	1	-	-	-	-	2	1.2	
	17	<i>Schima wallichii</i>	-	1	-	1	-	-	-	2	1.2	
	18	<i>Lithocarpus elegans</i>	-	1	-	-	-	-	-	1	0.6	
	19	<i>Quercus vestita</i>	-	-	1	-	-	-	-	1	0.6	
	20	<i>Canarium subulatum</i>	1	-	-	-	-	-	-	1	0.6	
	21	<i>Phyllanthus emblica</i>	1	-	-	-	-	-	-	1	0.6	
	Total		39	60	42	25	-	-	3	169	100	
	Total (%)		23.1	35.5	24.9	14.8	-	-	1.8	100		

Table 3-6 (Continued)

FF	No	Species	Number of tree individuals with different height classes (m) (per plot)							Total	Total (%)
			<5	5-10	10-15	15-20	20-25	25-30	30-35		
6	1	<i>Tristania rufescens</i>	2	9	3	3	-	-	-	17	19.1
	2	<i>Vaccinium sprengelii</i>	3	10	-	-	-	-	-	13	14.6
	3	<i>Castanopsis acuminatissima</i>	1	2	8	1	-	-	-	12	13.5
	4	<i>Craibiodendron stellatum</i>	4	3	-	-	-	-	-	7	7.9
	5	<i>Pinus kesiya</i>	-	1	-	-	-	6	-	7	7.9
	6	<i>Anneslea fragrans</i>	1	2	3	1	-	-	-	7	7.9
	7	<i>Wendlandia tinctoria</i>	1	4	1	-	-	-	-	6	6.7
	8	<i>Lithocarpus fenestratus</i>	-	2	2	-	-	-	-	4	4.5
	9	<i>Semecarpus albescens</i>	1	-	2	1	-	-	-	4	4.5
	10	<i>Castanopsis purpurea</i>	-	2	1	-	-	-	-	3	3.4
	11	<i>Lithocarpus polystachyus</i>	-	1	1	1	-	-	-	3	3.4
	12	<i>Styrax benzoides</i>	-	2	-	-	-	-	-	2	2.2
	13	<i>Quercus brandisiana</i>	-	-	-	1	-	-	-	1	1.1
	14	<i>Quercus vestita</i>	-	-	-	1	-	-	-	1	1.1
	15	<i>Aporosa villosa</i>	1	-	-	-	-	-	-	1	1.1
	16	<i>Viburnum sambucinum</i>	1	-	-	-	-	-	-	1	1.1
		Total	15	38	21	9	-	6	-	89	100
		Total (%)	16.9	42.7	23.6	10.1	-	6.7	-	100	
7	1	<i>Vaccinium sprengelii</i>	15	12	-	-	-	-	-	27	12.2
	2	<i>Viburnum sambucinum</i>	22	2	1	-	-	-	-	25	11.3
	3	<i>Castanopsis acuminatissima</i>	2	7	11	3	-	-	-	23	10.4
	4	<i>Tristania rufescens</i>	3.5	7	4.5	2	-	-	-	17	7.7
	5	<i>Styrax benzoides</i>	9	6	-	-	-	-	-	15	6.8
	6	<i>Pinus kesiya</i>	-	3	4	1	2	2	1	13	5.9
	7	<i>Dalbergia cultrata</i>	7	4	1	-	-	-	-	12	5.4
	8	<i>Semecarpus albescens</i>	8	2	-	1	-	-	-	11	5.0
	9	<i>Craibiodendron stellatum</i>	5	2	2	-	-	-	-	9	4.1
	10	<i>Phyllanthus emblica</i>	5	1	-	-	-	-	-	6	2.7
	11	<i>Helicia nilagirica</i>	1	5	-	-	-	-	-	6	2.7
	12	<i>Aporosa villosa</i>	4	2	-	-	-	-	-	6	2.7
	13	<i>Lithocarpus polystachyus</i>	1	3	1	-	-	-	-	5	2.3
	14	<i>Glochidion sphaerogynum</i>	4	1	-	-	-	-	-	5	2.3
	15	<i>Anneslea fragrans</i>	1	2	2	-	-	-	-	5	2.3
	16	<i>Quercus brandisiana</i>	2	-	1	1	-	-	-	4	1.8
	17	<i>Temstroemia gymnanthera</i>	-	1	3	-	-	-	-	4	1.8
	18	<i>Diospyros glandulosa</i>	2	1	-	-	-	-	-	3	1.4
	19	<i>Quercus vestita</i>	1	-	1	1	-	-	-	3	1.4
	20	<i>Wendlandia tinctoria</i>	-	3	-	-	-	-	-	3	1.4
	21	<i>Schima wallichii</i>	-	2	1	-	-	-	-	3	1.4
	22	<i>Castanopsis purpurea</i>	-	-	2	-	-	-	-	2	0.9
	23	<i>Lithocarpus elegans</i>	1	1	-	-	-	-	-	2	0.9
	24	<i>Catunaregam tomentosa</i>	2	-	-	-	-	-	-	2	0.9
	25	<i>Rhus javanica</i>	2	-	-	-	-	-	-	2	0.9
	26	<i>Lithocarpus fenestratus</i>	1	-	-	-	-	-	-	1	0.5
	27	<i>Albizia chinensis</i>	1	-	-	-	-	-	-	1	0.5
	28	<i>Stereospermum neuranthum</i>	1	-	-	-	-	-	-	1	0.5
	29	<i>Eurya nitida</i>	1	-	-	-	-	-	-	1	0.5
	30	<i>Phoebe paniculata</i>	1	-	-	-	-	-	-	1	0.5
	31	<i>Terminalia chebula</i>	1	-	-	-	-	-	-	1	0.5
	32	<i>Vernonia volkameriifolia</i>	1	-	-	-	-	-	-	1	0.5
	33	<i>Dillenia aurea</i>	-	1	-	-	-	-	-	1	0.5
	34	<i>Helicia terminalis</i>	1	-	-	-	-	-	-	1	0.5
		Total	105	68	35	9	2	2	1	222	100
		Total (%)	47.3	30.6	15.7	4.1	0.9	0.9	0.5	100	

Table 3-6 (Continued)

FF	No	Species	Number of tree individuals with different height classes (m) (per plot)								Total	Total (%)
			<5	5-10	10-15	15-20	20-25	25-30	30-35			
8	1	<i>Tristania rufescens</i>	10	16.5	11.5	6	-	-	-	44	29.3	
	2	<i>Vaccinium sprengelii</i>	9.8	7.8	0.5	-	-	-	-	18	12.0	
	3	<i>Castanopsis acuminatissima</i>	-	8	5	2	-	-	-	15	10.0	
	4	<i>Quercus brandisiana</i>	5.5	3	1.5	1	-	-	-	11	7.3	
	5	<i>Lithocarpus polystachyus</i>	1.5	4.5	1	-	-	-	-	7	4.7	
	6	<i>Craibiodendron stellatum</i>	3.5	3.5	-	-	-	-	-	7	4.7	
	7	<i>Pinus kesiya</i>	-	-	-	-	-	6	1	7	4.7	
	8	<i>Dalbergia cultrata</i>	3	3	-	-	-	-	-	6	4.0	
	9	<i>Phyllanthus emblica</i>	4	1	-	-	-	-	-	5	3.3	
	10	<i>Aporosa villosa</i>	3	1	1	-	-	-	-	5	3.3	
	11	<i>Quercus vestita</i>	-	2	1	-	-	-	-	3	2.0	
	12	<i>Semecarpus albescens</i>	2	-	1	-	-	-	-	3	2.0	
	13	<i>Quercus kingiana</i>	1	1	-	-	-	-	-	2	1.3	
	14	<i>Castanopsis diversifolia</i>	1	1	-	-	-	-	-	2	1.3	
	15	<i>Gardenia sootepensis</i>	-	1	1	-	-	-	-	2	1.3	
	16	<i>Dolichandrone serrulata</i>	-	1	1	-	-	-	-	2	1.3	
	17	<i>Stereospermum neuranthum</i>	2	-	-	-	-	-	-	2	1.3	
	18	<i>Glochidion sphaerogynum</i>	-	2	-	-	-	-	-	2	1.3	
	19	<i>Lithocarpus fenestratus</i>	-	1	-	-	-	-	-	1	0.7	
	20	<i>Lithocarpus elegans</i>	-	1	-	-	-	-	-	1	0.7	
	21	<i>Styrax benzoides</i>	-	1	-	-	-	-	-	1	0.7	
	22	<i>Engelhardtia spicata</i>	1	-	-	-	-	-	-	1	0.7	
	23	<i>Erythrina subumbrans</i>	1	-	-	-	-	-	-	1	0.7	
	24	<i>Dillenia aurea</i>	1	-	-	-	-	-	-	1	0.7	
	25	<i>Anneslea fragrans</i>	-	-	1	-	-	-	-	1	0.7	
Total			49	59	26	9	-	6	1	150	100	
Total (%)			32.8	39.5	17.0	6.0	-	4.0	0.7	100		

Table 3-6 (Continued)

FF	No	Species	Number of tree individuals with different height classes (m) (per plot)								Total	Total (%)
			<5	5-10	10-15	15-20	20-25	25-30	30-35			
9	1	<i>Quercus brandisiana</i>	4	13	10	4	-	-	-	31	16.8	
	2	<i>Tristania rufescens</i>	9	18	2	1	-	-	-	30	16.2	
	3	<i>Castanopsis acuminatissima</i>	-	8	10	2	-	-	-	20	10.8	
	4	<i>Vaccinium sprengelii</i>	8	8	-	-	-	-	-	16	8.6	
	5	<i>Semecarpus albescens</i>	9	3	1	-	-	-	-	13	7.0	
	6	<i>Craibiodendron stellatum</i>	6.5	2.5	-	-	-	-	-	9	4.9	
	7	<i>Pinus kesiya</i>	-	1	2	-	-	2	2	7	3.8	
	8	<i>Viburnum sambucinum</i>	4.5	1.5	-	-	-	-	-	6	3.2	
	9	<i>Castanopsis purpurea</i>	-	2	2	1	-	-	-	5	2.7	
	10	<i>Wendlandia tinctoria</i>	1	3	1	-	-	-	-	5	2.7	
	11	<i>Aporosa villosa</i>	4	1	-	-	-	-	-	5	2.7	
	12	<i>Lithocarpus sootepensis</i>	-	3.5	0.5	-	-	-	-	4	2.2	
	13	<i>Schima wallichii</i>	-	1	1	2	-	-	-	4	2.2	
	14	<i>Glochidion hirsutum</i>	3	1	-	-	-	-	-	4	2.2	
	15	<i>Phyllanthus emblica</i>	4	-	-	-	-	-	-	4	2.2	
	16	<i>Lithocarpus polystachyus</i>	2	-	1	-	-	-	-	3	1.6	
	17	<i>Anneslea fragrans</i>	2	1	-	-	-	-	-	3	1.6	
	18	<i>Helicia nilagirica</i>	-	2	1	-	-	-	-	3	1.6	
	19	<i>Quercus vestita</i>	-	2	-	-	-	-	-	2	1.1	
	20	<i>Glochidion sphaerogynum</i>	-	2	-	-	-	-	-	2	1.1	
	21	<i>Quercus kingiana</i>	1	-	-	-	-	-	-	1	0.5	
	22	<i>Lithocarpus fenestratus</i>	-	-	1	-	-	-	-	1	0.5	
	23	<i>Styrax benzoides</i>	-	-	1	-	-	-	-	1	0.5	
	24	<i>Pavetta tomentosa</i>	1	-	-	-	-	-	-	1	0.5	
	25	<i>Gardenia sootepensis</i>	1	-	-	-	-	-	-	1	0.5	
	26	<i>Catunaregan tomentosa</i>	1	-	-	-	-	-	-	1	0.5	
	27	<i>Dolichandrone serrulata</i>	-	1	-	-	-	-	-	1	0.5	
	28	<i>Archidendron clypearia</i>	1	-	-	-	-	-	-	1	0.5	
	29	<i>Artocarpus gomezianus</i>	-	1	-	-	-	-	-	1	0.5	
Total			62	76	33	10	-	2	2	185	100	
Total (%)			33.5	41.1	17.9	5.4	-	1.1	1.1	100		

Table 3-6 (Continued)

FF	No	Species	Number of tree individuals with different height classes (m) (per plot)								Total	Total (%)
			<5	5-10	10-15	15-20	20-25	25-30	30-35			
10	1	<i>Vaccinium sprengelii</i>	22.5	2.5	-	-	-	-	-	-	25	15.7
	2	<i>Pinus kesiya</i>	4	2	9	4	1	1	1	22	13.8	
	3	<i>Tristania rufescens</i>	10	6.5	3.5	-	-	-	-	20	12.6	
	4	<i>Quercus brandisiana</i>	9	5	4	1	-	-	-	19	11.9	
	5	<i>Craibiodendron stellatum</i>	8	4	1	-	-	-	-	13	8.2	
	6	<i>Castanopsis acuminatissima</i>	1	7	2	-	-	-	-	10	6.3	
	7	<i>Dalbergia cultrata</i>	2.3	5.3	0.3	-	-	-	-	8	5.0	
	8	<i>Lithocarpus elegans</i>	2	3	1	-	-	-	-	6	3.8	
	9	<i>Lithocarpus sootepensis</i>	2	1.5	0.5	-	-	-	-	4	2.5	
	10	<i>Phyllanthus emblica</i>	3	1	-	-	-	-	-	4	2.5	
	11	<i>Glochidion sphaerogynum</i>	2	2	-	-	-	-	-	4	2.5	
	12	<i>Aporosa villosa</i>	4	-	-	-	-	-	-	4	2.5	
	13	<i>Quercus kingiana</i>	-	3	-	-	-	-	-	3	1.9	
	14	<i>Anneslea fragrans</i>	1	2	-	-	-	-	-	3	1.9	
	15	<i>Glochidion hirsutum</i>	2	-	-	-	-	-	-	2	1.3	
	16	<i>Terminalia chebula</i>	-	1	1	-	-	-	-	2	1.3	
	17	<i>Quercus vestita</i>	-	0.5	0.5	-	-	-	-	1	0.6	
	18	<i>Albizia odoratissima</i>	-	1	-	-	-	-	-	1	0.6	
	19	<i>Wendlandia tinctoria</i>	1	-	-	-	-	-	-	1	0.6	
	20	<i>Catunaregam tomentosa</i>	1	-	-	-	-	-	-	1	0.6	
	21	<i>Stereospermum neuranthum</i>	-	1	-	-	-	-	-	1	0.6	
	22	<i>Celastrus paniculata</i>	1	-	-	-	-	-	-	1	0.6	
	23	<i>Rhus javanica</i>	1	-	-	-	-	-	-	1	0.6	
	24	<i>Semecarpus albescens</i>	1	-	-	-	-	-	-	1	0.6	
	25	<i>Gluta usitata</i>	-	-	1	-	-	-	-	1	0.6	
	26	<i>Rapanea porteriiana</i>	-	1	-	-	-	-	-	1	0.6	
		Total	78	49	24	5	1	1	1	159	100	
		Total (%)	49.1	30.9	15.0	3.1	0.6	0.6	0.6	100		



Table 3-6 (Continued)

FF	No	Species	Number of tree individuals with different height classes (m) (per plot)								Total	Total (%)
			<5	5-10	10-15	15-20	20-25	25-30	30-35			
11	1	<i>Wendlandia tinctoria</i>	15.5	75.5	2	-	-	-	-	93	32.9	
	2	<i>Lithocarpus elegans</i>	4	4	3	6	-	-	-	17	6.0	
	3	<i>Aporosa villosa</i>	6.5	8.5	-	-	-	-	-	15	5.3	
	4	<i>Castanopsis diversifolia</i>	3	2	2	4	-	-	-	11	3.9	
	5	<i>Dalbergia cultrata</i>	5	1	-	5	-	-	-	11	3.9	
	6	<i>Phyllanthus emblica</i>	3	5	1	1	-	-	-	10	3.5	
	7	<i>Eriolaena candollei</i>	3	4	1	1	-	-	-	9	3.2	
	8	<i>Turpinia cochinchinensis</i>	6	3	-	-	-	-	-	9	3.2	
	9	<i>Ternstroemia gymnanthera</i>	3	2	1	2	-	-	-	8	2.8	
	10	<i>Phoebe paniculata</i>	5	2	1	-	-	-	-	8	2.8	
	11	<i>Styrax benzoides</i>	3	2	2	-	-	-	-	7	2.5	
	12	<i>Engelhardtia spicata</i>	3	2	1	1	-	-	-	7	2.5	
	13	<i>Castanopsis purpurea</i>	1	1	1	3	-	-	-	6	2.1	
	14	<i>Canthium sp.</i>	6	-	-	-	-	-	-	6	2.1	
	15	<i>Schima wallichii</i>	-	-	-	6	-	-	-	6	2.1	
	16	<i>Pterospermum acerifolium</i>	5	1	-	-	-	-	-	6	2.1	
	17	<i>Helicia terminalis</i>	-	5	1	-	-	-	-	6	2.1	
	18	<i>Rhus javanica</i>	5	-	-	-	-	-	-	5	1.8	
	19	<i>Castanopsis acuminatissima</i>	1	-	1	-	2	-	-	4	1.4	
	20	<i>Glochidion acuminatum</i>	4	-	-	-	-	-	-	4	1.4	
	21	<i>Helicia nilagirica</i>	1	2	1	-	-	-	-	4	1.4	
	22	<i>Garuga pinnata</i>	-	3	-	-	-	-	-	3	1.1	
	23	<i>Protium serratum</i>	2	1	-	-	-	-	-	3	1.1	
	24	<i>Antidesma acidum</i>	3	-	-	-	-	-	-	3	1.1	
	25	<i>Stereospermum neuranthum</i>	1	1	-	-	-	-	-	2	0.7	
	26	<i>Xantolis cambodiana</i>	1	-	-	1	-	-	-	2	0.7	
	27	<i>Dalbergia velutina</i>	1	-	1	-	-	-	-	2	0.7	
	28	<i>Buchanania lanzan</i>	1	1	-	-	-	-	-	2	0.7	
	29	<i>Glochidion sphaerogynum</i>	-	2	-	-	-	-	-	2	0.7	
	30	<i>Vernonia volkameriifolia</i>	1	1	-	-	-	-	-	2	0.7	
	31	<i>Diospyros glandulosa</i>	1	-	-	-	-	-	-	1	0.4	
	32	<i>Albizia odoratissima</i>	-	-	-	1	-	-	-	1	0.4	
	33	<i>Radermachera ignea</i>	-	-	1	-	-	-	-	1	0.4	
	34	<i>Milletia pachycarpa</i>	-	-	-	1	-	-	-	1	0.4	
	35	<i>Bombax anceps</i>	-	-	-	1	-	-	-	1	0.4	
	36	<i>Mallotus philippensis</i>	-	1	-	-	-	-	-	1	0.4	
	37	<i>Kydia calycina</i>	-	-	-	1	-	-	-	1	0.4	
	38	<i>Dillenia aurea</i>	-	-	-	1	-	-	-	1	0.4	
	39	<i>Syzygium cumini</i>	-	-	1	-	-	-	-	1	0.4	
	40	<i>Viburnum sambucinum</i>	1	-	-	-	-	-	-	1	0.4	
		Total	95	131	21	35	2	-	-	283	100	
		Total (%)	33.6	46.2	7.4	12.2	0.6	-	-	100		

Table 3-6 (Continued)

FF	No	Species	Number of tree individuals with different height classes (m) (per plot)								Total	Total (%)
			<5	5-10	10-15	15-20	20-25	25-30	30-35			
12	1	<i>Ternstroemia gymnanthera</i>	3	9	9	3	-	-	-	24	11.9	
	2	<i>Wendlandia tinctoria</i>	6	17	1	-	-	-	-	24	11.9	
	3	<i>Helicia nilagirica</i>	4	13	5	1	-	-	-	23	11.4	
	4	<i>Schima wallichii</i>	3	7	5	6	1	-	-	22	10.9	
	5	<i>Castanopsis acuminatissima</i>	-	3	1	7	2	-	-	13	6.5	
	6	<i>Engelhardtia spicata</i>	-	6	5.5	1.5	-	-	-	13	6.5	
	7	<i>Castanopsis diversifolia</i>	1	2	6	3	-	-	-	12	6.0	
	8	<i>Lithocarpus elegans</i>	-	1	4	1	1	-	-	7	3.5	
	9	<i>Phoebe paniculata</i>	-	1	1	4	-	-	-	6	3.0	
	10	<i>Dillenia aurea</i>	2.5	2.5	-	1	-	-	-	6	3.0	
	11	<i>Phyllanthus emblica</i>	3	2	-	-	-	-	-	5	2.5	
	12	<i>Glochidion sphaerogynum</i>	-	3	1	1	-	-	-	5	2.5	
	13	<i>Olea salicifolia</i>	2	1	-	1	-	-	-	4	2.0	
	14	<i>Diospyros glandulosa</i>	-	1	1	1	-	-	-	3	1.5	
	15	<i>Albizia chinensis</i>	-	1	1	1	-	-	-	3	1.5	
	16	<i>Ilex umbellulata</i>	2	1	-	-	-	-	-	3	1.5	
	17	<i>Elaeocarpus stipularis</i>	-	2	-	1	-	-	-	3	1.5	
	18	<i>Beilschmiedia gammieana</i>	3	-	-	-	-	-	-	3	1.5	
	19	<i>Engelhardtia serrata</i>	1	-	2	-	-	-	-	3	1.5	
	20	<i>Eurya nitida</i>	-	2	-	-	-	-	-	2	1.0	
	21	<i>Pinus kesiya</i>	0.5	-	-	-	0.5	-	1	2	1.0	
	22	<i>Myrica esculenta</i>	-	1	1	-	-	-	-	2	1.0	
	23	<i>Dalbergia cultrata</i>	-	-	-	1	-	-	-	1	0.5	
	24	<i>Garcinia merguensis</i>	-	1	-	-	-	-	-	1	0.5	
	25	<i>Gardenia sootepensis</i>	-	-	-	1	-	-	-	1	0.5	
	26	<i>Entada rheedii</i>	-	-	-	1	-	-	-	1	0.5	
	27	<i>Xantolis cambodiana</i>	-	1	-	-	-	-	-	1	0.5	
	28	<i>Turpinia cochinchinensis</i>	-	1	-	-	-	-	-	1	0.5	
	29	<i>Buchanania lanzan</i>	-	-	0.5	0.5	-	-	-	1	0.5	
	30	<i>Syzygium albiflorum</i>	1	-	-	-	-	-	-	1	0.5	
	31	<i>Pyrenaria diospyricarpa</i>	-	1	-	-	-	-	-	1	0.5	
	32	<i>Vernonia volkameriifolia</i>	1	-	-	-	-	-	-	1	0.5	
	33	<i>Ampelocissus martinii</i>	-	-	-	1	-	-	-	1	0.5	
	34	<i>Phoebe cathia</i>	-	1	-	-	-	-	-	1	0.5	
	35	<i>Litsea glutinosa</i>	-	1	-	-	-	-	-	1	0.5	
		Total	33	82	44	37	5	-	1	201	100	
		Total (%)	16.4	40.7	21.8	18.4	2.2	-	0.5	100		

Table 3-6 (Continued)

FF	No	Species	Number of tree individuals with different height classes (m) (per plot)								Total	Total (%)
			<5	5-10	10-15	15-20	20-25	25-30	30-35			
13	1	<i>Eurya nitida</i>	20	2	-	-	-	-	-	22	13.0	
	2	<i>Ternstroemia gymnanthera</i>	2.5	9.5	4	3	-	-	-	19	11.2	
	3	<i>Anneslea fragrans</i>	1	5	5	2	-	-	-	13	7.7	
	4	<i>Castanopsis diversifolia</i>	2	1	2	5	2	-	-	12	7.1	
	5	<i>Schima wallichii</i>	7	1	1	2	-	-	-	11	6.5	
	6	<i>Helicia nilagirica</i>	1	5	3	-	-	-	-	9	5.3	
	7	<i>Wendlandia tinctoria</i>	-	8	-	-	-	-	-	8	4.7	
	8	<i>Rapanea porteri</i>	-	3	5	-	-	-	-	8	4.7	
	9	<i>Diospyros glandulosa</i>	3	2	2	-	-	-	-	7	4.1	
	10	<i>Engelhardtia spicata</i>	3	1	2	-	-	-	-	6	3.6	
	11	<i>Syzygium albiflorum</i>	3	1	1	1	-	-	-	6	3.6	
	12	<i>Trichilla connaroides</i>	1	3	-	-	-	-	-	4	2.4	
	13	<i>Pinus kesiya</i>	-	3	1	-	-	-	-	4	2.4	
	14	<i>Beilschmiedia gammieana</i>	1	3	-	-	-	-	-	4	2.4	
	15	<i>Lindera metcalfiana</i>	2	1	-	-	-	-	-	3	1.8	
	16	<i>Ilex umbellulata</i>	-	2	1	-	-	-	-	3	1.8	
	17	<i>Archidendron clypearia</i>	2	1	-	-	-	-	-	3	1.8	
	18	<i>Myrica esculenta</i>	-	2	1	-	-	-	-	3	1.8	
	19	<i>Quercus semiserrata</i>	-	1	1	-	-	-	-	2	1.2	
	20	<i>Magnolia henryi</i>	1	1	-	-	-	-	-	2	1.2	
	21	<i>Glochidion sphaerogynum</i>	-	2	-	-	-	-	-	2	1.2	
	22	<i>Ampelocissus martinii</i>	-	-	1	1	-	-	-	2	1.2	
	23	<i>Symplocos racemosa</i>	-	2	-	-	-	-	-	2	1.2	
	24	<i>Castanopsis armata</i>	-	-	-	-	1	-	-	1	0.6	
	25	<i>Mussaenda sandariana</i>	1	-	-	-	-	-	-	1	0.6	
	26	<i>Garcinia merguensis</i>	-	1	-	-	-	-	-	1	0.6	
	27	<i>Glochidion acuminatum</i>	1	-	-	-	-	-	-	1	0.6	
	28	<i>Ficus</i> sp.	1	-	-	-	-	-	-	1	0.6	
	29	<i>Xantolis cambodiana</i>	1	-	-	-	-	-	-	1	0.6	
	30	<i>Eriolaena candollei</i>	-	1	-	-	-	-	-	1	0.6	
	31	<i>Phyllanthus emblica</i>	1	-	-	-	-	-	-	1	0.6	
	32	<i>Phoebe paniculata</i>	1	-	-	-	-	-	-	1	0.6	
	33	<i>Dillenia aurea</i>	-	1	-	-	-	-	-	1	0.6	
	34	<i>Schefflera bengalensis</i>	-	1	-	-	-	-	-	1	0.6	
	35	<i>Helicia terminalis</i>	-	-	1	-	-	-	-	1	0.6	
	36	<i>Cinnamomum iners</i>	-	-	1	-	-	-	-	1	0.6	
	37	<i>Engelhardtia serrata</i>	-	-	-	1	-	-	-	1	0.6	
		Total	56	63	32	15	3	-	-	169	100	
		Total (%)	33.0	37.4	18.9	8.9	1.8	-	-	100		

Table 3-6 (Continued)

FF	No	Species	Number of tree individuals with different height classes (m) (per plot)								Total	Total (%)
			<5	5-10	10-15	15-20	20-25	25-30	30-35			
14	1	<i>Eurya nitida</i>	24	8	5	3	-	-	-	40	15.6	
	2	<i>Schima wallichii</i>	5	10	5	8	3	-	-	31	12.1	
	3	<i>Phoebe paniculata</i>	9	13	1	3	-	-	-	26	10.2	
	4	<i>Glochidion acuminatum</i>	20	2	-	-	-	-	-	22	8.6	
	5	<i>Quercus semiserrata</i>	4.5	5.5	2	2	3	-	-	17	6.6	
	6	<i>Pyrenaria diospyricarpa</i>	4	10	-	-	-	-	-	14	5.5	
	7	<i>Ternstroemia gymnanthera</i>	1.5	4	5	1.5	-	-	-	12	4.7	
	8	<i>Engelhardtia spicata</i>	3	0.7	2	4.3	1	-	-	11	4.3	
	9	<i>Lindera metcalfiana</i>	5	3	1	2	-	-	-	11	4.3	
	10	<i>Cinnamomum porrectum</i>	7	-	-	-	-	-	-	7	2.7	
	11	<i>Diospyros glandulosa</i>	3	2	-	1	-	-	-	6	2.3	
	12	<i>Phoebe cathia</i>	1	4	-	1	-	-	-	6	2.3	
	13	<i>Helicia nilagirica</i>	1	1	4	-	-	-	-	6	2.3	
	14	<i>Wendlandia tinctoria</i>	2	1	2	-	-	-	-	5	2.0	
	15	<i>Saurauia roxburghii</i>	4	1	-	-	-	-	-	5	2.0	
	16	<i>Mussaenda sandariana</i>	4	-	-	-	-	-	-	4	1.6	
	17	<i>Castanopsis acuminatissima</i>	1	-	-	2	-	-	-	3	1.2	
	18	<i>Sarcosperma arboreum</i>	1	1	-	1	-	-	-	3	1.2	
	19	<i>Glochidion sphaerogynum</i>	2	1	-	-	-	-	-	3	1.2	
	20	<i>Dillenia aurea</i>	-	2	1	1	-	-	-	3	1.2	
	21	<i>Litsea semecarpifolia</i>	-	-	1	2	-	-	-	3	1.2	
	22	<i>Helicia terminalis</i>	-	3	-	-	-	-	-	3	1.2	
	23	<i>Turpinia cochinchinensis</i>	1	-	1	-	-	-	-	2	0.8	
	24	<i>Archidendron clypearia</i>	-	1	-	1	-	-	-	2	0.8	
	25	<i>Anneslea fragrans</i>	1	1	-	-	-	-	-	2	0.8	
	26	<i>Symplocos racemosa</i>	1	1	-	-	-	-	-	2	0.8	
	27	<i>Melastoma malabathricum</i>	2	-	-	-	-	-	-	2	0.8	
	28	<i>Albizia chinensis</i>	1	-	-	-	-	-	-	1	0.4	
	29	<i>Magnolia henryi</i>	-	-	1	-	-	-	-	1	0.4	
	30	<i>Pinus kesiya</i>	-	-	-	-	-	1	-	1	0.4	
	31	<i>Combretum punctatum</i>	-	-	1	-	-	-	-	1	0.4	
	32	<i>Litsea glutinosa</i>	1	-	-	-	-	-	-	1	0.4	
		Total	109	75	32	32	7	1	-	256	100	
		Total (%)	42.7	29.4	12.3	12.5	2.7	0.4	-	100		

Table 3-6 (Continued)

FF	No	Species	Number of tree individuals with different height classes (m) (per plot)								Total	Total (%)
			<5	5-10	10-15	15-20	20-25	25-30	30-35			
15	1	<i>Schima wallichii</i>	6	4	7.3	13.3	0.3	-	-	31	22.1	
	2	<i>Glochidion acuminatum</i>	21	-	-	-	-	-	-	21	15.0	
	3	<i>Castanopsis diversifolia</i>	4	5	3	6	1	-	-	19	13.6	
	4	<i>Engelhardtia spicata</i>	4	1	1	6	-	-	-	12	8.6	
	5	<i>Wendlandia tinctoria</i>	1	9	1	-	-	-	-	11	7.9	
	6	<i>Milletia pachycarpa</i>	5	-	-	-	-	-	-	5	3.6	
	7	<i>Diospyros glandulosa</i>	3	-	1	-	-	-	-	4	2.9	
	8	<i>Saurauia roxburghii</i>	3	1	-	-	-	-	-	4	2.9	
	9	<i>Glochidion sphaerogynum</i>	3	-	-	-	-	-	-	3	2.1	
	10	<i>Pyrenaria diospyricarpa</i>	3	-	-	-	-	-	-	3	2.1	
	11	<i>Lithocarpus lindleyanus</i>	1	-	-	1	-	-	-	2	1.4	
	12	<i>Lindera metcalfiana</i>	2	-	-	-	-	-	-	2	1.4	
	13	<i>Rhus javanica</i>	2	-	-	-	-	-	-	2	1.4	
	14	<i>Rapanea porteriiana</i>	2	-	-	-	-	-	-	2	1.4	
	15	<i>Helicia terminalis</i>	-	-	-	2	-	-	-	2	1.4	
	16	<i>Albizia odoratissima</i>	-	1	-	-	-	-	-	1	0.7	
	17	<i>Styrax benzoides</i>	-	-	-	-	1	-	-	1	0.7	
	18	<i>Ternstroemia gymnanthera</i>	-	-	-	1	-	-	-	1	0.7	
	19	<i>Vitex pinnata</i>	-	-	1	-	-	-	-	1	0.7	
	20	<i>Eriolaena candollei</i>	-	-	-	-	1	-	-	1	0.7	
	21	<i>Phyllanthus emblica</i>	1	-	-	-	-	-	-	1	0.7	
	22	<i>Archidendron clypearia</i>	-	1	-	-	-	-	-	1	0.7	
	23	<i>Elaeocarpus stipularis</i>	-	-	-	-	1	-	-	1	0.7	
	24	<i>Eurya nitida</i>	-	-	-	1	-	-	-	1	0.7	
	25	<i>Trichilla connaroides</i>	1	-	-	-	-	-	-	1	0.7	
	26	<i>Phoebe cathia</i>	-	-	-	-	1	-	-	1	0.7	
	27	<i>Beilschmiedia gammieana</i>	1	-	-	-	-	-	-	1	0.7	
	28	<i>Myrica esculenta</i>	-	-	-	1	-	-	-	1	0.7	
	29	<i>Litsea glutinosa</i>	-	-	-	-	1	-	-	1	0.7	
	30	<i>Helicia nilagirica</i>	1	-	-	-	-	-	-	1	0.7	
	31	<i>Symplocos racemosa</i>	0.3	0.3	0.3	-	-	-	-	1	0.7	
	32	<i>Eurya acuminata</i>	1	-	-	-	-	-	-	1	0.7	
Total			65	22	15	31	6	-	-	140	100	
Total (%)			46.7	15.5	11.0	22.4	4.5	-	-	100		



**Table 3-7** Number of tree individuals with different stem-girth classes in fifteen fragmented forests

No	Species	Number of tree individuals with different stem-girth classes (cm) in 15 plots						Total	Total (%)
		<50	50-100	100-150	150-200	200-250	250-300		
1	<i>Tristania rufescens</i>	237	40	2	-	-	-	279	9.97
2	<i>Wendlandia tinctoria</i>	210	9	-	-	-	-	219	7.83
3	<i>Vaccinium sprengelii</i>	198	8	-	-	-	-	206	7.36
4	<i>Pinus kesiya</i>	50	36	48	28	3	-	165	5.90
5	<i>Schima wallichii</i>	89	51	5	4	1	-	150	5.36
6	<i>Castanopsis acuminatissima</i>	57	52	28	6	1	-	144	5.15
7	<i>Ternstroemia gymnanthera</i>	61	23	2	-	-	-	86	3.07
8	<i>Quercus brandisiana</i>	52	19	8	6	-	-	84	3.00
9	<i>Craibiodendron stellatum</i>	70	8	-	-	-	-	78	2.79
10	<i>Helicia nilagirica</i>	48	20	1	2	-	-	71	2.54
11	<i>Lithocarpus elegans</i>	49	18	2	1	-	-	70	2.50
12	<i>Eurya nitida</i>	67	2	-	-	-	-	69	2.47
13	<i>Quercus vestita</i>	55	11	2	-	-	-	68	2.43
14	<i>Anneslea fragrans</i>	42	22	2	-	-	-	66	2.36
15	<i>Phyllanthus emblica</i>	61	2	-	-	-	-	63	2.25
16	<i>Engelhardtia spicata</i>	42	14	5	1	-	-	62	2.22
17	<i>Castanopsis diversifolia</i>	27	21	8	1	2	1	59	2.11
18	<i>Dalbergia cultrata</i>	45	10	3	-	-	-	58	2.07
19	<i>Semecarpus albescens</i>	48	-	-	-	-	-	48	1.72
20	<i>Glochidion acuminatum</i>	41	4	3	-	-	-	48	1.72
21	<i>Phoebe paniculata</i>	36	7	-	-	-	-	43	1.54
22	<i>Castanopsis purpurea</i>	20	13	8	1	-	-	42	1.50
23	<i>Aporosa villosa</i>	39	3	-	-	-	-	42	1.50
24	<i>Glochidion sphaerogynum</i>	38	2	-	-	-	-	39	1.39
25	<i>Viburnum sambucinum</i>	37	-	-	-	-	-	37	1.32
26	<i>Styrax benzoides</i>	34	2	1	-	-	-	36	1.29
27	<i>Diospyros glandulosa</i>	23	4	-	-	-	-	27	0.96
28	<i>Lithocarpus polystachyus</i>	15	7	1	-	-	-	22	0.79
29	<i>Quercus semiserrata</i>	12	5	2	1	-	-	19	0.68
30	<i>Pyrenaria diospyricarpa</i>	18	-	-	-	-	-	18	0.64
31	<i>Lithocarpus fenestratus</i>	11	5	1	-	-	-	17	0.61
32	<i>Lithocarpus sootepensis</i>	17	-	-	-	-	-	17	0.61
33	<i>Stereospermum neuranthum</i>	16	-	-	-	-	-	16	0.57
34	<i>Lindera metcalfiana</i>	14	2	-	-	-	-	16	0.57
35	<i>Helicia terminalis</i>	8	7	-	-	-	-	15	0.54
36	<i>Dillenia aurea</i>	11	3	-	-	-	-	13	0.46
37	<i>Turpinia cochinchinensis</i>	12	-	-	-	-	-	12	0.43
38	<i>Eriolaena candollei</i>	7	4	-	-	-	-	11	0.39
39	<i>Rapanea porteriana</i>	9	2	-	-	-	-	11	0.39
40	<i>Syzygium gratum</i>	5	7	-	-	-	-	11	0.39
41	<i>Callicarpa arborea</i>	4	7	-	-	-	-	10	0.36
42	<i>Rhus javanica</i>	10	-	-	-	-	-	10	0.36
43	<i>Syzygium albiflorum</i>	7	2	-	-	-	-	9	0.32
44	<i>Saurauia roxburghii</i>	9	-	-	-	-	-	9	0.32
45	<i>Beilschmiedia gammieana</i>	9	-	-	-	-	-	9	0.32
46	<i>Phoebe cathia</i>	7	-	-	1	-	-	8	0.29
47	<i>Milletia pachycarpa</i>	7	-	-	-	-	-	7	0.25
48	<i>Cinnamomum porrectum</i>	7	-	-	-	-	-	7	0.25
49	<i>Ilex umbellulata</i>	7	-	-	-	-	-	7	0.25
50	<i>Archidendron clypearia</i>	6	1	-	-	-	-	7	0.25
51	<i>Quercus kingiana</i>	6	-	-	-	-	-	6	0.21
52	<i>Albizia odoratissima</i>	3	3	-	-	-	-	6	0.21
53	<i>Albizia chinensis</i>	3	3	-	-	-	-	6	0.21

Table 3-7 (Continued)

No	Species	Number of tree individuals with different stem-girth classes (cm) in 15 plots						Total	Total (%)
		<50	50-100	100-150	150-200	200-250	250-300		
54	<i>Gmelina philippensis</i>	6	-	-	-	-	-	6	0.21
55	<i>Catunaregam tomentosa</i>	6	-	-	-	-	-	6	0.21
56	<i>Pterospermum acerifolium</i>	6	-	-	-	-	-	6	0.21
57	<i>Glochidion hirsutum</i>	6	-	-	-	-	-	6	0.21
58	<i>Engelhardtia serrata</i>	4	-	2	-	-	-	6	0.21
59	<i>Mussaenda sandariana</i>	5	-	-	-	-	-	5	0.18
60	<i>Trichilla connaroides</i>	5	-	-	-	-	-	5	0.18
61	<i>Litsea glutinosa</i>	4	1	-	-	-	-	5	0.18
62	<i>Symplocos racemosa</i>	4	1	-	-	-	-	5	0.18
63	<i>Olea salicifolia</i>	3	1	-	-	-	-	4	0.14
64	<i>Gardenia sootepensis</i>	4	-	-	-	-	-	4	0.14
65	<i>Erythrina subumbrans</i>	3	1	-	-	-	-	4	0.14
66	<i>Embelia subcoriacea</i>	3	1	-	-	-	-	4	0.14
67	<i>Elaeocarpus stipularis</i>	2	-	-	2	-	-	4	0.14
68	<i>Vernonia volkameriifolia</i>	4	-	-	-	-	-	4	0.14
69	<i>Ampelocissus martinii</i>	4	-	-	-	-	-	4	0.14
70	<i>Terminalia chebula</i>	3	1	-	-	-	-	4	0.14
71	<i>Dolichandrone serrulata</i>	3	-	-	-	-	-	3	0.11
72	<i>Magnolia henryi</i>	2	1	-	-	-	-	3	0.11
73	<i>Garuga pinnata</i>	3	-	-	-	-	-	3	0.11
74	<i>Protium serratum</i>	3	-	-	-	-	-	3	0.11
75	<i>Buchanania lanzan</i>	2	1	-	1	-	-	3	0.11
76	<i>Sarcosperma arboreum</i>	2	1	-	-	-	-	3	0.11
77	<i>Antidesma ghaesembilla</i>	3	-	-	-	-	-	3	0.11
78	<i>Litsea semecarpifolia</i>	2	1	-	-	-	-	3	0.11
79	<i>Lithocarpus lindleyanus</i>	1	1	-	-	-	-	2	0.07
80	<i>Pavetta tomentosa</i>	2	-	-	-	-	-	2	0.07
81	<i>Gordonia dalglieshiana</i>	2	-	-	-	-	-	2	0.07
82	<i>Bombax anceps</i>	1	2	-	-	-	-	2	0.07
83	<i>Colona flagrocarpa</i>	2	-	-	-	-	-	2	0.07
84	<i>Dalbergia velutina</i>	2	-	-	-	-	-	2	0.07
85	<i>Shorea roxburghii</i>	2	-	-	-	-	-	2	0.07
86	<i>Syzygium cumini</i>	2	-	-	-	-	-	2	0.07
87	<i>Melastoma malabathricum</i>	2	-	-	-	-	-	2	0.07
88	<i>Castanopsis armata</i>	-	-	-	-	-	1	1	0.04
89	<i>Radermachera ignea</i>	1	-	-	-	-	-	1	0.04
90	<i>Betula alnoides</i>	1	1	-	-	-	-	1	0.04
91	<i>Entada rheedii</i>	1	-	-	-	-	-	1	0.04
92	<i>Vitex pinnata</i>	-	1	-	-	-	-	1	0.04
93	<i>Ficus sp.</i>	1	-	-	-	-	-	1	0.04
94	<i>Horsfieldia tomentosa</i>	1	-	-	-	-	-	1	0.04
95	<i>Canarium subulatum</i>	1	-	-	-	-	-	1	0.04
96	<i>Celastrus paniculata</i>	1	-	-	-	-	-	1	0.04
97	<i>Kydia calycina</i>	-	1	-	-	-	-	1	0.04
98	<i>Gluta usitata</i>	-	1	-	-	-	-	1	0.04
99	<i>Combretum punctatum</i>	1	-	-	-	-	-	1	0.04
100	<i>Schefflera bengalensis</i>	1	-	-	-	-	-	1	0.04
101	<i>Artocarpus gomezianus</i>	1	-	-	-	-	-	1	0.04
102	<i>Eurya acuminata</i>	1	-	-	-	-	-	1	0.04
103	<i>Cinnamomum iners</i>	1	-	-	-	-	-	1	0.04
Total		2,130	470	134	54	7	2	2,798	100
Total (%)		76.14	16.81	4.79	1.93	0.25	0.07	100	

**Table 3-8** Number of tree individuals with different stem-girth classes in each fragmented forest

FF	No	Species	Number of tree individuals with different stem-girth classes (cm) (per plot)							Total	Total (%)
			<50	50-100	100-150	150-200	200-250	250-300			
1	1	<i>Wendlandia tinctoria</i>	46	2	-	-	-	-	48	25.1	
	2	<i>Tristania rufescens</i>	42	1	-	-	-	-	43	22.5	
	3	<i>Pinus kesiya</i>	2	9	17	2	-	-	30	15.7	
	4	<i>Quercus vestita</i>	23	2	-	-	-	-	25	13.1	
	5	<i>Helicia nilagirica</i>	10	2	-	-	-	-	12	6.3	
	6	<i>Schima wallichii</i>	4	3	-	1	-	-	8	4.2	
	7	<i>Dalbergia cultrata</i>	2	3	1	-	-	-	6	3.1	
	8	<i>Craibiodendron stellatum</i>	5	-	-	-	-	-	5	2.6	
	9	<i>Lithocarpus elegans</i>	2	1	-	-	-	-	3	1.6	
	10	<i>Glochidion sphaerogynum</i>	3	1	-	-	-	-	3	1.6	
	11	<i>Vaccinium sprengelii</i>	3	-	-	-	-	-	3	1.6	
	12	<i>Castanopsis purpurea</i>	-	1	-	-	-	-	1	0.5	
	13	<i>Castanopsis diversifolia</i>	1	-	-	-	-	-	1	0.5	
	14	<i>Engelhardtia spicata</i>	1	-	-	-	-	-	1	0.5	
	15	<i>Erythrina subumbrans</i>	-	1	-	-	-	-	1	0.5	
	16	<i>Phyllanthus emblica</i>	1	-	-	-	-	-	1	0.5	
			<b>Total</b>	<b>145</b>	<b>25</b>	<b>18</b>	<b>3</b>	<b>-</b>	<b>-</b>	<b>191</b>	<b>100</b>
		<b>Total (%)</b>	<b>75.8</b>	<b>13.2</b>	<b>9.4</b>	<b>1.6</b>	<b>-</b>	<b>-</b>	<b>100</b>		
2	1	<i>Tristania rufescens</i>	57	-	-	-	-	-	57	23.8	
	2	<i>Vaccinium sprengelii</i>	36	-	-	-	-	-	36	15.0	
	3	<i>Pinus kesiya</i>	12	11	12	-	-	-	35	14.6	
	4	<i>Quercus vestita</i>	25	3	-	-	-	-	28	11.7	
	5	<i>Lithocarpus elegans</i>	20	3	-	-	-	-	23	9.6	
	6	<i>Schima wallichii</i>	8.5	3.5	-	-	-	-	12	5.0	
	7	<i>Castanopsis purpurea</i>	7	1	1	-	-	-	9	3.8	
	8	<i>Lithocarpus sootepensis</i>	9	-	-	-	-	-	9	3.8	
	9	<i>Wendlandia tinctoria</i>	7	-	-	-	-	-	7	2.9	
	10	<i>Helicia nilagirica</i>	6	-	-	-	-	-	6	2.5	
	11	<i>Myrica esculenta</i>	0.5	3.5	-	-	-	-	4	1.7	
	12	<i>Albizia odoratissima</i>	-	2	-	-	-	-	2	0.8	
	13	<i>Glochidion sphaerogynum</i>	2	-	-	-	-	-	2	0.8	
	14	<i>Eurya nitida</i>	2	-	-	-	-	-	2	0.8	
	15	<i>Anneslea fragrans</i>	2	-	-	-	-	-	2	0.8	
	16	<i>Castanopsis acuminatissima</i>	1	-	-	-	-	-	1	0.4	
	17	<i>Castanopsis diversifolia</i>	0.5	0.5	-	-	-	-	1	0.4	
	18	<i>Betula alnoides</i>	0.5	0.5	-	-	-	-	1	0.4	
	19	<i>Engelhardtia spicata</i>	1	-	-	-	-	-	1	0.4	
	20	<i>Craibiodendron stellatum</i>	1	-	-	-	-	-	1	0.4	
	21	<i>Semecarpus albens</i>	1	-	-	-	-	-	1	0.4	
		<b>Total</b>	<b>200</b>	<b>27</b>	<b>13</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>240</b>	<b>100</b>	
		<b>Total (%)</b>	<b>83.3</b>	<b>11.3</b>	<b>5.4</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>100</b>		

Table 3-8 (Continued)

FF	No	Species	Number of tree individuals with different stem-girth classes (cm) (per plot)							Total	Total (%)
			<50	50-100	100-150	150-200	200-250	250-300			
3	1	<i>Phyllanthus emblica</i>	25	-	-	-	-	-	25	12.6	
	2	<i>Pinus kesiya</i>	5	7	6	1	-	-	19	9.5	
	3	<i>Schima wallichii</i>	9	7	1	-	-	-	17	8.5	
	4	<i>Lithocarpus fenestratus</i>	6	4	-	-	-	-	10	5.0	
	5	<i>Lithocarpus elegans</i>	6	3	1	-	-	-	10	5.0	
	6	<i>Dalbergia cultrata</i>	7	2	1	-	-	-	10	5.0	
	7	<i>Ternstroemia gymnanthera</i>	8	2	-	-	-	-	10	5.0	
	8	<i>Engelhardtia spicata</i>	9	1	-	-	-	-	10	5.0	
	9	<i>Stereospermum neuranthum</i>	10	-	-	-	-	-	10	5.0	
	10	<i>Callicarpa arborea</i>	3.5	6.5	-	-	-	-	10	5.0	
	11	<i>Castanopsis purpurea</i>	3	0.3	2.7	1	-	-	7	3.5	
	12	<i>Tristania rufescens</i>	7	-	-	-	-	-	7	3.5	
	13	<i>Glochidion sphaerogynum</i>	5	-	-	-	-	-	5	2.5	
	14	<i>Quercus vestita</i>	3	1	-	-	-	-	4	2.0	
	15	<i>Craibiodendron stellatum</i>	3	1	-	-	-	-	4	2.0	
	16	<i>Diospyros glandulosa</i>	3	-	-	-	-	-	3	1.5	
	17	<i>Wendlandia tinctoria</i>	3	-	-	-	-	-	3	1.5	
	18	<i>Castanopsis acuminatissima</i>	1	1	-	-	-	-	2	1.0	
	19	<i>Catunaregam tomentosa</i>	2	-	-	-	-	-	2	1.0	
	20	<i>Erythrina subumbrans</i>	2	-	-	-	-	-	2	1.0	
	21	<i>Colona flagrocarpa</i>	2	-	-	-	-	-	2	1.0	
	22	<i>Syzygium albiflorum</i>	2	-	-	-	-	-	2	1.0	
	23	<i>Semecarpus albescens</i>	2	-	-	-	-	-	2	1.0	
	24	<i>Litsea glutinosa</i>	2	-	-	-	-	-	2	1.0	
	25	<i>Helicia terminalis</i>	-	2	-	-	-	-	2	1.0	
	26	<i>Aporosa villosa</i>	2	-	-	-	-	-	2	1.0	
	27	<i>Engelhardtia serrata</i>	1	-	1	-	-	-	2	1.0	
	28	<i>Castanopsis diversifolia</i>	1	-	-	-	-	-	1	0.5	
	29	<i>Albizia odoratissima</i>	1	-	-	-	-	-	1	0.5	
	30	<i>Albizia chinensis</i>	-	1	-	-	-	-	1	0.5	
	31	<i>Styrax benzoides</i>	1	-	-	-	-	-	1	0.5	
	32	<i>Milletia pachycarpa</i>	1	-	-	-	-	-	1	0.5	
	33	<i>Bombax anceps</i>	0.5	0.5	-	-	-	-	1	0.5	
	34	<i>Ilex umbellulata</i>	1	-	-	-	-	-	1	0.5	
	35	<i>Eurya nitida</i>	1	-	-	-	-	-	1	0.5	
	36	<i>Ampelocissus martinii</i>	1	-	-	-	-	-	1	0.5	
	37	<i>Vaccinium sprengelii</i>	1	-	-	-	-	-	1	0.5	
	38	<i>Terminalia chebula</i>	0.7	0.3	-	-	-	-	1	0.5	
	39	<i>Phoebe paniculata</i>	1	-	-	-	-	-	1	0.5	
	40	<i>Beilschmiedia gammieana</i>	1	-	-	-	-	-	1	0.5	
	41	<i>Syzygium cumini</i>	1	-	-	-	-	-	1	0.5	
	42	<i>Helicia nilagirica</i>	-	1	-	-	-	-	1	0.5	
		Total	144	41	13	2	-	-	199	100	
		Total (%)	72.2	20.4	6.4	1.0	-	-	100		

Table 3-8 (Continued)

FF	No	Species	Number of tree individuals with different stem-girth classes (cm) (per plot)							Total	Total (%)
			<50	50-100	100-150	150-200	200-250	250-300			
4	1	<i>Vaccinium sprengelii</i>	41	2	-	-	-	-	43	29.7	
	2	<i>Castanopsis acuminatissima</i>	4	6.5	5.5	-	-	-	16	11.0	
	3	<i>Pinus kesiya</i>	3	4	2	5	-	-	14	9.7	
	4	<i>Tristania rufescens</i>	9	3	-	-	-	-	12	8.3	
	5	<i>Craibiodendron stellatum</i>	12	-	-	-	-	-	12	8.3	
	6	<i>Anneslea fragrans</i>	7	4	1	-	-	-	12	8.3	
	7	<i>Quercus brandisiana</i>	-	2	2	2	-	-	6	4.1	
	8	<i>Ternstroemia gymnanthera</i>	3.5	2.5	-	-	-	-	6	4.1	
	9	<i>Styrax benzoides</i>	4	-	-	-	-	-	4	2.8	
	10	<i>Semecarpus albescens</i>	4	-	-	-	-	-	4	2.8	
	11	<i>Castanopsis purpurea</i>	-	1	2	-	-	-	3	2.1	
	12	<i>Schima wallichii</i>	3	-	-	-	-	-	3	2.1	
	13	<i>Lithocarpus polystachyus</i>	0.5	1	0.5	-	-	-	2	1.4	
	14	<i>Shorea roxburghii</i>	2	-	-	-	-	-	2	1.4	
	15	<i>Dalbergia cultrata</i>	1	-	-	-	-	-	1	0.7	
	16	<i>Pavetta tomentosa</i>	1	-	-	-	-	-	1	0.7	
	17	<i>Wendlandia tinctoria</i>	1	-	-	-	-	-	1	0.7	
	18	<i>Glochidion sphaerogynum</i>	1	-	-	-	-	-	1	0.7	
	19	<i>Myrica esculenta</i>	1	-	-	-	-	-	1	0.7	
	20	<i>Viburnum sambucinum</i>	1	-	-	-	-	-	1	0.7	
Total			99	26	13	7	-	-	145	100	
Total (%)			68.0	18.2	9.0	4.8	-	-	100		
5	1	<i>Tristania rufescens</i>	26	5	1	-	-	-	32	18.9	
	2	<i>Castanopsis acuminatissima</i>	3	16.5	5.5	-	-	-	25	14.8	
	3	<i>Vaccinium sprengelii</i>	22	2	-	-	-	-	24	14.2	
	4	<i>Anneslea fragrans</i>	14	4	-	-	-	-	18	10.7	
	5	<i>Quercus brandisiana</i>	2	6	3	1	-	-	12	7.1	
	6	<i>Craibiodendron stellatum</i>	9	2	-	-	-	-	11	6.5	
	7	<i>Semecarpus albescens</i>	8	1	-	-	-	-	9	5.3	
	8	<i>Castanopsis purpurea</i>	2	4	-	-	-	-	6	3.6	
	9	<i>Styrax benzoides</i>	3	1	-	-	-	-	4	2.4	
	10	<i>Wendlandia tinctoria</i>	4	-	-	-	-	-	4	2.4	
	11	<i>Pinus kesiya</i>	1	-	1	1	1	-	4	2.4	
	12	<i>Aporosa villosa</i>	4	-	-	-	-	-	4	2.4	
	13	<i>Dalbergia cultrata</i>	3	-	-	-	-	-	3	1.8	
	14	<i>Viburnum sambucinum</i>	3	-	-	-	-	-	3	1.8	
	15	<i>Lithocarpus polystachyus</i>	1	1	-	-	-	-	2	1.2	
	16	<i>Ternstroemia gymnanthera</i>	2	-	-	-	-	-	2	1.2	
	17	<i>Schima wallichii</i>	1	1	-	-	-	-	2	1.2	
	18	<i>Lithocarpus elegans</i>	1	-	-	-	-	-	1	0.6	
	19	<i>Quercus vestita</i>	-	1	-	-	-	-	1	0.6	
	20	<i>Canarium subulatum</i>	1	-	-	-	-	-	1	0.6	
	21	<i>Phyllanthus emblica</i>	1	-	-	-	-	-	1	0.6	
Total			111	45	11	2	1	-	169	100	
Total (%)			65.7	26.3	6.2	1.2	0.6	-	100		



Table 3-8 (Continued)

FF	No	Species	Number of tree individuals with different stem-girth classes (cm) (per plot)							Total	Total (%)
			<50	50-100	100-150	150-200	200-250	250-300			
6	1	<i>Tristania rufescens</i>	11	6	-	-	-	-	17	19.1	
	2	<i>Vaccinium sprengelii</i>	9.5	3.5	-	-	-	-	13	14.6	
	3	<i>Castanopsis acuminatissima</i>	4	5.5	2.5	-	-	-	12	13.5	
	4	<i>Craibiodendron stellatum</i>	6	1	-	-	-	-	7	7.9	
	5	<i>Pinus kesiya</i>	1	-	1	4	1	-	7	7.9	
	6	<i>Anneslea fragrans</i>	2	4	1	-	-	-	7	7.9	
	7	<i>Wendlandia tinctoria</i>	6	-	-	-	-	-	6	6.7	
	8	<i>Lithocarpus fenestratus</i>	3	1	-	-	-	-	4	4.5	
	9	<i>Semecarpus albescens</i>	1	1	2	-	-	-	4	4.5	
	10	<i>Castanopsis purpurea</i>	2	1	-	-	-	-	3	3.4	
	11	<i>Lithocarpus polystachyus</i>	1	2	-	-	-	-	3	3.4	
	12	<i>Styrax benzoides</i>	2	-	-	-	-	-	2	2.2	
	13	<i>Quercus brandisiana</i>	-	1	-	-	-	-	1	1.1	
	14	<i>Quercus vestita</i>	-	-	1	-	-	-	1	1.1	
	15	<i>Aporosa villosa</i>	1	-	-	-	-	-	1	1.1	
	16	<i>Viburnum sambucinum</i>	1	-	-	-	-	-	1	1.1	
		Total	51	26	8	4	1	-	89	100	
		Total (%)	56.7	29.2	8.4	4.5	1.1	-	100		
7	1	<i>Vaccinium sprengelii</i>	26.5	0.5	-	-	-	-	27	12.2	
	2	<i>Viburnum sambucinum</i>	25	-	-	-	-	-	25	11.3	
	3	<i>Castanopsis acuminatissima</i>	11	8	3	1	-	-	23	10.4	
	4	<i>Tristania rufescens</i>	12.5	4.5	-	-	-	-	17	7.7	
	5	<i>Styrax benzoides</i>	15	-	-	-	-	-	15	6.8	
	6	<i>Pinus kesiya</i>	7	-	2	4	-	-	13	5.9	
	7	<i>Dalbergia cultrata</i>	12	-	-	-	-	-	12	5.4	
	8	<i>Semecarpus albescens</i>	10	-	1	-	-	-	11	5.0	
	9	<i>Craibiodendron stellatum</i>	7	2	-	-	-	-	9	4.1	
	10	<i>Phyllanthus emblica</i>	6	-	-	-	-	-	6	2.7	
	11	<i>Helicia nilagirica</i>	6	-	-	-	-	-	6	2.7	
	12	<i>Aporosa villosa</i>	6	-	-	-	-	-	6	2.7	
	13	<i>Lithocarpus polystachyus</i>	4	1	-	-	-	-	5	2.3	
	14	<i>Glochidion sphaerogynum</i>	5	-	-	-	-	-	5	2.3	
	15	<i>Anneslea fragrans</i>	3	2	-	-	-	-	5	2.3	
	16	<i>Quercus brandisiana</i>	2	2	-	-	-	-	4	1.8	
	17	<i>Ternstroemia gymnanthera</i>	4	-	-	-	-	-	4	1.8	
	18	<i>Diospyros glandulosa</i>	3	-	-	-	-	-	3	1.4	
	19	<i>Quercus vestita</i>	1	1	1	-	-	-	3	1.4	
	20	<i>Wendlandia tinctoria</i>	3	-	-	-	-	-	3	1.4	
	21	<i>Schima wallichii</i>	3	-	-	-	-	-	3	1.4	
	22	<i>Castanopsis purpurea</i>	1	1	-	-	-	-	2	0.9	
	23	<i>Lithocarpus elegans</i>	2	-	-	-	-	-	2	0.9	
	24	<i>Catunaregam tomentosa</i>	2	-	-	-	-	-	2	0.9	
	25	<i>Rhus javanica</i>	2	-	-	-	-	-	2	0.9	
	26	<i>Lithocarpus fenestratus</i>	1	-	-	-	-	-	1	0.5	
	27	<i>Albizia chinensis</i>	1	-	-	-	-	-	1	0.5	
	28	<i>Stereospermum neuranthum</i>	1	-	-	-	-	-	1	0.5	
	29	<i>Eurya nitida</i>	1	-	-	-	-	-	1	0.5	
	30	<i>Phoebe paniculata</i>	1	-	-	-	-	-	1	0.5	
	31	<i>Terminalia chebula</i>	1	-	-	-	-	-	1	0.5	
	32	<i>Vernonia volkamerifolia</i>	1	-	-	-	-	-	1	0.5	
	33	<i>Dillenia aurea</i>	1	-	-	-	-	-	1	0.5	
	34	<i>Helicia terminalis</i>	1	-	-	-	-	-	1	0.5	
		Total	188	22	7	5	-	-	222	100	
		Total (%)	84.8	9.7	3.2	2.3	-	-	100		

Table 3-8 (Continued)

FF	No	Species	Number of tree individuals with different stem-girth classes (cm) (per plot)						Total	Total (%)
			<50	50-100	100-150	150-200	200-250	250-300		
8	1	<i>Tristania rufescens</i>	30	14	-	-	-	-	44	29.3
	2	<i>Vaccinium sprengelii</i>	18	-	-	-	-	-	18	12.0
	3	<i>Castanopsis acuminatissima</i>	10	1	4	-	-	-	15	10.0
	4	<i>Quercus brandisiana</i>	8.5	0.5	1	1	-	-	11	7.3
	5	<i>Lithocarpus polystachyus</i>	5	2	-	-	-	-	7	4.7
	6	<i>Craibiodendron stellatum</i>	7	-	-	-	-	-	7	4.7
	7	<i>Pinus kesiya</i>	-	-	3	4	-	-	7	4.7
	8	<i>Dalbergia cultrata</i>	6	-	-	-	-	-	6	4.0
	9	<i>Phyllanthus emblica</i>	5	-	-	-	-	-	5	3.3
	10	<i>Aporosa villosa</i>	4	1	-	-	-	-	5	3.3
	11	<i>Quercus vestita</i>	1	2	-	-	-	-	3	2.0
	12	<i>Semecarpus albescens</i>	2	1	-	-	-	-	3	2.0
	13	<i>Quercus kingiana</i>	2	-	-	-	-	-	2	1.3
	14	<i>Castanopsis diversifolia</i>	2	-	-	-	-	-	2	1.3
	15	<i>Gardenia sootepensis</i>	2	-	-	-	-	-	2	1.3
	16	<i>Dolichandrone serrulata</i>	2	-	-	-	-	-	2	1.3
	17	<i>Stereospermum neuranthum</i>	2	-	-	-	-	-	2	1.3
	18	<i>Glochidion sphaerogynum</i>	2	-	-	-	-	-	2	1.3
	19	<i>Lithocarpus fenestratus</i>	1	-	-	-	-	-	1	0.7
	20	<i>Lithocarpus elegans</i>	1	-	-	-	-	-	1	0.7
	21	<i>Styrax benzoides</i>	1	-	-	-	-	-	1	0.7
	22	<i>Engelhardtia spicata</i>	1	-	-	-	-	-	1	0.7
	23	<i>Erythrina subumbrans</i>	1	-	-	-	-	-	1	0.7
	24	<i>Dillenia aurea</i>	1	-	-	-	-	-	1	0.7
	25	<i>Anneslea fragrans</i>	-	1	-	-	-	-	1	0.7
Total			115	22	8	5	-	-	150	100
Total (%)			76.5	14.8	5.3	3.3	-	-	100	

Table 3-8 (Continued)

FF	No	Species	Number of tree individuals with different stem-girth classes (cm) (per plot)							Total	Total (%)
			<50	50-100	100-150	150-200	200-250	250-300			
9	1	<i>Quercus brandisiana</i>	25	5	-	1	-	-	31	16.8	
	2	<i>Tristania rufescens</i>	27	3	-	-	-	-	30	16.2	
	3	<i>Castanopsis acuminatissima</i>	7	9.4	2.4	1.2	-	-	20	10.8	
	4	<i>Vaccinium sprengelii</i>	16	-	-	-	-	-	16	8.6	
	5	<i>Semecarpus albescens</i>	12	1	-	-	-	-	13	7.0	
	6	<i>Craibiodendron stellatum</i>	9	-	-	-	-	-	9	4.9	
	7	<i>Pinus kesiya</i>	3	-	1	2	1	-	7	3.8	
	8	<i>Viburnum sambucinum</i>	6	-	-	-	-	-	6	3.2	
	9	<i>Castanopsis purpurea</i>	3	1	1	-	-	-	5	2.7	
	10	<i>Wendlandia tinctoria</i>	5	-	-	-	-	-	5	2.7	
	11	<i>Aporosa villosa</i>	5	-	-	-	-	-	5	2.7	
	12	<i>Lithocarpus sootepensis</i>	4	-	-	-	-	-	4	2.2	
	13	<i>Schima wallichii</i>	2	1	1	-	-	-	4	2.2	
	14	<i>Glochidion hirsutum</i>	4	-	-	-	-	-	4	2.2	
	15	<i>Phyllanthus emblica</i>	4	-	-	-	-	-	4	2.2	
	16	<i>Lithocarpus polystachyus</i>	3	-	-	-	-	-	3	1.6	
	17	<i>Anneslea fragrans</i>	3	-	-	-	-	-	3	1.6	
	18	<i>Helicia nilagirica</i>	2	1	-	-	-	-	3	1.6	
	19	<i>Quercus vestita</i>	2	-	-	-	-	-	2	1.1	
	20	<i>Glochidion sphaerogynum</i>	2	-	-	-	-	-	2	1.1	
	21	<i>Quercus kingiana</i>	1	-	-	-	-	-	1	0.5	
	22	<i>Lithocarpus fenestratus</i>	-	-	1	-	-	-	1	0.5	
	23	<i>Styrax benzoides</i>	1	-	-	-	-	-	1	0.5	
	24	<i>Pavetta tomentosa</i>	1	-	-	-	-	-	1	0.5	
	25	<i>Gardenia sootepensis</i>	1	-	-	-	-	-	1	0.5	
	26	<i>Catunaregam tomentosa</i>	1	-	-	-	-	-	1	0.5	
	27	<i>Dolichandrone serrulata</i>	1	-	-	-	-	-	1	0.5	
	28	<i>Archidendron clypearia</i>	1	-	-	-	-	-	1	0.5	
	29	<i>Artocarpus gomezianus</i>	1	-	-	-	-	-	1	0.5	
Total			152	21	6	4	1	-	185	100	
Total (%)			82.1	11.6	3.5	2.3	0.5	-	100		

Table 3-8 (Continued)

FF	No	Species	Number of tree individuals with different stem-girth classes (cm) (per plot)						Total	Total (%)
			<50	50-100	100-150	150-200	200-250	250-300		
10	1	<i>Vaccinium sprengelii</i>	25	-	-	-	-	-	25	15.7
	2	<i>Pinus kesiya</i>	12.5	4.5	3	2	-	-	22	13.8
	3	<i>Tristania rufescens</i>	15.5	3.5	1	-	-	-	20	12.6
	4	<i>Quercus brandisiana</i>	14	2	2	1	-	-	19	11.9
	5	<i>Craibiodendron stellatum</i>	11	2	-	-	-	-	13	8.2
	6	<i>Castanopsis acuminatissima</i>	8	1.3	0.3	-	-	-	10	6.3
	7	<i>Dalbergia cultrata</i>	8	-	-	-	-	-	8	5.0
	8	<i>Lithocarpus elegans</i>	5	1	-	-	-	-	6	3.8
	9	<i>Lithocarpus sootepensis</i>	4	-	-	-	-	-	4	2.5
	10	<i>Phyllanthus emblica</i>	4	-	-	-	-	-	4	2.5
	11	<i>Glochidion sphaerogynum</i>	4	-	-	-	-	-	4	2.5
	12	<i>Aporosa villosa</i>	4	-	-	-	-	-	4	2.5
	13	<i>Quercus kingiana</i>	3	-	-	-	-	-	3	1.9
	14	<i>Anneslea fragrans</i>	3	-	-	-	-	-	3	1.9
	15	<i>Glochidion hirsutum</i>	2	-	-	-	-	-	2	1.3
	16	<i>Terminalia chebula</i>	1	1	-	-	-	-	2	1.3
	17	<i>Quercus vestita</i>	-	1	-	-	-	-	1	0.6
	18	<i>Albizia odoratissima</i>	1	-	-	-	-	-	1	0.6
	19	<i>Wendlandia tinctoria</i>	1	-	-	-	-	-	1	0.6
	20	<i>Catunaregam tomentosa</i>	1	-	-	-	-	-	1	0.6
	21	<i>Stereospermum neuranthum</i>	1	-	-	-	-	-	1	0.6
	22	<i>Celastrus paniculata</i>	1	-	-	-	-	-	1	0.6
	23	<i>Rhus javanica</i>	1	-	-	-	-	-	1	0.6
	24	<i>Semecarpus albescens</i>	1	-	-	-	-	-	1	0.6
	25	<i>Gluta usitata</i>	-	1	-	-	-	-	1	0.6
	26	<i>Rapanea porteriiana</i>	1	-	-	-	-	-	1	0.6
		Total	132	18	6	3	-	-	159	100
		Total (%)	83.0	11.1	4.0	1.9	-	-	100	

Table 3-8 (Continued)

FF	No	Species	Number of tree individuals with different stem-girth classes (cm) (per plot)							Total	Total (%)
			<50	50-100	100-150	150-200	200-250	250-300			
11	1	<i>Wendlandia tinctoria</i>	89.5	3.5	-	-	-	-	93	32.9	
	2	<i>Lithocarpus elegans</i>	9.5	7.5	-	-	-	-	17	6.0	
	3	<i>Aporosa villosa</i>	13	2	-	-	-	-	15	5.3	
	4	<i>Castanopsis diversifolia</i>	6	3	2	-	-	-	11	3.9	
	5	<i>Dalbergia cultrata</i>	6.5	3.5	1	-	-	-	11	3.9	
	6	<i>Phyllanthus emblica</i>	8	2	-	-	-	-	10	3.5	
	7	<i>Eriolaena candollei</i>	7	2	-	-	-	-	9	3.2	
	8	<i>Turpinia cochinchinensis</i>	9	-	-	-	-	-	9	3.2	
	9	<i>Ternstroemia gymnanthera</i>	6	2	-	-	-	-	8	2.8	
	10	<i>Phoebe paniculata</i>	8	-	-	-	-	-	8	2.8	
	11	<i>Styrax benzoides</i>	7	1	-	-	-	-	7	2.5	
	12	<i>Engelhardtia spicata</i>	4	2	1	-	-	-	7	2.5	
	13	<i>Castanopsis purpurea</i>	2	2	2	-	-	-	6	2.1	
	14	<i>Canthium sp.</i>	6	-	-	-	-	-	6	2.1	
	15	<i>Schima wallichii</i>	-	5	1	-	-	-	6	2.1	
	16	<i>Pterospermum acerifolium</i>	6	-	-	-	-	-	6	2.1	
	17	<i>Helicia terminalis</i>	5	1	-	-	-	-	6	2.1	
	18	<i>Rhus javanica</i>	5	-	-	-	-	-	5	1.8	
	19	<i>Castanopsis acuminatissima</i>	1.0	0.3	0.3	2.3	-	-	4	1.4	
	20	<i>Glochidion acuminatum</i>	4	-	-	-	-	-	4	1.4	
	21	<i>Helicia nilagirica</i>	3	1	-	-	-	-	4	1.4	
	22	<i>Garuga pinnata</i>	3	-	-	-	-	-	3	1.1	
	23	<i>Protium serratum</i>	3	-	-	-	-	-	3	1.1	
	24	<i>Antidesma acidum</i>	3	-	-	-	-	-	3	1.1	
	25	<i>Stereospermum neuranthum</i>	2	-	-	-	-	-	2	0.7	
	26	<i>Xantolis cambodiana</i>	1	1	-	-	-	-	2	0.7	
	27	<i>Dalbergia velutina</i>	2	-	-	-	-	-	2	0.7	
	28	<i>Buchanania lanzan</i>	2	-	-	-	-	-	2	0.7	
	29	<i>Glochidion sphaerogynum</i>	2	-	-	-	-	-	2	0.7	
	30	<i>Vernonia volkamerifolia</i>	2	-	-	-	-	-	2	0.7	
	31	<i>Diospyros glandulosa</i>	1	-	-	-	-	-	1	0.4	
	32	<i>Albizia odoratissima</i>	-	1	-	-	-	-	1	0.4	
	33	<i>Radermachera ignea</i>	1	-	-	-	-	-	1	0.4	
	34	<i>Milletia pachycarpa</i>	1	-	-	-	-	-	1	0.4	
	35	<i>Bombax anceps</i>	-	1	-	-	-	-	1	0.4	
	36	<i>Mallotus philippensis</i>	1	-	-	-	-	-	1	0.4	
	37	<i>Kydia calycina</i>	-	1	-	-	-	-	1	0.4	
	38	<i>Dillenia aurea</i>	-	1	-	-	-	-	1	0.4	
	39	<i>Syzygium cumini</i>	1	-	-	-	-	-	1	0.4	
	40	<i>Viburnum sambucinum</i>	1	-	-	-	-	-	1	0.4	
		Total	232	43	6	2	-	-	283	100	
		Total (%)	81.8	15.1	2.2	0.8	-	-	100		



Table 3-8 (Continued)

FF	No	Species	Number of tree individuals with different stem-girth classes (cm) (per plot)						Total	Total (%)
			<50	50-100	100-150	150-200	200-250	250-300		
12	1	<i>Ternstroemia gymnanthera</i>	17	7	-	-	-	-	24	11.9
	2	<i>Wendlandia tinctoria</i>	24	-	-	-	-	-	24	11.9
	3	<i>Helicia nilagirica</i>	16	7	-	-	-	-	23	11.4
	4	<i>Schima wallichii</i>	14	7	1	-	-	-	22	10.9
	5	<i>Castanopsis acuminatissima</i>	4	3	4	1	1	-	13	6.5
	6	<i>Engelhardtia spicata</i>	10	3	-	-	-	-	13	6.5
	7	<i>Castanopsis diversifolia</i>	5	5	2	-	-	-	12	6.0
	8	<i>Lithocarpus elegans</i>	2.5	2.5	1	1	-	-	7	3.5
	9	<i>Phoebe paniculata</i>	2	4	-	-	-	-	6	3.0
	10	<i>Dillenia aurea</i>	5	1	-	-	-	-	6	3.0
	11	<i>Phyllanthus emblica</i>	5	-	-	-	-	-	5	2.5
	12	<i>Glochidion sphaerogynum</i>	4	1	-	-	-	-	5	2.5
	13	<i>Olea salicifolia</i>	3	1	-	-	-	-	4	2.0
	14	<i>Diospyros glandulosa</i>	2	1	-	-	-	-	3	1.5
	15	<i>Albizia chinensis</i>	1	2	-	-	-	-	3	1.5
	16	<i>Ilex umbellata</i>	3	-	-	-	-	-	3	1.5
	17	<i>Elaeocarpus stipularis</i>	2	-	-	1	-	-	3	1.5
	18	<i>Beilschmiedia gammieana</i>	3	-	-	-	-	-	3	1.5
	19	<i>Engelhardtia serrata</i>	3	-	-	-	-	-	3	1.5
	20	<i>Eurya nitida</i>	2	-	-	-	-	-	2	1.0
	21	<i>Pinus kesiya</i>	1	-	-	2	-	-	2	1.0
	22	<i>Myrica esculenta</i>	1	1	-	-	-	-	2	1.0
	23	<i>Dalbergia cultrata</i>	-	1	-	-	-	-	1	0.5
	24	<i>Garcinia merguensis</i>	1	-	-	-	-	-	1	0.5
	25	<i>Gardenia sootepensis</i>	1	-	-	-	-	-	1	0.5
	26	<i>Entada rheedii</i>	1	-	-	-	-	-	1	0.5
	27	<i>Xantolis cambodiana</i>	1	-	-	-	-	-	1	0.5
	28	<i>Turpinia cochinchinensis</i>	1	-	-	-	-	-	1	0.5
	29	<i>Buchanania lanzan</i>	-	1	-	1	-	-	1	0.5
	30	<i>Syzygium albiflorum</i>	1	-	-	-	-	-	1	0.5
	31	<i>Pyrenaria diospyricarpa</i>	1	-	-	-	-	-	1	0.5
	32	<i>Vernonia volkamerifolia</i>	1	-	-	-	-	-	1	0.5
	33	<i>Ampelocissus martinii</i>	1	-	-	-	-	-	1	0.5
	34	<i>Phoebe cathia</i>	1	-	-	-	-	-	1	0.5
	35	<i>Litsea glutinosa</i>	1	-	-	-	-	-	1	0.5
Total			140	47	8	5	1	-	201	100
Total (%)			69.5	23.5	4.0	2.5	0.5	-	100	

Table 3-8 (Continued)

FF	No	Species	Number of tree individuals with different stem-girth classes (cm) (per plot)							Total	Total (%)
			<50	50-100	100-150	150-200	200-250	250-300			
13	1	<i>Eurya nitida</i>	22	-	-	-	-	-	22	13.0	
	2	<i>Ternstroemia gymnanthera</i>	11.5	5.5	2	-	-	-	19	11.2	
	3	<i>Anneslea fragrans</i>	6	7	-	-	-	-	13	7.7	
	4	<i>Castanopsis diversifolia</i>	2	5	1	1	2	1	12	7.1	
	5	<i>Schima wallichii</i>	8	-	1	2	-	-	11	6.5	
	6	<i>Helicia nilagirica</i>	2	6	-	1	-	-	9	5.3	
	7	<i>Wendlandia tinctoria</i>	7	1	-	-	-	-	8	4.7	
	8	<i>Rapanea porteriiana</i>	6	2	-	-	-	-	8	4.7	
	9	<i>Diospyros glandulosa</i>	6	1	-	-	-	-	7	4.1	
	10	<i>Engelhardtia spicata</i>	4	2	-	-	-	-	6	3.6	
	11	<i>Syzygium albiflorum</i>	4	2	-	-	-	-	6	3.6	
	12	<i>Trichilla connaroides</i>	4	-	-	-	-	-	4	2.4	
	13	<i>Pinus kesiya</i>	3	1	-	-	-	-	4	2.4	
	14	<i>Beilschmiedia gammieana</i>	4	-	-	-	-	-	4	2.4	
	15	<i>Lindera metcalifiana</i>	3	-	-	-	-	-	3	1.8	
	16	<i>Ilex umbellata</i>	3	-	-	-	-	-	3	1.8	
	17	<i>Archidendron clypearia</i>	3	-	-	-	-	-	3	1.8	
	18	<i>Myrica esculenta</i>	2	1	-	-	-	-	3	1.8	
	19	<i>Quercus semiserrata</i>	0.5	0.5	-	1	-	-	2	1.2	
	20	<i>Magnolia henryi</i>	1	1	-	-	-	-	2	1.2	
	21	<i>Glochidion sphaerogynum</i>	2	-	-	-	-	-	2	1.2	
	22	<i>Ampelocissus martinii</i>	2	-	-	-	-	-	2	1.2	
	23	<i>Symplocos racemosa</i>	1	1	-	-	-	-	2	1.2	
	24	<i>Castanopsis armata</i>	-	-	-	-	-	1	1	0.6	
	25	<i>Mussaenda sanderiana</i>	1	-	-	-	-	-	1	0.6	
	26	<i>Garcinia merguensis</i>	1	-	-	-	-	-	1	0.6	
	27	<i>Glochidion acuminatum</i>	1	-	-	-	-	-	1	0.6	
	28	<i>Ficus</i> sp.	1	-	-	-	-	-	1	0.6	
	29	<i>Xantolis cambodiana</i>	1	-	-	-	-	-	1	0.6	
	30	<i>Eriolaena candollei</i>	-	1	-	-	-	-	1	0.6	
	31	<i>Phyllanthus emblica</i>	1	-	-	-	-	-	1	0.6	
	32	<i>Phoebe paniculata</i>	1	-	-	-	-	-	1	0.6	
	33	<i>Dillenia aurea</i>	1	-	-	-	-	-	1	0.6	
	34	<i>Schefflera bengalensis</i>	1	-	-	-	-	-	1	0.6	
	35	<i>Helicia terminalis</i>	-	1	-	-	-	-	1	0.6	
	36	<i>Cinnamomum iners</i>	1	-	-	-	-	-	1	0.6	
	37	<i>Engelhardtia serrata</i>	-	-	1	-	-	-	1	0.6	
		Total	117	38	5	5	2	2	169	100	
		Total (%)	69.4	22.3	3.0	3.0	1.2	1.2	100		

Table 3-8 (Continued)

FF	No	Species	Number of tree individuals with different stem-girth classes (cm) (per plot)							Total	Total (%)
			<50	50-100	100-150	150-200	200-250	250-300			
14	1	<i>Eurya nitida</i>	39	1	-	-	-	-	40	15.6	
	2	<i>Schima wallichii</i>	18.3	11.3	0.3	1	-	-	31	12.1	
	3	<i>Phoebe paniculata</i>	23	3	-	-	-	-	26	10.2	
	4	<i>Glochidion acuminatum</i>	22	-	-	-	-	-	22	8.6	
	5	<i>Quercus semiserrata</i>	11	4	2	-	-	-	17	6.6	
	6	<i>Pyrenaria diospyricarpa</i>	14	-	-	-	-	-	14	5.5	
	7	<i>Ternstroemia gymnanthera</i>	8.5	3.5	-	-	-	-	12	4.7	
	8	<i>Engelhardtia spicata</i>	6	2	3	-	-	-	11	4.3	
	9	<i>Lindera metcalfiana</i>	9	2	-	-	-	-	11	4.3	
	10	<i>Cinnamomum porrectum</i>	7	-	-	-	-	-	7	2.7	
	11	<i>Diospyros glandulosa</i>	5	1	-	-	-	-	6	2.3	
	12	<i>Phoebe cathia</i>	6	-	-	-	-	-	6	2.3	
	13	<i>Helicia nilagirica</i>	2	2	1	1	-	-	6	2.3	
	14	<i>Wendlandia tinctoria</i>	5	-	-	-	-	-	5	2.0	
	15	<i>Saurauia roxburghii</i>	5	-	-	-	-	-	5	2.0	
	16	<i>Mussaenda sanderiana</i>	4	-	-	-	-	-	4	1.6	
	17	<i>Castanopsis acuminatissima</i>	2	-	0.5	0.5	-	-	3	1.2	
	18	<i>Sarcosperma arboreum</i>	2	1	-	-	-	-	3	1.2	
	19	<i>Glochidion sphaerogynum</i>	3	-	-	-	-	-	3	1.2	
	20	<i>Dillenia aurea</i>	2.5	0.5	-	-	-	-	3	1.2	
	21	<i>Litsea semecarpifolia</i>	2	1	-	-	-	-	3	1.2	
	22	<i>Helicia terminalis</i>	2	1	-	-	-	-	3	1.2	
	23	<i>Turpinia cochinchinensis</i>	2	-	-	-	-	-	2	0.8	
	24	<i>Archidendron clypearia</i>	1	1	-	-	-	-	2	0.8	
	25	<i>Anneslea fragrans</i>	2	-	-	-	-	-	2	0.8	
	26	<i>Symplocos racemosa</i>	2	-	-	-	-	-	2	0.8	
	27	<i>Melastoma malabathricum</i>	2	-	-	-	-	-	2	0.8	
	28	<i>Albizia chinensis</i>	1	-	-	-	-	-	1	0.4	
	29	<i>Magnolia henryi</i>	1	-	-	-	-	-	1	0.4	
	30	<i>Pinus kesiya</i>	-	-	-	1	-	-	1	0.4	
	31	<i>Combretum punctatum</i>	1	-	-	-	-	-	1	0.4	
	32	<i>Litsea glutinosa</i>	1	-	-	-	-	-	1	0.4	
Total			211	35	7	4	-	-	256	100	
Total (%)			82.4	13.5	2.7	1.4	-	-	100		

Table 3-8 (Continued)

FF	No	Species	Number of tree individuals with different stem-girth classes (cm) (per plot)						Total	Total (%)
			<50	50-100	100-150	150-200	200-250	250-300		
15	1	<i>Schima wallichii</i>	18	12	-	-	1	-	31	22.1
	2	<i>Glochidion acuminatum</i>	21	-	-	-	-	-	21	15.0
	3	<i>Castanopsis diversifolia</i>	9	7	3	-	-	-	19	13.6
	4	<i>Engelhardtia spicata</i>	6	4	1	1	-	-	12	8.6
	5	<i>Wendlandia tinctoria</i>	9	2	-	-	-	-	11	7.9
	6	<i>Milletia pachycarpa</i>	5	-	-	-	-	-	5	3.6
	7	<i>Diospyros glandulosa</i>	3	1	-	-	-	-	4	2.9
	8	<i>Saurauia roxburghii</i>	4	-	-	-	-	-	4	2.9
	9	<i>Glochidion sphaerogynum</i>	3	-	-	-	-	-	3	2.1
	10	<i>Pyrenaria diospyricarpa</i>	3	-	-	-	-	-	3	2.1
	11	<i>Lithocarpus lindleyanus</i>	1	1	-	-	-	-	2	1.4
	12	<i>Lindera metcalfiana</i>	2	-	-	-	-	-	2	1.4
	13	<i>Rhus javanica</i>	2	-	-	-	-	-	2	1.4
	14	<i>Rapanea porteriiana</i>	2	-	-	-	-	-	2	1.4
	15	<i>Helicia terminalis</i>	-	2	-	-	-	-	2	1.4
	16	<i>Albizia odoratissima</i>	1	-	-	-	-	-	1	0.7
	17	<i>Styrax benzoides</i>	-	-	1	-	-	-	1	0.7
	18	<i>Ternstroemia gymnanthera</i>	-	1	-	-	-	-	1	0.7
	19	<i>Vitex pinnata</i>	-	1	-	-	-	-	1	0.7
	20	<i>Eriolaena candollei</i>	-	1	-	-	-	-	1	0.7
	21	<i>Phyllanthus emblica</i>	1	-	-	-	-	-	1	0.7
	22	<i>Archidendron clypearia</i>	1	-	-	-	-	-	1	0.7
	23	<i>Elaeocarpus stipularis</i>	-	-	-	1	-	-	1	0.7
	24	<i>Eurya nitida</i>	-	1	-	-	-	-	1	0.7
	25	<i>Trichilla connaroides</i>	1	-	-	-	-	-	1	0.7
	26	<i>Phoebe cathia</i>	-	-	-	1	-	-	1	0.7
	27	<i>Beilschmiedia gammieana</i>	1	-	-	-	-	-	1	0.7
	28	<i>Myrica esculenta</i>	-	1	-	-	-	-	1	0.7
	29	<i>Litsea glutinosa</i>	-	1	-	-	-	-	1	0.7
	30	<i>Helicia nilagirica</i>	1	-	-	-	-	-	1	0.7
	31	<i>Symplocos racemosa</i>	1	-	-	-	-	-	1	0.7
	32	<i>Eurya acuminata</i>	1	-	-	-	-	-	1	0.7
		Total	95	35	5	3	1	-	140	100
		Total (%)	68.1	25.2	3.8	2.1	0.7	-	100	

### 3.3.1.2 Variations of Plant Communities

#### (1) Species Richness

The number of tree species per plot in fifteen fragmented forests was shown in Table 3-9. The values varied between 16 and 42 species (13-35 genus and 10-24 families). The species richness in each plot was rather low since most fragmented forests were situated at the summit of mountainous areas where forest sites were relatively dry. There were no correlation between the species richness and altitude gradient. The species richness was higher in mesic areas between 1,345-1,586 m altitude.

#### (2) Species Diversity Index

The indexes of species diversity in fragmented forests calculated by the Shannon-Wiener Index (SWI) varied from 3.01 to 4.65 (Table 3-10), and the value of 5.28 for the whole fragmented forests. The SWI value in each fragmented forest varied from low to intermediate. However, it was high for the whole fragmented forests. This implied to the high species diversity of the original montane forest in this watershed area.

#### (3) Tree Density

Tree densities were greatly different among fragmented forests, 556-1,769 individuals/plot. The tree densities were low in areas of 1,230-1,260 m altitude, and high between 1,300-1,560 m. It is found that some fragmented forests consisted of mainly intermediate-size and big trees whereas densely small trees were existed in the others. The human disturbance through selective tree cutting resulted in the big canopy gaps in some fragmented forests. This stimulated the natural regeneration, and many saplings were grown densely in the gaps. Thus, tree densities were higher in the disturbed forests.

#### (4) Stem Basal Area

The total stem basal area of all tree species in fragmented forests varied between 17.46-36.58 m<sup>2</sup>/ha. This parameter is implied to forest production according to stem size and number of trees, and forest condition. Since the fragmented forests had different forest conditions, from poor to good, the values were therefore greatly different.





**Figure 3-3** Over views pictures of fragmented forests

**Table 3-9** Quantitative characteristics of tree species in fifteenth fragmented forests

FF	No	Species	No. of trees	Basal area (m <sup>2</sup> /ha)	Relative (%)		IVI	
					Density	Dominance	(200)	(%)
1	1	<i>Pinus kesiya</i>	188	20.12	15.71	63.57	79.28	39.64
	2	<i>Wendlandia tinctoria</i>	300	1.69	25.13	5.35	30.49	15.24
	3	<i>Tristania rufescens</i>	269	1.02	22.51	3.21	25.72	12.86
	4	<i>Quercus vestita</i>	156	1.10	13.09	3.48	16.57	8.29
	5	<i>Schima wallichii</i>	50	2.28	4.19	7.20	11.39	5.69
	6	<i>Helicia nilagirica</i>	75	1.16	6.28	3.65	9.94	4.97
	7	<i>Dalbergia cultrata</i>	38	1.81	3.14	5.73	8.87	4.44
	8	<i>Lithocarpus elegans</i>	19	1.19	1.57	3.76	5.33	2.66
	9	<i>Craibiodendron stellatum</i>	31	0.17	2.62	0.52	3.14	1.57
	10	<i>Glochidion sphaerogynum</i>	19	0.33	1.57	1.05	2.62	1.31
	11	<i>Castanopsis purpurea</i>	6	0.40	0.52	1.26	1.78	0.89
	12	<i>Vaccinium sprengelii</i>	19	0.05	1.57	0.15	1.72	0.86
	13	<i>Erythrina subumbrans</i>	6	0.22	0.52	0.71	1.23	0.61
	14	<i>Castanopsis diversifolia</i>	6	0.09	0.52	0.29	0.81	0.41
	15	<i>Engelhardtia spicata</i>	6	0.02	0.52	0.05	0.57	0.29
	16	<i>Phyllanthus emblica</i>	6	0.002	0.52	0.01	0.53	0.27
Total			1,194	31.65	100	100	200	100
2	1	<i>Pinus kesiya</i>	219	13.50	14.58	53.73	68.31	34.16
	2	<i>Tristania rufescens</i>	356	1.63	23.75	6.49	30.24	15.12
	3	<i>Quercus vestita</i>	175	1.74	11.67	6.93	18.60	9.30
	4	<i>Vaccinium sprengelii</i>	225	0.45	15.00	1.80	16.80	8.40
	5	<i>Lithocarpus elegans</i>	144	1.80	9.58	7.18	16.76	8.38
	6	<i>Schima wallichii</i>	75	1.38	5.00	5.48	10.48	5.24
	7	<i>Castanopsis purpurea</i>	56	1.39	3.75	5.52	9.27	4.63
	8	<i>Lithocarpus sootepensis</i>	56	0.69	3.75	2.74	6.49	3.25
	9	<i>Myrica esculenta</i>	25	0.82	1.67	3.25	4.92	2.46
	10	<i>Wendlandia tinctoria</i>	44	0.19	2.92	0.76	3.67	1.84
	11	<i>Helicia nilagirica</i>	38	0.28	2.50	1.11	3.61	1.81
	12	<i>Albizia odoratissima</i>	13	0.46	0.83	1.82	2.66	1.33
	13	<i>Betula alnoides</i>	6	0.31	0.42	1.24	1.65	0.83
	14	<i>Castanopsis diversifolia</i>	6	0.29	0.42	1.16	1.57	0.79
	15	<i>Glochidion sphaerogynum</i>	13	0.08	0.83	0.32	1.16	0.58
	16	<i>Anneslea fragrans</i>	13	0.03	0.83	0.12	0.95	0.48
	17	<i>Eurya nitida</i>	13	0.03	0.83	0.11	0.95	0.47
	18	<i>Craibiodendron stellatum</i>	6	0.02	0.42	0.08	0.50	0.25
	19	<i>Castanopsis acuminatissima</i>	6	0.02	0.42	0.07	0.49	0.24
	20	<i>Semecarpus albescens</i>	6	0.01	0.42	0.04	0.46	0.23
	21	<i>Engelhardtia spicata</i>	6	0.01	0.42	0.04	0.46	0.23
Total			1,500	25.12	100	100	200	100

Table 3-9 (Continued)

FF	No	Species	No. of trees	Basal area (m <sup>2</sup> /ha)	Relative (%)		IVI	
					Density	Dominance	(200)	(%)
3	1	<i>Pinus kesiya</i>	119	8.44	9.55	25.67	35.22	17.61
	2	<i>Castanopsis purpurea</i>	44	5.34	3.52	16.24	19.76	9.88
	3	<i>Schima wallichii</i>	106	3.08	8.54	9.36	17.90	8.95
	4	<i>Phyllanthus emblica</i>	156	0.58	12.56	1.75	14.31	7.16
	5	<i>Lithocarpus fenestratus</i>	63	2.42	5.03	7.36	12.39	6.19
	6	<i>Callicarpa arborea</i>	63	2.23	5.03	6.77	11.80	5.90
	7	<i>Lithocarpus elegans</i>	63	1.91	5.03	5.80	10.83	5.41
	8	<i>Dalbergia cultrata</i>	63	1.72	5.03	5.24	10.27	5.13
	9	<i>Ternstroemia gymnanthera</i>	63	1.05	5.03	3.19	8.21	4.11
	10	<i>Engelhardtia spicata</i>	63	0.61	5.03	1.86	6.89	3.44
	11	<i>Stereospermum neuranthum</i>	63	0.47	5.03	1.42	6.45	3.22
	12	<i>Tristania rufescens</i>	44	0.27	3.52	0.82	4.34	2.17
	13	<i>Quercus vestita</i>	25	0.56	2.01	1.71	3.72	1.86
	14	<i>Glochidion sphaerogynum</i>	31	0.25	2.51	0.76	3.27	1.64
	15	<i>Engelhardtia serrata</i>	13	0.64	1.01	1.95	2.95	1.48
	16	<i>Craibiodendron stellatum</i>	25	0.29	2.01	0.87	2.88	1.44
	17	<i>Castanopsis acuminatissima</i>	13	0.53	1.01	1.61	2.61	1.31
	18	<i>Helicia terminalis</i>	13	0.35	1.01	1.07	2.08	1.04
	19	<i>Terminalia chebula</i>	6	0.44	0.50	1.34	1.85	0.92
	20	<i>Wendlandia tinctoria</i>	19	0.09	1.51	0.28	1.79	0.89
	21	<i>Diospyros glandulosa</i>	19	0.07	1.51	0.21	1.72	0.86
	22	<i>Bombax anceps</i>	6	0.35	0.50	1.08	1.58	0.79
	23	<i>Colona flagrocarpa</i>	13	0.14	1.01	0.44	1.44	0.72
	24	<i>Helicia nilagirica</i>	6	0.30	0.50	0.91	1.41	0.71
	25	<i>Erythrina subumbrans</i>	13	0.06	1.01	0.19	1.20	0.60
	26	<i>Syzygium albiflorum</i>	13	0.06	1.01	0.19	1.19	0.60
	27	<i>Aporosa villosa</i>	13	0.05	1.01	0.14	1.15	0.57
	28	<i>Albizia chinensis</i>	6	0.20	0.50	0.62	1.12	0.56
	29	<i>Catunaregam tomentosa</i>	13	0.02	1.01	0.07	1.07	0.54
	30	<i>Litsea glutinosa</i>	13	0.01	1.01	0.03	1.04	0.52
	31	<i>Semecarpus albescens</i>	13	0.01	1.01	0.02	1.03	0.51
	32	<i>Ampelocissus martinii</i>	6	0.08	0.50	0.23	0.73	0.37
	33	<i>Milletia pachycarpa</i>	6	0.06	0.50	0.17	0.67	0.34
	34	<i>Styrax benzoides</i>	6	0.04	0.50	0.12	0.62	0.31
	35	<i>Albizia odoratissima</i>	6	0.03	0.50	0.10	0.60	0.30
	36	<i>Syzygium cumini</i>	6	0.03	0.50	0.09	0.60	0.30
	37	<i>Castanopsis diversifolia</i>	6	0.03	0.50	0.09	0.59	0.30
	38	<i>Eurya nitida</i>	6	0.02	0.50	0.07	0.57	0.29
	39	<i>Vaccinium sprengelii</i>	6	0.02	0.50	0.06	0.56	0.28
	40	<i>Phoebe paniculata</i>	6	0.01	0.50	0.03	0.53	0.26
	41	<i>Beilschmiedia gammieana</i>	6	0.01	0.50	0.03	0.53	0.26
	42	<i>Ilex umbellulata</i>	6	0.01	0.50	0.02	0.52	0.26
		Total	1,244	32.88	100	100	200	100



Table 3-9 (Continued)

FF	No	Species	No. of trees	Basal area (m <sup>2</sup> /ha)	Relative (%)		IVI	
					Density	Dominance	(200)	(%)
4	1	<i>Pinus kesiya</i>	88	10.03	9.66	33.88	43.54	21.77
	2	<i>Vaccinium sprengelii</i>	269	1.49	29.66	5.04	34.70	17.35
	3	<i>Castanopsis acuminatissima</i>	100	6.21	11.03	20.98	32.01	16.01
	4	<i>Quercus brandisiana</i>	38	5.43	4.14	18.33	22.47	11.23
	5	<i>Anneslea fragrans</i>	75	1.56	8.28	5.27	13.54	6.77
	6	<i>Tristania rufescens</i>	75	0.77	8.28	2.59	10.87	5.43
	7	<i>Craibiodendron stellatum</i>	75	0.18	8.28	0.60	8.88	4.44
	8	<i>Castanopsis purpurea</i>	19	1.98	2.07	6.70	8.77	4.39
	9	<i>Ternstroemia gymnanthera</i>	38	0.56	4.14	1.91	6.04	3.02
	10	<i>Lithocarpus polystachyus</i>	13	1.08	1.38	3.66	5.04	2.52
	11	<i>Styrax benzoides</i>	25	0.07	2.76	0.25	3.01	1.50
	12	<i>Semecarpus albescens</i>	25	0.04	2.76	0.14	2.90	1.45
	13	<i>Schima wallichii</i>	19	0.06	2.07	0.19	2.26	1.13
	14	<i>Shorea roxburghii</i>	13	0.07	1.38	0.25	1.63	0.81
	15	<i>Myrica esculenta</i>	6	0.03	0.69	0.10	0.79	0.40
	16	<i>Glochidion sphaerogynum</i>	6	0.02	0.69	0.05	0.74	0.37
	17	<i>Viburnum sambucinum</i>	6	0.01	0.69	0.02	0.71	0.36
	18	<i>Dalbergia cultrata</i>	6	0.004	0.69	0.01	0.70	0.35
	19	<i>Wendlandia tinctoria</i>	6	0.002	0.69	0.01	0.70	0.35
	20	<i>Pavetta tomentosa</i>	6	0.002	0.69	0.01	0.70	0.35
Total			906	29.61	100	100	200	100
5	1	<i>Castanopsis acuminatissima</i>	156	8.61	14.79	30.80	45.60	22.80
	2	<i>Tristania rufescens</i>	200	2.78	18.93	9.93	28.87	14.43
	3	<i>Quercus brandisiana</i>	75	5.41	7.10	19.34	26.44	13.22
	4	<i>Pinus kesiya</i>	25	4.62	2.37	16.51	18.87	9.44
	5	<i>Vaccinium sprengelii</i>	150	1.21	14.20	4.34	18.54	9.27
	6	<i>Anneslea fragrans</i>	113	1.88	10.65	6.73	17.38	8.69
	7	<i>Craibiodendron stellatum</i>	69	0.69	6.51	2.48	8.99	4.49
	8	<i>Semecarpus albescens</i>	56	0.38	5.33	1.36	6.69	3.34
	9	<i>Castanopsis purpurea</i>	38	0.83	3.55	2.96	6.51	3.26
	10	<i>Styrax benzoides</i>	25	0.39	2.37	1.39	3.75	1.88
	11	<i>Wendlandia tinctoria</i>	25	0.13	2.37	0.45	2.82	1.41
	12	<i>Aporosa villosa</i>	25	0.07	2.37	0.24	2.61	1.30
	13	<i>Dalbergia cultrata</i>	19	0.12	1.78	0.43	2.21	1.10
	14	<i>Schima wallichii</i>	13	0.22	1.18	0.79	1.97	0.99
	15	<i>Lithocarpus polystachyus</i>	13	0.21	1.18	0.74	1.92	0.96
	16	<i>Viburnum sambucinum</i>	19	0.03	1.78	0.09	1.87	0.93
	17	<i>Ternstroemia gymnanthera</i>	13	0.14	1.18	0.51	1.69	0.85
	18	<i>Quercus vestita</i>	6	0.17	0.59	0.60	1.19	0.59
	19	<i>Lithocarpus elegans</i>	6	0.07	0.59	0.25	0.84	0.42
	20	<i>Canarium subulatum</i>	6	0.01	0.59	0.05	0.64	0.32
	21	<i>Phyllanthus emblica</i>	6	0.003	0.59	0.01	0.60	0.30
Total			1,056	27.96	100	100	200	100

Table 3-9 (Continued)

FF	No	Species	No. of trees	Basal area (m <sup>2</sup> /ha)	Relative (%)		IVI	
					Density	Dominance	(200)	(%)
6	1	<i>Pinus kesiya</i>	44	10.14	7.87	38.67	46.54	23.27
	2	<i>Castanopsis acuminatissima</i>	75	5.24	13.48	19.96	33.45	16.72
	3	<i>Tristania rufescens</i>	106	2.44	19.10	9.31	28.41	14.21
	4	<i>Vaccinium sprengelii</i>	81	1.50	14.61	5.72	20.33	10.16
	5	<i>Anneslea fragrans</i>	44	1.64	7.87	6.26	14.12	7.06
	6	<i>Semecarpus albescens</i>	25	2.00	4.49	7.62	12.11	6.06
	7	<i>Craibiodendron stellatum</i>	44	0.45	7.87	1.70	9.56	4.78
	8	<i>Wendlandia tinctoria</i>	38	0.27	6.74	1.02	7.76	3.88
	9	<i>Lithocarpus fenestratus</i>	25	0.54	4.49	2.05	6.55	3.27
	10	<i>Lithocarpus polystachyus</i>	19	0.39	3.37	1.49	4.87	2.43
	11	<i>Quercus vestita</i>	6	0.95	1.12	3.61	4.73	2.37
	12	<i>Castanopsis purpurea</i>	19	0.28	3.37	1.09	4.46	2.23
	13	<i>Styrax benzoides</i>	13	0.05	2.25	0.21	2.45	1.23
	14	<i>Quercus brandisiana</i>	6	0.33	1.12	1.27	2.40	1.20
	15	<i>Viburnum sambucinum</i>	6	0.003	1.12	0.01	1.14	0.57
	16	<i>Aporosa villosa</i>	6	0.001	1.12	0.00	1.13	0.56
Total			556	26.22	100	100	200	100
7	1	<i>Castanopsis acuminatissima</i>	144	7.70	10.36	34.07	44.43	22.22
	2	<i>Pinus kesiya</i>	81	7.08	5.86	31.33	37.19	18.59
	3	<i>Vaccinium sprengelii</i>	169	0.95	12.16	4.22	16.38	8.19
	4	<i>Tristania rufescens</i>	106	1.35	7.66	5.98	13.64	6.82
	5	<i>Viburnum sambucinum</i>	156	0.16	11.26	0.70	11.96	5.98
	6	<i>Semecarpus albescens</i>	69	0.68	4.95	3.02	7.98	3.99
	7	<i>Styrax benzoides</i>	94	0.24	6.76	1.05	7.81	3.90
	8	<i>Craibiodendron stellatum</i>	56	0.56	4.05	2.50	6.55	3.28
	9	<i>Dalbergia oltrata</i>	75	0.21	5.41	0.95	6.35	3.18
	10	<i>Quercus vestita</i>	19	0.90	1.35	3.96	5.31	2.66
	11	<i>Anneslea fragrans</i>	31	0.68	2.25	2.99	5.24	2.62
	12	<i>Quercus brandisiana</i>	25	0.73	1.80	3.21	5.01	2.51
	13	<i>Lithocarpus polystachyus</i>	31	0.29	2.25	1.29	3.54	1.77
	14	<i>Helicia nilagirica</i>	38	0.11	2.70	0.49	3.19	1.60
	15	<i>Aporosa villosa</i>	38	0.08	2.70	0.37	3.07	1.54
	16	<i>Phyllanthus emblica</i>	38	0.06	2.70	0.28	2.98	1.49
	17	<i>Ternstroemia gymnanthera</i>	25	0.21	1.80	0.92	2.72	1.36
	18	<i>Glochidion sphaerogynum</i>	31	0.03	2.25	0.13	2.38	1.19
	19	<i>Wendlandia tinctoria</i>	19	0.14	1.35	0.61	1.96	0.98
	20	<i>Castanopsis purpurea</i>	13	0.21	0.90	0.95	1.85	0.92
	21	<i>Schima wallichii</i>	19	0.09	1.35	0.40	1.75	0.87
	22	<i>Diospyros glandulosa</i>	19	0.02	1.35	0.07	1.42	0.71
	23	<i>Lithocarpus elegans</i>	13	0.04	0.90	0.19	1.10	0.55
	24	<i>Catunaregam tomentosa</i>	13	0.02	0.90	0.08	0.98	0.49
	25	<i>Rhus javanica</i>	13	0.01	0.90	0.05	0.95	0.47
	26	<i>Dillenia aurea</i>	6	0.01	0.45	0.06	0.51	0.26
	27	<i>Stereospermum neuranthum</i>	6	0.01	0.45	0.04	0.49	0.24
	28	<i>Terminalia chebula</i>	6	0.01	0.45	0.03	0.48	0.24
	29	<i>Albizia chinensis</i>	6	0.004	0.45	0.02	0.47	0.23
	30	<i>Phoebe paniculata</i>	6	0.003	0.45	0.01	0.46	0.23
	31	<i>Vernonia volkameriifolia</i>	6	0.003	0.45	0.01	0.46	0.23
	32	<i>Helicia terminalis</i>	6	0.002	0.45	0.01	0.46	0.23
	33	<i>Eurya nitida</i>	6	0.002	0.45	0.01	0.46	0.23
	34	<i>Lithocarpus fenestratus</i>	6	0.001	0.45	0.01	0.46	0.23
Total			1,388	22.59	100	100	200	100

Table 3-9 (Continued)

FF	No	Species	No. of trees	Basal area (m <sup>2</sup> /ha)	Relative (%)		IVI	
					Density	Dominance	(200)	(%)
8	1	<i>Tristania rufescens</i>	275	4.23	29.33	18.16	47.49	23.74
	2	<i>Pinus kesiya</i>	44	7.83	4.67	33.57	38.24	19.12
	3	<i>Castanopsis acuminatissima</i>	94	4.10	10.00	17.61	27.61	13.80
	4	<i>Quercus brandisiana</i>	69	3.28	7.33	14.08	21.42	10.71
	5	<i>Vaccinium sprengelii</i>	113	0.82	12.00	3.51	15.51	7.76
	6	<i>Lithocarpus polystachyus</i>	44	0.79	4.67	3.39	8.05	4.03
	7	<i>Craibiodendron stellatum</i>	44	0.27	4.67	1.18	5.85	2.92
	8	<i>Quercus vestita</i>	19	0.76	2.00	3.26	5.26	2.63
	9	<i>Dalbergia cultrata</i>	38	0.12	4.00	0.53	4.53	2.26
	10	<i>Aporosa villosa</i>	31	0.25	3.33	1.08	4.41	2.21
	11	<i>Phyllanthus emblica</i>	31	0.02	3.33	0.11	3.44	1.72
	12	<i>Semecarpus albescens</i>	19	0.25	2.00	1.09	3.09	1.54
	13	<i>Gardenia sootepensis</i>	13	0.09	1.33	0.37	1.70	0.85
	14	<i>Anneslea fragrans</i>	6	0.24	0.67	1.03	1.70	0.85
	15	<i>Dolichandrone serrulata</i>	13	0.07	1.33	0.30	1.63	0.82
	16	<i>Quercus kingiana</i>	13	0.03	1.33	0.14	1.47	0.74
	17	<i>Stereospermum neuranthum</i>	13	0.03	1.33	0.14	1.47	0.74
	18	<i>Castanopsis diversifolia</i>	13	0.03	1.33	0.11	1.44	0.72
	19	<i>Glochidion sphaerogynum</i>	13	0.02	1.33	0.07	1.40	0.70
	20	<i>Lithocarpus fenestratus</i>	6	0.03	0.67	0.11	0.78	0.39
	21	<i>Lithocarpus elegans</i>	6	0.02	0.67	0.10	0.77	0.38
	22	<i>Styrax benzoides</i>	6	0.01	0.67	0.05	0.72	0.36
	23	<i>Erythrina subumbrans</i>	6	0.003	0.67	0.01	0.68	0.34
	24	<i>Engelhardtia spicata</i>	6	0.002	0.67	0.01	0.68	0.34
	25	<i>Dillenia aurea</i>	6	0.001	0.67	0.00	0.67	0.34
Total			938	23.32	100	100	200	100
9	1	<i>Castanopsis acuminatissima</i>	125	9.26	10.81	35.83	46.64	23.32
	2	<i>Quercus brandisiana</i>	194	3.67	16.76	14.22	30.97	15.49
	3	<i>Pinus kesiya</i>	44	6.72	3.78	25.99	29.77	14.89
	4	<i>Tristania rufescens</i>	188	0.82	16.22	3.16	19.38	9.69
	5	<i>Vaccinium sprengelii</i>	100	0.54	8.65	2.10	10.75	5.37
	6	<i>Semecarpus albescens</i>	81	0.27	7.03	1.03	8.06	4.03
	7	<i>Schima wallichii</i>	25	1.25	2.16	4.85	7.01	3.50
	8	<i>Castanopsis purpurea</i>	31	0.93	2.70	3.60	6.30	3.15
	9	<i>Craibiodendron stellatum</i>	56	0.18	4.86	0.71	5.57	2.79
	10	<i>Lithocarpus fenestratus</i>	6	0.80	0.54	3.10	3.64	1.82
	11	<i>Viburnum sambucinum</i>	38	0.08	3.24	0.32	3.57	1.78
	12	<i>Wendlandia tinctoria</i>	31	0.14	2.70	0.56	3.26	1.63
	13	<i>Lithocarpus sootepensis</i>	25	0.23	2.16	0.91	3.07	1.53
	14	<i>Aporosa villosa</i>	31	0.05	2.70	0.19	2.90	1.45
	15	<i>Helicia nilagirica</i>	19	0.28	1.62	1.10	2.72	1.36
	16	<i>Glochidion hirsutum</i>	25	0.08	2.16	0.32	2.49	1.24
	17	<i>Phyllanthus emblica</i>	25	0.02	2.16	0.08	2.24	1.12
	18	<i>Lithocarpus polystachyus</i>	19	0.12	1.62	0.48	2.10	1.05
	19	<i>Anneslea fragrans</i>	19	0.03	1.62	0.11	1.73	0.87
	20	<i>Quercus vestita</i>	13	0.06	1.08	0.22	1.30	0.65
	21	<i>Glochidion sphaerogynum</i>	13	0.02	1.08	0.09	1.17	0.58
	22	<i>Styrax benzoides</i>	6	0.14	0.54	0.55	1.09	0.54
	23	<i>Artocarpus gomezianus</i>	6	0.06	0.54	0.22	0.76	0.38
	24	<i>Dolichandrone serrulata</i>	6	0.04	0.54	0.16	0.70	0.35
	25	<i>Catunaregam tomentosa</i>	6	0.01	0.54	0.03	0.57	0.28
	26	<i>Gardenia sootepensis</i>	6	0.01	0.54	0.03	0.57	0.28
	27	<i>Quercus kingiana</i>	6	0.01	0.54	0.02	0.56	0.28
	28	<i>Pavetta tomentosa</i>	6	0.005	0.54	0.02	0.56	0.28
	29	<i>Archidendron clypearia</i>	6	0.004	0.54	0.01	0.55	0.28
Total			1,156	25.85	100	100	200	100



Table 3-9 (Continued)

FF	No	Species	No. of trees	Basal area (m <sup>2</sup> /ha)	Relative (%)		IVI	
					Density	Dominance	(200)	(%)
10	1	<i>Pinus kesiya</i>	138	6.88	13.84	39.39	53.23	26.61
	2	<i>Quercus brandisiana</i>	119	3.05	11.95	17.47	29.42	14.71
	3	<i>Tristania rufescens</i>	125	1.69	12.58	9.70	22.28	11.14
	4	<i>Vaccinium sprengelii</i>	156	0.48	15.72	2.74	18.47	9.23
	5	<i>Castanopsis acuminatissima</i>	63	2.09	6.29	11.96	18.25	9.12
	6	<i>Craibiodendron stellatum</i>	81	0.54	8.18	3.08	11.26	5.63
	7	<i>Dalbergia cultrata</i>	50	0.51	5.03	2.94	7.97	3.98
	8	<i>Lithocarpus elegans</i>	38	0.54	3.77	3.11	6.89	3.44
	9	<i>Lithocarpus sootepensis</i>	25	0.15	2.52	0.86	3.37	1.69
	10	<i>Phyllanthus emblica</i>	25	0.09	2.52	0.51	3.03	1.51
	11	<i>Gluta usitata</i>	6	0.41	0.63	2.36	2.99	1.49
	12	<i>Quercus kingiana</i>	19	0.16	1.89	0.94	2.83	1.41
	13	<i>Terminalia chebula</i>	13	0.26	1.26	1.47	2.73	1.36
	14	<i>Glochidion sphaerogynum</i>	25	0.04	2.52	0.20	2.72	1.36
	15	<i>Aporosa villosa</i>	25	0.03	2.52	0.15	2.67	1.34
	16	<i>Quercus vestita</i>	6	0.35	0.63	1.99	2.62	1.31
	17	<i>Anneslea fragrans</i>	19	0.10	1.89	0.58	2.47	1.23
	18	<i>Glochidion hirsutum</i>	13	0.01	1.26	0.07	1.33	0.67
	19	<i>Rapanea porteriana</i>	6	0.03	0.63	0.16	0.79	0.40
	20	<i>Albizia odoratissima</i>	6	0.02	0.63	0.12	0.75	0.37
	21	<i>Stereospermum neuranthum</i>	6	0.02	0.63	0.10	0.73	0.36
	22	<i>Celastrus paniculata</i>	6	0.01	0.63	0.05	0.68	0.34
	23	<i>Semecarpus albescens</i>	6	0.004	0.63	0.02	0.65	0.33
	24	<i>Wendlandia tinctoria</i>	6	0.002	0.63	0.01	0.64	0.32
	25	<i>Rhus javanica</i>	6	0.001	0.63	0.01	0.64	0.32
	26	<i>Catunaregam tomentosa</i>	6	0.000	0.63	0.00	0.63	0.32
Total			994	17.46	100	100	200	100

Table 3-9 (Continued)

FF	No	Species	No. of trees	Basal area (m <sup>2</sup> /ha)	Relative (%)		IVI	
					Density	Dominance	(200)	(%)
11	1	<i>Wendlandia tinctoria</i>	581	4.85	32.86	15.63	48.49	24.25
	2	<i>Castanopsis acuminatissima</i>	25	5.39	1.41	17.37	18.79	9.39
	3	<i>Lithocarpus elegans</i>	106	3.17	6.01	10.22	16.23	8.11
	4	<i>Castanopsis diversifolia</i>	69	3.35	3.89	10.80	14.69	7.34
	5	<i>Castanopsis purpurea</i>	38	2.98	2.12	9.61	11.74	5.87
	6	<i>Dalbergia cultrata</i>	69	2.03	3.89	6.53	10.42	5.21
	7	<i>Schima wallichii</i>	38	1.85	2.12	5.96	8.08	4.04
	8	<i>Aporosa villosa</i>	94	0.85	5.30	2.73	8.03	4.02
	9	<i>Engelhardtia spicata</i>	44	1.09	2.47	3.52	5.99	2.99
	10	<i>Ternstroemia gymnanthera</i>	50	0.81	2.83	2.62	5.44	2.72
	11	<i>Phyllanthus emblica</i>	63	0.57	3.53	1.85	5.39	2.69
	12	<i>Eriolaena candollei</i>	56	0.58	3.18	1.87	5.05	2.52
	13	<i>Styrax benzoides</i>	44	0.48	2.47	1.56	4.03	2.02
	14	<i>Turpinia cochinchinensis</i>	56	0.14	3.18	0.44	3.62	1.81
	15	<i>Phoebe paniculata</i>	50	0.15	2.83	0.48	3.31	1.66
	16	<i>Helicia terminalis</i>	38	0.33	2.12	1.07	3.19	1.60
	17	<i>Helicia nilagirica</i>	25	0.36	1.41	1.17	2.58	1.29
	18	<i>Pterospermum acerifolium</i>	38	0.07	2.12	0.23	2.35	1.17
	19	<i>Canthium sp.</i>	38	0.01	2.12	0.02	2.14	1.07
	20	<i>Xantolis cambodiana</i>	13	0.44	0.71	1.40	2.11	1.05
	21	<i>Rhus javanica</i>	31	0.01	1.77	0.02	1.79	0.89
	22	<i>Bombax anceps</i>	6	0.35	0.35	1.13	1.48	0.74
	23	<i>Glochidion acuminatum</i>	25	0.01	1.41	0.03	1.44	0.72
	24	<i>Garuga pinnata</i>	19	0.09	1.06	0.29	1.35	0.68
	25	<i>Antidesma acidum</i>	19	0.03	1.06	0.10	1.16	0.58
	26	<i>Protium serratum</i>	19	0.01	1.06	0.02	1.08	0.54
	27	<i>Buchanania lanzan</i>	13	0.10	0.71	0.33	1.04	0.52
	28	<i>Stereospermum neuranthum</i>	13	0.09	0.71	0.30	1.01	0.50
	29	<i>Dalbergia velutina</i>	13	0.08	0.71	0.27	0.97	0.49
	30	<i>Vernonia volkameriifolia</i>	13	0.08	0.71	0.26	0.97	0.48
	31	<i>Glochidion sphaerogynum</i>	13	0.07	0.71	0.23	0.94	0.47
	32	<i>Dillenia aurea</i>	6	0.16	0.35	0.50	0.86	0.43
	33	<i>Albizia odoratissima</i>	6	0.14	0.35	0.46	0.82	0.41
	34	<i>Kydia calycina</i>	6	0.13	0.35	0.42	0.77	0.39
	35	<i>Radermachera ignea</i>	6	0.10	0.35	0.31	0.66	0.33
	36	<i>Syzygium cumini</i>	6	0.04	0.35	0.11	0.47	0.23
	37	<i>Milletia pachycarpa</i>	6	0.02	0.35	0.08	0.43	0.22
	38	<i>Mallotus philippensis</i>	6	0.01	0.35	0.03	0.39	0.19
	39	<i>Diospyros glandulosa</i>	6	0.003	0.35	0.01	0.36	0.18
	40	<i>Viburnum sambucinum</i>	6	0.001	0.35	0.00	0.36	0.18
Total			1,769	31.01	100	100	200	100

Table 3-9 (Continued)

FF	No	Species	No. of trees	Basal area (m <sup>2</sup> /ha)	Relative (%)		IVI	
					Density	Dominance	(200)	(%)
12	1	<i>Castanopsis acuminatissima</i>	81	7.36	6.47	22.43	28.90	14.45
	2	<i>Schima wallichii</i>	138	3.56	10.95	10.85	21.79	10.90
	3	<i>Helicia nilagirica</i>	144	2.50	11.44	7.62	19.06	9.53
	4	<i>Ternstroemia gymnanthera</i>	150	2.05	11.94	6.25	18.19	9.09
	5	<i>Castanopsis diversifolia</i>	75	2.93	5.97	8.93	14.90	7.45
	6	<i>Wendlandia tinctoria</i>	150	0.80	11.94	2.43	14.37	7.18
	7	<i>Lithocarpus elegans</i>	44	2.86	3.48	8.72	12.20	6.10
	8	<i>Engelhardtia spicata</i>	81	1.76	6.47	5.38	11.85	5.92
	9	<i>Pinus kesiya</i>	13	2.40	1.00	7.33	8.32	4.16
	10	<i>Phoebe paniculata</i>	38	0.90	2.99	2.76	5.74	2.87
	11	<i>Elaeocarpus stipularis</i>	19	1.24	1.49	3.79	5.28	2.64
	12	<i>Buchanania lanzan</i>	6	1.43	0.50	4.37	4.87	2.43
	13	<i>Glochidion sphaerogynum</i>	31	0.47	2.49	1.44	3.93	1.97
	14	<i>Dillenia aurea</i>	38	0.25	2.99	0.75	3.73	1.87
	15	<i>Albizia chinensis</i>	19	0.58	1.49	1.75	3.25	1.62
	16	<i>Phyllanthus emblica</i>	31	0.15	2.49	0.46	2.94	1.47
	17	<i>Olea salicifolia</i>	25	0.24	1.99	0.72	2.71	1.36
	18	<i>Diospyros glandulosa</i>	19	0.24	1.49	0.73	2.22	1.11
	19	<i>Engelhardtia serrata</i>	19	0.14	1.49	0.43	1.93	0.96
	20	<i>Ilex umbellulata</i>	19	0.05	1.49	0.15	1.64	0.82
	21	<i>Beilschmiedia gammieana</i>	19	0.02	1.49	0.06	1.55	0.78
	22	<i>Myrica esculenta</i>	13	0.16	1.00	0.48	1.48	0.74
	23	<i>Dalbergia cultrata</i>	6	0.29	0.50	0.88	1.37	0.69
	24	<i>Eurya nitida</i>	13	0.09	1.00	0.26	1.25	0.63
	25	<i>Gardenia sootepensis</i>	6	0.07	0.50	0.21	0.71	0.35
	26	<i>Phoebe cathia</i>	6	0.06	0.50	0.17	0.67	0.33
	27	<i>Ampelocissus martinii</i>	6	0.05	0.50	0.16	0.65	0.33
	28	<i>Garcinia merguensis</i>	6	0.04	0.50	0.14	0.63	0.32
	29	<i>Vernonia volkamerifolia</i>	6	0.03	0.50	0.10	0.60	0.30
	30	<i>Turpinia cochinchinensis</i>	6	0.02	0.50	0.07	0.57	0.29
	31	<i>Litsea glutinosa</i>	6	0.02	0.50	0.06	0.56	0.28
	32	<i>Xantolis cambodiana</i>	6	0.02	0.50	0.05	0.55	0.27
	33	<i>Entada rheedii</i>	6	0.02	0.50	0.05	0.55	0.27
	34	<i>Pyrenaria diospyricarpa</i>	6	0.01	0.50	0.03	0.52	0.26
	35	<i>Syzygium albiflorum</i>	6	0.001	0.50	0.00	0.50	0.25
		Total	1,256	32.80	100	100	200	100

Table 3-9 (Continued)

FF	No	Species	No. of trees	Basal area (m <sup>2</sup> /ha)	Relative (%)		IVI	
					Density	Dominance	(200)	(%)
13	1	<i>Castanopsis diversifolia</i>	75	12.15	7.10	33.22	40.32	20.16
	2	<i>Ternstroemia gymnanthera</i>	119	3.49	11.24	9.55	20.79	10.39
	3	<i>Schima wallichii</i>	69	3.57	6.51	9.77	16.28	8.14
	4	<i>Helicia nilagirica</i>	56	3.55	5.33	9.71	15.03	7.52
	5	<i>Eurya nitida</i>	138	0.03	13.02	0.08	13.09	6.55
	6	<i>Anneslea fragrans</i>	81	1.87	7.69	5.12	12.81	6.40
	7	<i>Castanopsis armata</i>	6	3.40	0.59	9.30	9.89	4.95
	8	<i>Quercus semiserrata</i>	13	2.23	1.18	6.09	7.27	3.63
	9	<i>Rapanea porteriiana</i>	50	0.75	4.73	2.06	6.79	3.40
	10	<i>Wendlandia tinctoria</i>	50	0.51	4.73	1.39	6.12	3.06
	11	<i>Syzygium albiflorum</i>	38	0.78	3.55	2.14	5.69	2.84
	12	<i>Engelhardtia spicata</i>	38	0.66	3.55	1.81	5.36	2.68
	13	<i>Diospyros glandulosa</i>	44	0.33	4.14	0.89	5.03	2.52
	14	<i>Pinus kesiya</i>	25	0.33	2.37	0.91	3.28	1.64
	15	<i>Myrica esculenta</i>	19	0.40	1.78	1.11	2.88	1.44
	16	<i>Trichilla connaroides</i>	25	0.13	2.37	0.34	2.71	1.36
	17	<i>Beilschmiedia gammieana</i>	25	0.05	2.37	0.15	2.51	1.26
	18	<i>Engelhardtia serrata</i>	6	0.69	0.59	1.89	2.48	1.24
	19	<i>Symplocos racemosa</i>	13	0.46	1.18	1.26	2.45	1.22
	20	<i>Ilex umbellulata</i>	19	0.19	1.78	0.52	2.29	1.15
	21	<i>Archidendron clypearia</i>	19	0.02	1.78	0.06	1.84	0.92
	22	<i>Lindera metcalifiana</i>	19	0.01	1.78	0.03	1.80	0.90
	23	<i>Glochidion sphaerogynum</i>	13	0.20	1.18	0.55	1.73	0.87
	24	<i>Magnolia henryi</i>	13	0.15	1.18	0.42	1.60	0.80
	25	<i>Ampelocissus martinii</i>	13	0.06	1.18	0.16	1.35	0.67
	26	<i>Helicia terminalis</i>	6	0.15	0.59	0.42	1.01	0.51
	27	<i>Eriolaena candollei</i>	6	0.15	0.59	0.40	1.00	0.50
	28	<i>Garcinia merguensis</i>	6	0.09	0.59	0.24	0.83	0.41
	29	<i>Cinnamomum iners</i>	6	0.06	0.59	0.17	0.76	0.38
	30	<i>Schefflera bengalensis</i>	6	0.05	0.59	0.13	0.72	0.36
	31	<i>Ficus</i> sp.	6	0.02	0.59	0.05	0.64	0.32
	32	<i>Dillenia aurea</i>	6	0.02	0.59	0.05	0.64	0.32
	33	<i>Mussaenda sanderiana</i>	6	0.01	0.59	0.03	0.62	0.31
	34	<i>Glochidion acuminatum</i>	6	0.001	0.59	0.00	0.60	0.30
	35	<i>Xantolis cambodiana</i>	6	0.001	0.59	0.00	0.60	0.30
	36	<i>Phyllanthus emblica</i>	6	0.001	0.59	0.00	0.59	0.30
	37	<i>Phoebe paniculata</i>	6	0.000	0.59	0.00	0.59	0.30
Total			1,056	36.58	100	100	200	100

Table 3-9 (Continued)

FF	No	Species	No. of trees	Basal area (m <sup>2</sup> /ha)	Relative (%)		IVI	
					Density	Dominance	(200)	(%)
14	1	<i>Schima wallichii</i>	194	5.92	12.11	21.90	34.01	17.00
	2	<i>Eurya nitida</i>	250	0.92	15.63	3.39	19.02	9.51
	3	<i>Engelhardtia spicata</i>	69	3.91	4.30	14.49	18.78	9.39
	4	<i>Quercus semiserrata</i>	106	2.88	6.64	10.67	17.31	8.66
	5	<i>Phoebe paniculata</i>	163	1.27	10.16	4.72	14.87	7.44
	6	<i>Helicia nilagirica</i>	38	2.95	2.34	10.90	13.25	6.62
	7	<i>Ternstroemia gymnanthera</i>	75	1.50	4.69	5.56	10.25	5.12
	8	<i>Castanopsis acuminatissima</i>	19	2.10	1.17	7.78	8.95	4.47
	9	<i>Glochidion acuminatum</i>	138	0.04	8.59	0.16	8.75	4.37
	10	<i>Pinus kesiya</i>	6	1.89	0.39	7.00	7.39	3.69
	11	<i>Pyrenaria diospyricarpa</i>	88	0.27	5.47	1.02	6.48	3.24
	12	<i>Lindera metcalfiana</i>	69	0.55	4.30	2.03	6.32	3.16
	13	<i>Diospyros glandulosa</i>	38	0.30	2.34	1.10	3.44	1.72
	14	<i>Phoebe cathia</i>	38	0.19	2.34	0.70	3.04	1.52
	15	<i>Dillenia aurea</i>	19	0.46	1.17	1.72	2.89	1.45
	16	<i>Litsea semecarpifolia</i>	19	0.44	1.17	1.64	2.81	1.41
	17	<i>Cinnamomum porrectum</i>	44	0.00	2.73	0.02	2.75	1.38
	18	<i>Wendlandia tinctoria</i>	31	0.19	1.95	0.71	2.66	1.33
	19	<i>Saurauia roxburghii</i>	31	0.07	1.95	0.24	2.19	1.10
	20	<i>Archidendron clypearia</i>	13	0.34	0.78	1.26	2.04	1.02
	21	<i>Sarcosperma arboreum</i>	19	0.20	1.17	0.74	1.91	0.96
	22	<i>Helicia terminalis</i>	19	0.17	1.17	0.63	1.80	0.90
	23	<i>Mussaenda sanderiana</i>	25	0.02	1.56	0.07	1.63	0.82
	24	<i>Glochidion sphaerogynum</i>	19	0.05	1.17	0.20	1.38	0.69
	25	<i>Turpinia cochinchinensis</i>	13	0.11	0.78	0.39	1.17	0.59
	26	<i>Symplocos racemosa</i>	13	0.05	0.78	0.18	0.96	0.48
	27	<i>Anneslea fragrans</i>	13	0.05	0.78	0.18	0.96	0.48
	28	<i>Melastoma malabathricum</i>	13	0.01	0.78	0.02	0.80	0.40
	29	<i>Magnolia henryi</i>	6	0.10	0.39	0.37	0.76	0.38
	30	<i>Combretum punctatum</i>	6	0.06	0.39	0.21	0.60	0.30
	31	<i>Litsea glutinosa</i>	6	0.002	0.39	0.01	0.40	0.20
	32	<i>Albizia chinensis</i>	6	0.0004	0.39	0.00	0.39	0.20
Total			1,600	27.02	100	100	200	100

Table 3-9 (Continued)

FF	No	Species	No. of trees	Basal area (m <sup>2</sup> /ha)	Relative (%)		IVI	
					Density	Dominance	(200)	(%)
15	1	<i>Schima wallichii</i>	194	6.40	22.14	25.73	47.88	23.94
	2	<i>Castanopsis diversifolia</i>	119	5.36	13.57	21.55	35.13	17.56
	3	<i>Engelhardtia spicata</i>	75	3.85	8.57	15.50	24.08	12.04
	4	<i>Glochidion acuminatum</i>	131	0.01	15.00	0.05	15.05	7.53
	5	<i>Wendlandia tinctoria</i>	69	1.09	7.86	4.38	12.23	6.12
	6	<i>Elaeocarpus stipularis</i>	6	1.72	0.71	6.92	7.63	3.82
	7	<i>Phoebe cathia</i>	6	1.34	0.71	5.38	6.09	3.05
	8	<i>Ternstroemia gymnanthera</i>	6	1.23	0.71	4.97	5.68	2.84
	9	<i>Diospyros glandulosa</i>	25	0.44	2.86	1.77	4.63	2.32
	10	<i>Helicia terminalis</i>	13	0.68	1.43	2.74	4.17	2.08
	11	<i>Milletia pachycarpa</i>	31	0.00	3.57	0.01	3.58	1.79
	12	<i>Styrax benzoides</i>	6	0.71	0.71	2.86	3.57	1.79
	13	<i>Saurauia roxburghii</i>	25	0.04	2.86	0.17	3.03	1.52
	14	<i>Lithocarpus lindleyanus</i>	13	0.37	1.43	1.48	2.91	1.45
	15	<i>Myrica esculenta</i>	6	0.41	0.71	1.63	2.35	1.17
	16	<i>Glochidion sphaerogynum</i>	19	0.01	2.14	0.03	2.18	1.09
	17	<i>Pyrenaria diospyricarpa</i>	19	0.00	2.14	0.00	2.15	1.07
	18	<i>Litsea glutinosa</i>	6	0.25	0.71	0.99	1.71	0.85
	19	<i>Vitex pinnata</i>	6	0.21	0.71	0.86	1.57	0.79
	20	<i>Eurya nitida</i>	6	0.21	0.71	0.83	1.55	0.77
	21	<i>Eriolaena candollei</i>	6	0.20	0.71	0.79	1.51	0.75
	22	<i>Rapanea porteriana</i>	13	0.01	1.43	0.05	1.47	0.74
	23	<i>Rhus javanica</i>	13	0.01	1.43	0.02	1.45	0.72
	24	<i>Lindera metcalfiana</i>	13	0.00	1.43	0.02	1.45	0.72
	25	<i>Symplocos racemosa</i>	6	0.18	0.71	0.72	1.43	0.72
	26	<i>Albizia odoratissima</i>	6	0.08	0.71	0.32	1.03	0.52
	27	<i>Archidendron clypearia</i>	6	0.04	0.71	0.16	0.88	0.44
	28	<i>Helicia nilagirica</i>	6	0.004	0.71	0.01	0.73	0.36
	29	<i>Phyllanthus emblica</i>	6	0.003	0.71	0.01	0.73	0.36
	30	<i>Trichilla connaroides</i>	6	0.003	0.71	0.01	0.73	0.36
	31	<i>Eurya acuminata</i>	6	0.002	0.71	0.01	0.72	0.36
	32	<i>Beilschmiedia gammieana</i>	6	0.0004	0.71	0.00	0.72	0.36
Total			875	24.85	100	100	200	100



**Table 3-10** Species diversity index (SWI) of tree species in each fragmented forest

FF	No	Species	$p_i$	$\log_2 p_i$	$p_i * \log_2 p_i$
1	1	<i>Wendlandia tinctoria</i>	0.2513	-1.9925	-0.5007
	2	<i>Tristania rufescens</i>	0.2251	-2.1512	-0.4843
	3	<i>Pinus kesiya</i>	0.1571	-2.6705	-0.4195
	4	<i>Quercus vestita</i>	0.1309	-2.9336	-0.3840
	5	<i>Helicia nilagirica</i>	0.0628	-3.9925	-0.2508
	6	<i>Schima wallichii</i>	0.0419	-4.5774	-0.1917
	7	<i>Dalbergia cultrata</i>	0.0314	-4.9925	-0.1568
	8	<i>Craibiodendron stellatum</i>	0.0262	-5.2555	-0.1376
	9	<i>Lithocarpus elegans</i>	0.0157	-5.9925	-0.0941
	10	<i>Glochidion sphaerogynum</i>	0.0157	-5.9925	-0.0941
	11	<i>Vaccinium sprengelii</i>	0.0157	-5.9925	-0.0941
	12	<i>Castanopsis purpurea</i>	0.0052	-7.5774	-0.0397
	13	<i>Castanopsis diversifolia</i>	0.0052	-7.5774	-0.0397
	14	<i>Engelhardtia spicata</i>	0.0052	-7.5774	-0.0397
	15	<i>Erythrina subumbrans</i>	0.0052	-7.5774	-0.0397
	16	<i>Phyllanthus emblica</i>	0.0052	-7.5774	-0.0397
Total			1.00	-84.43	-3.01
Shannon-Wiener Index					3.01
2	1	<i>Tristania rufescens</i>	0.2375	-2.0740	-0.4926
	2	<i>Vaccinium sprengelii</i>	0.1500	-2.7370	-0.4105
	3	<i>Pinus kesiya</i>	0.1458	-2.7776	-0.4051
	4	<i>Quercus vestita</i>	0.1167	-3.0995	-0.3616
	5	<i>Lithocarpus elegans</i>	0.0958	-3.3833	-0.3242
	6	<i>Schima wallichii</i>	0.0500	-4.3219	-0.2161
	7	<i>Castanopsis purpurea</i>	0.0375	-4.7370	-0.1776
	8	<i>Lithocarpus sootepensis</i>	0.0375	-4.7370	-0.1776
	9	<i>Wendlandia tinctoria</i>	0.0292	-5.0995	-0.1487
	10	<i>Helicia nilagirica</i>	0.0250	-5.3219	-0.1330
	11	<i>Myrica esculenta</i>	0.0167	-5.9069	-0.0984
	12	<i>Albizia odoratissima</i>	0.0083	-6.9069	-0.0576
	13	<i>Glochidion sphaerogynum</i>	0.0083	-6.9069	-0.0576
	14	<i>Eurya nitida</i>	0.0083	-6.9069	-0.0576
	15	<i>Anneslea fragrans</i>	0.0083	-6.9069	-0.0576
	16	<i>Castanopsis acuminatissima</i>	0.0042	-7.9069	-0.0329
	17	<i>Castanopsis diversifolia</i>	0.0042	-7.9069	-0.0329
	18	<i>Betula alnoides</i>	0.0042	-7.9069	-0.0329
	19	<i>Engelhardtia spicata</i>	0.0042	-7.9069	-0.0329
	20	<i>Craibiodendron stellatum</i>	0.0042	-7.9069	-0.0329
	21	<i>Semecarpus albescens</i>	0.0042	-7.9069	-0.0329
Total			1.00	-119.26	-3.37
Shannon-Wiener Index					3.37

Table 3-10 (Continued)

FF	No	Species	$p_i$	$\log_2 p_i$	$p_i * \log_2 p_i$
3	1	<i>Phyllanthus emblica</i>	0.1256	-2.9928	-0.3760
	2	<i>Pinus kesiya</i>	0.0955	-3.3887	-0.3235
	3	<i>Schima wallichii</i>	0.0854	-3.5492	-0.3032
	4	<i>Lithocarpus fenestratus</i>	0.0503	-4.3147	-0.2168
	5	<i>Lithocarpus elegans</i>	0.0503	-4.3147	-0.2168
	6	<i>Dalbergia cultrata</i>	0.0503	-4.3147	-0.2168
	7	<i>Ternstroemia gymnanthera</i>	0.0503	-4.3147	-0.2168
	8	<i>Engelhardtia spicata</i>	0.0503	-4.3147	-0.2168
	9	<i>Stereospermum neuranthum</i>	0.0503	-4.3147	-0.2168
	10	<i>Callicarpa arborea</i>	0.0503	-4.3147	-0.2168
	11	<i>Castanopsis purpurea</i>	0.0352	-4.8293	-0.1699
	12	<i>Tristania rufescens</i>	0.0352	-4.8293	-0.1699
	13	<i>Glochidion sphaerogynum</i>	0.0251	-5.3147	-0.1335
	14	<i>Quercus vestita</i>	0.0201	-5.6366	-0.1133
	15	<i>Craibiodendron stellatum</i>	0.0201	-5.6366	-0.1133
	16	<i>Diospyros glandulosa</i>	0.0151	-6.0517	-0.0912
	17	<i>Wendlandia tinctoria</i>	0.0151	-6.0517	-0.0912
	18	<i>Castanopsis acuminatissima</i>	0.0101	-6.6366	-0.0667
	19	<i>Catunaregam tomentosa</i>	0.0101	-6.6366	-0.0667
	20	<i>Erythrina subumbrans</i>	0.0101	-6.6366	-0.0667
	21	<i>Colona flagrocarpa</i>	0.0101	-6.6366	-0.0667
	22	<i>Syzygium albiflorum</i>	0.0101	-6.6366	-0.0667
	23	<i>Semecarpus albescens</i>	0.0101	-6.6366	-0.0667
	24	<i>Litsea glutinosa</i>	0.0101	-6.6366	-0.0667
	25	<i>Helicia terminalis</i>	0.0101	-6.6366	-0.0667
	26	<i>Aporosa villosa</i>	0.0101	-6.6366	-0.0667
	27	<i>Engelhardtia serrata</i>	0.0101	-6.6366	-0.0667
	28	<i>Castanopsis diversifolia</i>	0.0050	-7.6366	-0.0384
	29	<i>Albizia odoratissima</i>	0.0050	-7.6366	-0.0384
	30	<i>Albizia chinensis</i>	0.0050	-7.6366	-0.0384
	31	<i>Styrax benzoides</i>	0.0050	-7.6366	-0.0384
	32	<i>Milletia pachycarpa</i>	0.0050	-7.6366	-0.0384
	33	<i>Bombax anceps</i>	0.0050	-7.6366	-0.0384
	34	<i>Ilex umbellulata</i>	0.0050	-7.6366	-0.0384
	35	<i>Eurya nitida</i>	0.0050	-7.6366	-0.0384
	36	<i>Ampelocissus martinii</i>	0.0050	-7.6366	-0.0384
	37	<i>Vaccinium sprengelii</i>	0.0050	-7.6366	-0.0384
	38	<i>Terminalia chebula</i>	0.0050	-7.6366	-0.0384
	39	<i>Phoebe paniculata</i>	0.0050	-7.6366	-0.0384
	40	<i>Beilschmiedia gammieana</i>	0.0050	-7.6366	-0.0384
	41	<i>Syzygium cumini</i>	0.0050	-7.6366	-0.0384
	42	<i>Helicia nilagirica</i>	0.0050	-7.6366	-0.0384
Total			1.00	-259.40	-4.65
Shannon-Wiener Index					4.65

Table 3-10 (Continued)

FF	No	Species	$p_i$	$\log_2 p_i$	$p_i \cdot \log_2 p_i$
4	1	<i>Vaccinium sprengelii</i>	0.2966	-1.7536	-0.5200
	2	<i>Castanopsis acuminatissima</i>	0.1103	-3.1799	-0.3509
	3	<i>Pinus kesiya</i>	0.0966	-3.3726	-0.3256
	4	<i>Tristania rufescens</i>	0.0828	-3.5949	-0.2975
	5	<i>Craibiodendron stellatum</i>	0.0828	-3.5949	-0.2975
	6	<i>Anneslea fragrans</i>	0.0828	-3.5949	-0.2975
	7	<i>Quercus brandisiana</i>	0.0414	-4.5949	-0.1901
	8	<i>Ternstroemia gymnanthera</i>	0.0414	-4.5949	-0.1901
	9	<i>Styrax benzoides</i>	0.0276	-5.1799	-0.1429
	10	<i>Semecarpus albescens</i>	0.0276	-5.1799	-0.1429
	11	<i>Castanopsis purpurea</i>	0.0207	-5.5949	-0.1158
	12	<i>Schima wallichii</i>	0.0207	-5.5949	-0.1158
	13	<i>Lithocarpus polystachyus</i>	0.0138	-6.1799	-0.0852
	14	<i>Shorea roxburghii</i>	0.0138	-6.1799	-0.0852
	15	<i>Dalbergia cultrata</i>	0.0069	-7.1799	-0.0495
	16	<i>Pavetta tomentosa</i>	0.0069	-7.1799	-0.0495
	17	<i>Wendlandia tinctoria</i>	0.0069	-7.1799	-0.0495
	18	<i>Glochidion sphaerogynum</i>	0.0069	-7.1799	-0.0495
	19	<i>Myrica esculenta</i>	0.0069	-7.1799	-0.0495
	20	<i>Viburnum sambucinum</i>	0.0069	-7.1799	-0.0495
Total			1.00	-105.27	-3.45
Shannon-Wiener Index					3.45
5	1	<i>Tristania rufescens</i>	0.1893	-2.4009	-0.4546
	2	<i>Castanopsis acuminatissima</i>	0.1479	-2.7570	-0.4078
	3	<i>Vaccinium sprengelii</i>	0.1420	-2.8159	-0.3999
	4	<i>Anneslea fragrans</i>	0.1065	-3.2310	-0.3441
	5	<i>Quercus brandisiana</i>	0.0710	-3.8159	-0.2710
	6	<i>Craibiodendron stellatum</i>	0.0651	-3.9414	-0.2565
	7	<i>Semecarpus albescens</i>	0.0533	-4.2310	-0.2253
	8	<i>Castanopsis purpurea</i>	0.0355	-4.8159	-0.1710
	9	<i>Styrax benzoides</i>	0.0237	-5.4009	-0.1278
	10	<i>Wendlandia tinctoria</i>	0.0237	-5.4009	-0.1278
	11	<i>Pinus kesiya</i>	0.0237	-5.4009	-0.1278
	12	<i>Aporosa villosa</i>	0.0237	-5.4009	-0.1278
	13	<i>Dalbergia cultrata</i>	0.0178	-5.8159	-0.1032
	14	<i>Viburnum sambucinum</i>	0.0178	-5.8159	-0.1032
	15	<i>Lithocarpus polystachyus</i>	0.0118	-6.4009	-0.0758
	16	<i>Ternstroemia gymnanthera</i>	0.0118	-6.4009	-0.0758
	17	<i>Schima wallichii</i>	0.0118	-6.4009	-0.0758
	18	<i>Lithocarpus elegans</i>	0.0059	-7.4009	-0.0438
	19	<i>Quercus vestita</i>	0.0059	-7.4009	-0.0438
	20	<i>Canarium subulatum</i>	0.0059	-7.4009	-0.0438
	21	<i>Phyllanthus emblica</i>	0.0059	-7.4009	-0.0438
Total			1.00	-110.05	-3.65
Shannon-Wiener Index					3.65

Table 3-10 (Continued)

FF	No	Species	$p_i$	$\log_2 p_i$	$p_i * \log_2 p_i$
6	1	<i>Tristania rufescens</i>	0.1910	-2.3883	-0.4562
	2	<i>Vaccinium sprengelii</i>	0.1461	-2.7753	-0.4054
	3	<i>Castanopsis acuminatissima</i>	0.1348	-2.8908	-0.3898
	4	<i>Craibiodendron stellatum</i>	0.0787	-3.6684	-0.2885
	5	<i>Pinus kesiya</i>	0.0787	-3.6684	-0.2885
	6	<i>Anneslea fragrans</i>	0.0787	-3.6684	-0.2885
	7	<i>Wendlandia tinctoria</i>	0.0674	-3.8908	-0.2623
	8	<i>Lithocarpus fenestratus</i>	0.0449	-4.4757	-0.2012
	9	<i>Semecarpus albescens</i>	0.0449	-4.4757	-0.2012
	10	<i>Castanopsis purpurea</i>	0.0337	-4.8908	-0.1649
	11	<i>Lithocarpus polystachyus</i>	0.0337	-4.8908	-0.1649
	12	<i>Styrax benzoides</i>	0.0225	-5.4757	-0.1231
	13	<i>Quercus brandisiana</i>	0.0112	-6.4757	-0.0728
	14	<i>Quercus vestita</i>	0.0112	-6.4757	-0.0728
	15	<i>Aporosa villosa</i>	0.0112	-6.4757	-0.0728
	16	<i>Viburnum sambucinum</i>	0.0112	-6.4757	-0.0728
Total			1.00	-73.06	-3.53
Shannon-Wiener Index					3.53
7	1	<i>Vaccinium sprengelii</i>	0.1216	-3.0395	-0.3697
	2	<i>Viburnum sambucinum</i>	0.1126	-3.1506	-0.3548
	3	<i>Castanopsis acuminatissima</i>	0.1036	-3.2709	-0.3389
	4	<i>Tristania rufescens</i>	0.0766	-3.7070	-0.2839
	5	<i>Styrax benzoides</i>	0.0676	-3.8875	-0.2627
	6	<i>Pinus kesiya</i>	0.0586	-4.0940	-0.2397
	7	<i>Dalbergia cultrata</i>	0.0541	-4.2095	-0.2275
	8	<i>Semecarpus albescens</i>	0.0495	-4.3350	-0.2148
	9	<i>Craibiodendron stellatum</i>	0.0405	-4.6245	-0.1875
	10	<i>Phyllanthus emblica</i>	0.0270	-5.2095	-0.1408
	11	<i>Helicia nilagirica</i>	0.0270	-5.2095	-0.1408
	12	<i>Aporosa villosa</i>	0.0270	-5.2095	-0.1408
	13	<i>Lithocarpus polystachyus</i>	0.0225	-5.4725	-0.1233
	14	<i>Glochidion sphaerogynum</i>	0.0225	-5.4725	-0.1233
	15	<i>Anneslea fragrans</i>	0.0225	-5.4725	-0.1233
	16	<i>Quercus brandisiana</i>	0.0180	-5.7944	-0.1044
	17	<i>Ternstroemia gymnanthera</i>	0.0180	-5.7944	-0.1044
	18	<i>Diospyros glandulosa</i>	0.0135	-6.2095	-0.0839
	19	<i>Quercus vestita</i>	0.0135	-6.2095	-0.0839
	20	<i>Wendlandia tinctoria</i>	0.0135	-6.2095	-0.0839
	21	<i>Schima wallichii</i>	0.0135	-6.2095	-0.0839
	22	<i>Castanopsis purpurea</i>	0.0090	-6.7944	-0.0612
	23	<i>Lithocarpus elegans</i>	0.0090	-6.7944	-0.0612
	24	<i>Catunaregam tomentosa</i>	0.0090	-6.7944	-0.0612
	25	<i>Rhus javanica</i>	0.0090	-6.7944	-0.0612
	26	<i>Lithocarpus fenestratus</i>	0.0045	-7.7944	-0.0351
	27	<i>Albizia chinensis</i>	0.0045	-7.7944	-0.0351
	28	<i>Stereospermum neuranthum</i>	0.0045	-7.7944	-0.0351
	29	<i>Eurya nitida</i>	0.0045	-7.7944	-0.0351
	30	<i>Phoebe paniculata</i>	0.0045	-7.7944	-0.0351
	31	<i>Terminalia chebula</i>	0.0045	-7.7944	-0.0351
	32	<i>Vernonia volkamerifolia</i>	0.0045	-7.7944	-0.0351
	33	<i>Dillenia aurea</i>	0.0045	-7.7944	-0.0351
	34	<i>Helicia terminalis</i>	0.0045	-7.7944	-0.0351
Total			1.00	-200.12	-4.38
Shannon-Wiener Index					4.38

Table 3-10 (Continued)

FF	No	Species	$p_i$	$\log_2 p_i$	$p_i * \log_2 p_i$
8	1	<i>Tristania rufescens</i>	0.2933	-1.7694	-0.5190
	2	<i>Vaccinium sprengelii</i>	0.1200	-3.0589	-0.3671
	3	<i>Castanopsis acuminatissima</i>	0.1000	-3.3219	-0.3322
	4	<i>Quercus brandisiana</i>	0.0733	-3.7694	-0.2764
	5	<i>Lithocarpus polystachyus</i>	0.0467	-4.4215	-0.2063
	6	<i>Craibiodendron stellatum</i>	0.0467	-4.4215	-0.2063
	7	<i>Pinus kesiya</i>	0.0467	-4.4215	-0.2063
	8	<i>Dalbergia cultrata</i>	0.0400	-4.6439	-0.1858
	9	<i>Phyllanthus emblica</i>	0.0333	-4.9069	-0.1636
	10	<i>Aporosa villosa</i>	0.0333	-4.9069	-0.1636
	11	<i>Quercus vestita</i>	0.0200	-5.6439	-0.1129
	12	<i>Semecarpus albescens</i>	0.0200	-5.6439	-0.1129
	13	<i>Quercus kingiana</i>	0.0133	-6.2288	-0.0831
	14	<i>Castanopsis diversifolia</i>	0.0133	-6.2288	-0.0831
	15	<i>Gardenia sootepensis</i>	0.0133	-6.2288	-0.0831
	16	<i>Dolichandrone serrulata</i>	0.0133	-6.2288	-0.0831
	17	<i>Stereospermum neuranthum</i>	0.0133	-6.2288	-0.0831
	18	<i>Glochidion sphaerogynum</i>	0.0133	-6.2288	-0.0831
	19	<i>Lithocarpus fenestratus</i>	0.0067	-7.2288	-0.0482
	20	<i>Lithocarpus elegans</i>	0.0067	-7.2288	-0.0482
	21	<i>Styrax benzoides</i>	0.0067	-7.2288	-0.0482
	22	<i>Engelhardtia spicata</i>	0.0067	-7.2288	-0.0482
	23	<i>Erythrina subumbrans</i>	0.0067	-7.2288	-0.0482
	24	<i>Dillenia aurea</i>	0.0067	-7.2288	-0.0482
	25	<i>Anneslea fragrans</i>	0.0067	-7.2288	-0.0482
Total			1.00	-138.90	-3.69
Shannon-Wiener Index					3.69

Table 3-10 (Continued)

FF	No	Species	$p_i$	$\log_2 p_i$	$p_i * \log_2 p_i$
9	1	<i>Quercus brandisiana</i>	0.1676	-2.5772	-0.4319
	2	<i>Tristania rufescens</i>	0.1622	-2.6245	-0.4256
	3	<i>Castanopsis acuminatissima</i>	0.1081	-3.2095	-0.3470
	4	<i>Vaccinium sprengelii</i>	0.0865	-3.5314	-0.3054
	5	<i>Semecarpus albescens</i>	0.0703	-3.8309	-0.2692
	6	<i>Craibiodendron stellatum</i>	0.0486	-4.3615	-0.2122
	7	<i>Pinus kesiya</i>	0.0378	-4.7240	-0.1787
	8	<i>Viburnum sambucinum</i>	0.0324	-4.9464	-0.1604
	9	<i>Castanopsis purpurea</i>	0.0270	-5.2095	-0.1408
	10	<i>Wendlandia tinctoria</i>	0.0270	-5.2095	-0.1408
	11	<i>Aporosa villosa</i>	0.0270	-5.2095	-0.1408
	12	<i>Lithocarpus sootepensis</i>	0.0216	-5.5314	-0.1196
	13	<i>Schima wallichii</i>	0.0216	-5.5314	-0.1196
	14	<i>Glochidion hirsutum</i>	0.0216	-5.5314	-0.1196
	15	<i>Phyllanthus emblica</i>	0.0216	-5.5314	-0.1196
	16	<i>Lithocarpus polystachyus</i>	0.0162	-5.9464	-0.0964
	17	<i>Anneslea fragrans</i>	0.0162	-5.9464	-0.0964
	18	<i>Helicia nilagirica</i>	0.0162	-5.9464	-0.0964
	19	<i>Quercus vestita</i>	0.0108	-6.5314	-0.0706
	20	<i>Glochidion sphaerogynum</i>	0.0108	-6.5314	-0.0706
	21	<i>Quercus kingiana</i>	0.0054	-7.5314	-0.0407
	22	<i>Lithocarpus fenestratus</i>	0.0054	-7.5314	-0.0407
	23	<i>Styrax benzoides</i>	0.0054	-7.5314	-0.0407
	24	<i>Pavetta tomentosa</i>	0.0054	-7.5314	-0.0407
	25	<i>Gardenia sootepensis</i>	0.0054	-7.5314	-0.0407
	26	<i>Catunaregam tomentosa</i>	0.0054	-7.5314	-0.0407
	27	<i>Dolichandrone serrulata</i>	0.0054	-7.5314	-0.0407
	28	<i>Archidendron clypearia</i>	0.0054	-7.5314	-0.0407
	29	<i>Artocarpus gomezianus</i>	0.0054	-7.5314	-0.0407
Total			1.00	-166.24	-4.03
Shannon-Wiener Index					4.03



Table 3-10 (Continued)

FF	No	Species	$p_i$	$\log_2 p_i$	$p_i * \log_2 p_i$
10	1	<i>Vaccinium sprengelii</i>	0.1572	-2.6690	-0.4197
	2	<i>Pinus kesiya</i>	0.1384	-2.8535	-0.3948
	3	<i>Tristania rufescens</i>	0.1258	-2.9910	-0.3762
	4	<i>Quercus brandisiana</i>	0.1195	-3.0650	-0.3663
	5	<i>Craibiodendron stellatum</i>	0.0818	-3.6124	-0.2954
	6	<i>Castanopsis acuminatissima</i>	0.0629	-3.9910	-0.2510
	7	<i>Dalbergia cultrata</i>	0.0503	-4.3129	-0.2170
	8	<i>Lithocarpus elegans</i>	0.0377	-4.7279	-0.1784
	9	<i>Lithocarpus sootepensis</i>	0.0252	-5.3129	-0.1337
	10	<i>Phyllanthus emblica</i>	0.0252	-5.3129	-0.1337
	11	<i>Glochidion sphaerogynum</i>	0.0252	-5.3129	-0.1337
	12	<i>Aporosa villosa</i>	0.0252	-5.3129	-0.1337
	13	<i>Quercus kingiana</i>	0.0189	-5.7279	-0.1081
	14	<i>Anneslea fragrans</i>	0.0189	-5.7279	-0.1081
	15	<i>Glochidion hirsutum</i>	0.0126	-6.3129	-0.0794
	16	<i>Terminalia chebula</i>	0.0126	-6.3129	-0.0794
	17	<i>Quercus vestita</i>	0.0063	-7.3129	-0.0460
	18	<i>Albizia odoratissima</i>	0.0063	-7.3129	-0.0460
	19	<i>Wendlandia tinctoria</i>	0.0063	-7.3129	-0.0460
	20	<i>Catunaregam tomentosa</i>	0.0063	-7.3129	-0.0460
	21	<i>Stereospermum neuranthum</i>	0.0063	-7.3129	-0.0460
	22	<i>Celastrus paniculata</i>	0.0063	-7.3129	-0.0460
	23	<i>Rhus javanica</i>	0.0063	-7.3129	-0.0460
	24	<i>Semecarpus albescens</i>	0.0063	-7.3129	-0.0460
	25	<i>Gluta usitata</i>	0.0063	-7.3129	-0.0460
	26	<i>Rapanea porteriana</i>	0.0063	-7.3129	-0.0460
Total			1.00	-146.68	-3.87
Shannon-Wiener Index					3.87

Table 3-10 (Continued)

FF	No	Species	$p_i$	$\log_2 p_i$	$p_i * \log_2 p_i$
11	1	<i>Wendlandia tinctoria</i>	0.3286	-1.6055	-0.5276
	2	<i>Lithocarpus elegans</i>	0.0601	-4.0572	-0.2437
	3	<i>Aporosa villosa</i>	0.0530	-4.2378	-0.2246
	4	<i>Castanopsis diversifolia</i>	0.0389	-4.6852	-0.1821
	5	<i>Dalbergia cultrata</i>	0.0389	-4.6852	-0.1821
	6	<i>Phyllanthus emblica</i>	0.0353	-4.8227	-0.1704
	7	<i>Eriolaena candollei</i>	0.0318	-4.9747	-0.1582
	8	<i>Turpinia cochinchinensis</i>	0.0318	-4.9747	-0.1582
	9	<i>Ternstroemia gymnanthera</i>	0.0283	-5.1447	-0.1454
	10	<i>Phoebe paniculata</i>	0.0283	-5.1447	-0.1454
	11	<i>Styrax benzoides</i>	0.0247	-5.3373	-0.1320
	12	<i>Engelhardtia spicata</i>	0.0247	-5.3373	-0.1320
	13	<i>Castanopsis purpurea</i>	0.0212	-5.5597	-0.1179
	14	<i>Canthium sp.</i>	0.0212	-5.5597	-0.1179
	15	<i>Schima wallichii</i>	0.0212	-5.5597	-0.1179
	16	<i>Pterospermum acerifolium</i>	0.0212	-5.5597	-0.1179
	17	<i>Helicia terminalis</i>	0.0212	-5.5597	-0.1179
	18	<i>Rhus javanica</i>	0.0177	-5.8227	-0.1029
	19	<i>Castanopsis acuminatissima</i>	0.0141	-6.1447	-0.0869
	20	<i>Glochidion acuminatum</i>	0.0141	-6.1447	-0.0869
	21	<i>Helicia nilagirica</i>	0.0141	-6.1447	-0.0869
	22	<i>Garuga pinnata</i>	0.0106	-6.5597	-0.0695
	23	<i>Protium serratum</i>	0.0106	-6.5597	-0.0695
	24	<i>Antidesma acidum</i>	0.0106	-6.5597	-0.0695
	25	<i>Stereospermum neuranthum</i>	0.0071	-7.1447	-0.0505
	26	<i>Xantolis cambodiana</i>	0.0071	-7.1447	-0.0505
	27	<i>Dalbergia velutina</i>	0.0071	-7.1447	-0.0505
	28	<i>Buchanania lanzan</i>	0.0071	-7.1447	-0.0505
	29	<i>Glochidion sphaerogynum</i>	0.0071	-7.1447	-0.0505
	30	<i>Vernonia volkamerifolia</i>	0.0071	-7.1447	-0.0505
	31	<i>Diospyros glandulosa</i>	0.0035	-8.1447	-0.0288
	32	<i>Albizia odoratissima</i>	0.0035	-8.1447	-0.0288
	33	<i>Radermachera ignea</i>	0.0035	-8.1447	-0.0288
	34	<i>Milletia pachycarpa</i>	0.0035	-8.1447	-0.0288
	35	<i>Bombax anceps</i>	0.0035	-8.1447	-0.0288
	36	<i>Mallotus philippensis</i>	0.0035	-8.1447	-0.0288
	37	<i>Kydia calycina</i>	0.0035	-8.1447	-0.0288
	38	<i>Dillenia aurea</i>	0.0035	-8.1447	-0.0288
	39	<i>Syzygium cumini</i>	0.0035	-8.1447	-0.0288
	40	<i>Viburnum sambucinum</i>	0.0035	-8.1447	-0.0288
Total			1.00	-251.06	-4.15
Shannon-Wiener Index					4.15

Table 3-10 (Continued)

FF	No	Species	$p_i$	$\log_2 p_i$	$p_i * \log_2 p_i$
12	1	<i>Ternstroemia gymnanthera</i>	0.1194	-3.0661	-0.3661
	2	<i>Wendlandia tinctoria</i>	0.1194	-3.0661	-0.3661
	3	<i>Helicia nilagirica</i>	0.1144	-3.1275	-0.3579
	4	<i>Schima wallichii</i>	0.1095	-3.1916	-0.3493
	5	<i>Castanopsis acuminatissima</i>	0.0647	-3.9506	-0.2555
	6	<i>Engelhardtia spicata</i>	0.0647	-3.9506	-0.2555
	7	<i>Castanopsis diversifolia</i>	0.0597	-4.0661	-0.2428
	8	<i>Lithocarpus elegans</i>	0.0348	-4.8437	-0.1687
	9	<i>Phoebe paniculata</i>	0.0299	-5.0661	-0.1512
	10	<i>Dillenia aurea</i>	0.0299	-5.0661	-0.1512
	11	<i>Phyllanthus emblica</i>	0.0249	-5.3291	-0.1326
	12	<i>Glochidion sphaerogynum</i>	0.0249	-5.3291	-0.1326
	13	<i>Olea salicifolia</i>	0.0199	-5.6511	-0.1125
	14	<i>Diospyros glandulosa</i>	0.0149	-6.0661	-0.0905
	15	<i>Albizia chinensis</i>	0.0149	-6.0661	-0.0905
	16	<i>Ilex umbellulata</i>	0.0149	-6.0661	-0.0905
	17	<i>Elaeocarpus stipularis</i>	0.0149	-6.0661	-0.0905
	18	<i>Beilschmiedia gammieana</i>	0.0149	-6.0661	-0.0905
	19	<i>Engelhardtia serrata</i>	0.0149	-6.0661	-0.0905
	20	<i>Eurya nitida</i>	0.0100	-6.6511	-0.0662
	21	<i>Pinus kesiya</i>	0.0100	-6.6511	-0.0662
	22	<i>Myrica esculenta</i>	0.0100	-6.6511	-0.0662
	23	<i>Dalbergia cultrata</i>	0.0050	-7.6511	-0.0381
	24	<i>Garcinia merguensis</i>	0.0050	-7.6511	-0.0381
	25	<i>Gardenia sootepensis</i>	0.0050	-7.6511	-0.0381
	26	<i>Entada rheedii</i>	0.0050	-7.6511	-0.0381
	27	<i>Xantolis cambodiana</i>	0.0050	-7.6511	-0.0381
	28	<i>Turpinia cochinchinensis</i>	0.0050	-7.6511	-0.0381
	29	<i>Buchanania lanzan</i>	0.0050	-7.6511	-0.0381
	30	<i>Syzygium albiflorum</i>	0.0050	-7.6511	-0.0381
	31	<i>Pyrenaria diospyricarpa</i>	0.0050	-7.6511	-0.0381
	32	<i>Vernonia volkamerifolia</i>	0.0050	-7.6511	-0.0381
	33	<i>Ampelocissus martinii</i>	0.0050	-7.6511	-0.0381
	34	<i>Phoebe cathia</i>	0.0050	-7.6511	-0.0381
	35	<i>Litsea glutinosa</i>	0.0050	-7.6511	-0.0381
Total			1.00	-211.52	-4.28
Shannon-Wiener Index					4.28

Table 3-10 (Continued)

FF	No	Species	$p_i$	$\log_2 p_i$	$p_i * \log_2 p_i$
13	1	<i>Eurya nitida</i>	0.1302	-2.9414	-0.3829
	2	<i>Ternstroemia gymnanthera</i>	0.1124	-3.1530	-0.3545
	3	<i>Anneslea fragrans</i>	0.0769	-3.7004	-0.2846
	4	<i>Castanopsis diversifolia</i>	0.0710	-3.8159	-0.2710
	5	<i>Schima wallichii</i>	0.0651	-3.9414	-0.2565
	6	<i>Helicia nilagirica</i>	0.0533	-4.2310	-0.2253
	7	<i>Wendlandia tinctoria</i>	0.0473	-4.4009	-0.2083
	8	<i>Rapanea porteriana</i>	0.0473	-4.4009	-0.2083
	9	<i>Diospyros glandulosa</i>	0.0414	-4.5935	-0.1903
	10	<i>Engelhardtia spicata</i>	0.0355	-4.8159	-0.1710
	11	<i>Syzygium albiflorum</i>	0.0355	-4.8159	-0.1710
	12	<i>Trichilla connaroides</i>	0.0237	-5.4009	-0.1278
	13	<i>Pinus kesiya</i>	0.0237	-5.4009	-0.1278
	14	<i>Beilschmiedia gammieana</i>	0.0237	-5.4009	-0.1278
	15	<i>Lindera metcalfiana</i>	0.0178	-5.8159	-0.1032
	16	<i>Ilex umbellulata</i>	0.0178	-5.8159	-0.1032
	17	<i>Archidendron clypearia</i>	0.0178	-5.8159	-0.1032
	18	<i>Myrica esculenta</i>	0.0178	-5.8159	-0.1032
	19	<i>Quercus semiserrata</i>	0.0118	-6.4009	-0.0758
	20	<i>Magnolia henryi</i>	0.0118	-6.4009	-0.0758
	21	<i>Glochidion sphaerogynum</i>	0.0118	-6.4009	-0.0758
	22	<i>Ampelocissus martinii</i>	0.0118	-6.4009	-0.0758
	23	<i>Symplocos racemosa</i>	0.0118	-6.4009	-0.0758
	24	<i>Castanopsis armata</i>	0.0059	-7.4009	-0.0438
	25	<i>Mussaenda sandariana</i>	0.0059	-7.4009	-0.0438
	26	<i>Garcinia merguensis</i>	0.0059	-7.4009	-0.0438
	27	<i>Glochidion acuminatum</i>	0.0059	-7.4009	-0.0438
	28	<i>Ficus</i> sp.	0.0059	-7.4009	-0.0438
	29	<i>Xantolis cambodiana</i>	0.0059	-7.4009	-0.0438
	30	<i>Eriolaena candollei</i>	0.0059	-7.4009	-0.0438
	31	<i>Phyllanthus emblica</i>	0.0059	-7.4009	-0.0438
	32	<i>Phoebe paniculata</i>	0.0059	-7.4009	-0.0438
	33	<i>Dillenia aurea</i>	0.0059	-7.4009	-0.0438
	34	<i>Schefflera bengalensis</i>	0.0059	-7.4009	-0.0438
	35	<i>Helicia terminalis</i>	0.0059	-7.4009	-0.0438
	36	<i>Cinnamomum iners</i>	0.0059	-7.4009	-0.0438
	37	<i>Engelhardtia serrata</i>	0.0059	-7.4009	-0.0438
Total			1.00	-219.89	-4.51
Shannon-Wiener Index					4.51

Table 3-10 (Continued)

FF	No	Species	$p_i$	$\log_2 p_i$	$p_i * \log_2 p_i$
14	1	<i>Eurya nitida</i>	0.1563	-2.6781	-0.4184
	2	<i>Schima wallichii</i>	0.1211	-3.0458	-0.3688
	3	<i>Phoebe paniculata</i>	0.1016	-3.2996	-0.3351
	4	<i>Glochidion acuminatum</i>	0.0859	-3.5406	-0.3043
	5	<i>Quercus semiserrata</i>	0.0664	-3.9125	-0.2598
	6	<i>Pyrenaria diospyricarpa</i>	0.0547	-4.1926	-0.2293
	7	<i>Ternstroemia gymnanthera</i>	0.0469	-4.4150	-0.2070
	8	<i>Engelhardtia spicata</i>	0.0430	-4.5406	-0.1951
	9	<i>Lindera metcalfiana</i>	0.0430	-4.5406	-0.1951
	10	<i>Cinnamomum porrectum</i>	0.0273	-5.1926	-0.1420
	11	<i>Diospyros glandulosa</i>	0.0234	-5.4150	-0.1269
	12	<i>Phoebe cathia</i>	0.0234	-5.4150	-0.1269
	13	<i>Helicia nilagirica</i>	0.0234	-5.4150	-0.1269
	14	<i>Wendlandia tinctoria</i>	0.0195	-5.6781	-0.1109
	15	<i>Saurauia roxburghii</i>	0.0195	-5.6781	-0.1109
	16	<i>Mussaenda sandariana</i>	0.0156	-6.0000	-0.0938
	17	<i>Castanopsis acuminatissima</i>	0.0117	-6.4150	-0.0752
	18	<i>Dillenia aurea</i>	0.0117	-6.4150	-0.0752
	19	<i>Litsea semecarpifolia</i>	0.0117	-6.4150	-0.0752
	20	<i>Sarcosperma arboreum</i>	0.0117	-6.4150	-0.0752
	21	<i>Helicia terminalis</i>	0.0117	-6.4150	-0.0752
	22	<i>Glochidion sphaerogynum</i>	0.0117	-6.4150	-0.0752
	23	<i>Turpinia cochinchinensis</i>	0.0078	-7.0000	-0.0547
	24	<i>Archidendron clypearia</i>	0.0078	-7.0000	-0.0547
	25	<i>Anneslea fragrans</i>	0.0078	-7.0000	-0.0547
	26	<i>Symplocos racemosa</i>	0.0078	-7.0000	-0.0547
	27	<i>Melastoma malabathricum</i>	0.0078	-7.0000	-0.0547
	28	<i>Albizia chinensis</i>	0.0039	-8.0000	-0.0313
	29	<i>Magnolia henryi</i>	0.0039	-8.0000	-0.0313
	30	<i>Pinus kesiya</i>	0.0039	-8.0000	-0.0313
	31	<i>Combretum punctatum</i>	0.0039	-8.0000	-0.0313
	32	<i>Litsea glutinosa</i>	0.0039	-8.0000	-0.0313
Total			1.00	-186.45	-4.23
Shannon-Wiener Index					4.23

Table 3-10 (Continued)

FF	No	Species	$p_i$	$\log_2 p_i$	$p_i * \log_2 p_i$
15	1	<i>Schima wallichii</i>	0.2214	-2.1751	-0.4816
	2	<i>Glochidion acuminatum</i>	0.1500	-2.7370	-0.4105
	3	<i>Castanopsis diversifolia</i>	0.1357	-2.8814	-0.3910
	4	<i>Engelhardtia spicata</i>	0.0857	-3.5443	-0.3038
	5	<i>Wendlandia tinctoria</i>	0.0786	-3.6699	-0.2883
	6	<i>Milletia pachycarpa</i>	0.0357	-4.8074	-0.1717
	7	<i>Diospyros glandulosa</i>	0.0286	-5.1293	-0.1466
	8	<i>Saurauia roxburghii</i>	0.0286	-5.1293	-0.1466
	9	<i>Glochidion sphaerogynum</i>	0.0214	-5.5443	-0.1188
	10	<i>Pyrenaria diospyricarpa</i>	0.0214	-5.5443	-0.1188
	11	<i>Lithocarpus lindleyanus</i>	0.0143	-6.1293	-0.0876
	12	<i>Lindera metcalfiana</i>	0.0143	-6.1293	-0.0876
	13	<i>Rhus javanica</i>	0.0143	-6.1293	-0.0876
	14	<i>Rapanea porteriana</i>	0.0143	-6.1293	-0.0876
	15	<i>Helicia terminalis</i>	0.0143	-6.1293	-0.0876
	16	<i>Albizia odoratissima</i>	0.0071	-7.1293	-0.0509
	17	<i>Styrax benzoides</i>	0.0071	-7.1293	-0.0509
	18	<i>Ternstroemia gymnanthera</i>	0.0071	-7.1293	-0.0509
	19	<i>Vitex pinnata</i>	0.0071	-7.1293	-0.0509
	20	<i>Eriolaena candollei</i>	0.0071	-7.1293	-0.0509
	21	<i>Phyllanthus emblica</i>	0.0071	-7.1293	-0.0509
	22	<i>Archidendron clypearia</i>	0.0071	-7.1293	-0.0509
	23	<i>Elaeocarpus stipularis</i>	0.0071	-7.1293	-0.0509
	24	<i>Eurya nitida</i>	0.0071	-7.1293	-0.0509
	25	<i>Trichilla connaroides</i>	0.0071	-7.1293	-0.0509
	26	<i>Phoebe cathia</i>	0.0071	-7.1293	-0.0509
	27	<i>Beilschmiedia gammieana</i>	0.0071	-7.1293	-0.0509
	28	<i>Myrica esculenta</i>	0.0071	-7.1293	-0.0509
	29	<i>Litsea glutinosa</i>	0.0071	-7.1293	-0.0509
	30	<i>Helicia nilagirica</i>	0.0071	-7.1293	-0.0509
	31	<i>Symplocos racemosa</i>	0.0071	-7.1293	-0.0509
	32	<i>Eurya acuminata</i>	0.0071	-7.1293	-0.0509
Total			1.00	-193.01	-3.88
Shannon-Wiener Index					3.88



### (5) Similarity

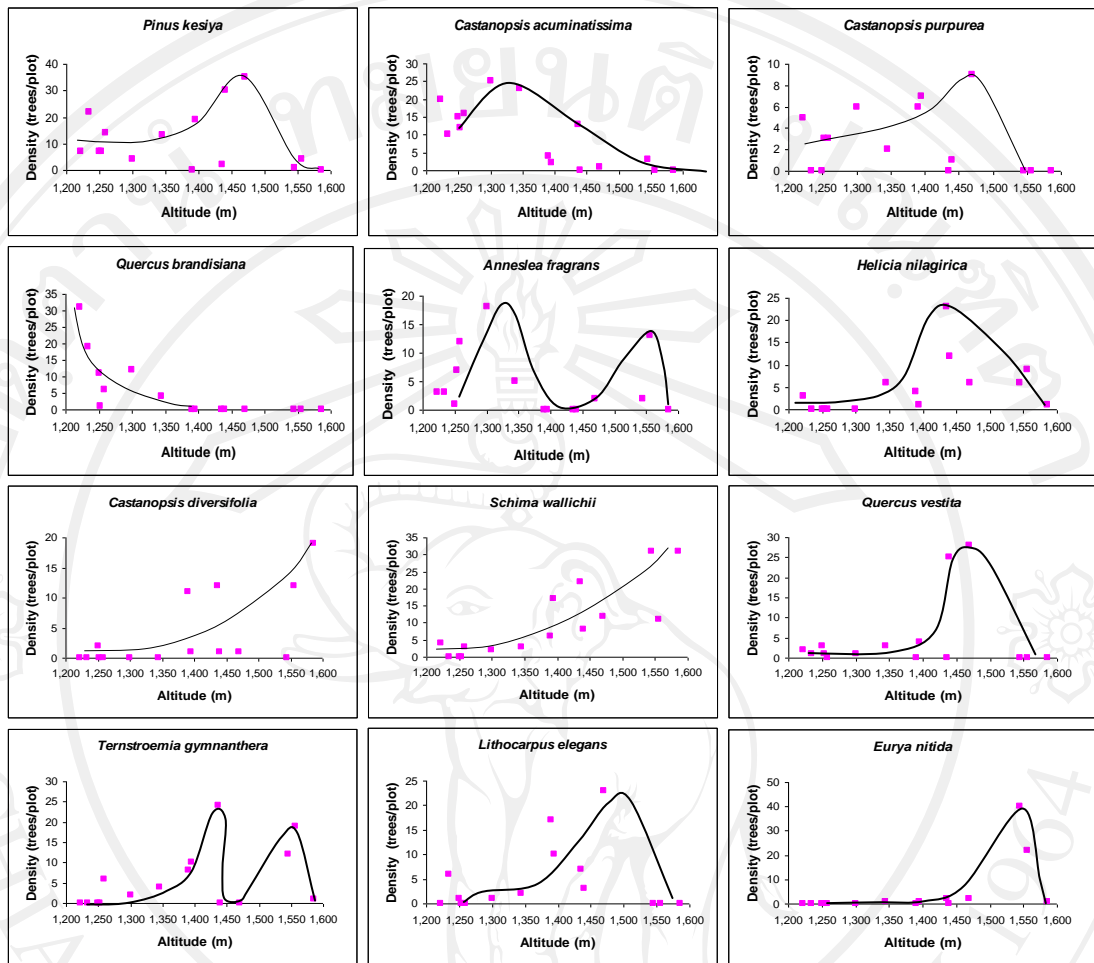
The similarity percentages of plant communities among fragmented forests were varied within a wide range, 2-78% (Figure 3-5). These indicated that some fragmented forests were not similar to the others. The distance between fragmented forests and different altitude ranges were important factors. The nearest distance between the two fragmented forests with the same altitude showed the high similarity.

Altitude (m)																		
1,440	1	100																
1,470	2	70	100															
1,395	3	41	41	100														
1,259	4	33	43	33	100													
1,300	5	30	40	24	73	100												
1,253	6	46	54	32	74	73	100											
1,345	7	40	43	40	66	70	70	100										
1,250	8	42	48	33	67	66	68	67	100									
1,222	9	36	44	34	65	78	65	71	66	100								
1,234	10	50	55	38	64	62	63	61	71	65	100							
1,390	11	30	22	37	20	21	17	26	19	23	21	100						
1,436	12	28	22	37	24	23	22	29	23	27	21	47	100					
1,556	13	17	15	24	13	12	11	12	5	10	5	24	48	100				
1,545	14	17	14	27	14	12	10	16	10	16	10	22	46	43	100			
1,586	15	14	11	22	7	5	5	8	2	7	3	31	41	45	45	100		
FF	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15			

Figure 3-4 Similarity percentages of plant communities among fragmented forests

### (6) Spatial Distribution

The distribution and population abundance along altitude gradient of tree species in fragmented forests were different: *P. kesiya* and *C. acuminatissima*; 1,200-1,500 m msl, *Q. brandisiana* and *A. fragrans*; 1,200-1,300 m, *L. elegans*, *T. gymnanthera* and *C. purpurea*; 1,300-1,400 m, and *C. diversifolia*, *T. gymnanthera*, *H. nilagirica*, *S. wallichii*, *Q. vestita* and *E. nitida*; 1,400-1,500 m (Figure 3-6). Altitude is the complex gradient that is highly correlated with temperature, light intensity, rainfall and condensation, and soil parameters (Grubb, 1977; Vetaas, 1997; Givnish, 1999; Hansen, 2001; Ashton, 2003). The altitude was the most important environmental variable explaining species composition and vegetation structure of montane forest (Khamyong *et al.*, 2004). Different tree species in the montane forest can adapt to variable environmental conditions along altitude gradient particularly air temperature. Therefore, the tree species in this forest may be identified as subtropical and temperate species.



**Figure 3-5** Spatial distribution of dominant tree species in fragmented forests located on different altitudes

### 3.3.1.3 Quantitative Characteristics of Tree Species

#### (1) Tree Frequency

There were five tree species having the frequency values over than 80% in fifteen fragmented forests including *W. tinctoria*, *P. kesiya*, *G. sphaerogynum*, *C. acuminatissima* and *S. wallichii*. These trees existed in most fragmented forests. The tree species having the lower frequency (60-80%) were *P. emblica*, *T. rufescens*, *V. sprengelii*, *H. nilagirica*, *A. fragrans*, *C. stellatum*, *T. gymnanthera*, *L. elegans*, *E. spicata*, *C. purpurea*, *Q. vestita*, *D. cultrata*, *S. albescens* and *S. benzoides*.

#### (2) Tree Density

The average tree density in the whole fragmented forests was 1,166 trees/ha. The shrubby tree, *T. rufescens* had the highest density (116 trees/ha), and followed by *W. tinctoria* (91), *V. sprengelii* (86), *P. kesiya* (69), *S. wallichii* (63) and *C. acuminatissima* (60).

### (3) Tree Dominance

The dominance was calculated on the basis of the stem basal area. *P. kesiya* had the highest relative dominance (24.10% of all species), and followed by *C. acuminatissima* (14.12%), *S. wallichii* (7.14%), *C. diversifolia* (5.84%), *Q. brandisiana* (5.28%), *T. rufescens* (4.10%) and *C. purpurea* (3.46%).

### (4) Importance Value Index (IVI)

The IVI value combines relative frequency, relative density and relative dominance into a measure that can be used to indicate the ecological influence of each species in the forest. *P. kesiya* had the highest value (11.02% of all species), and followed by *C. acuminatissima*, *T. rufescens*, *S. wallichii*, *W. tinctoria*, *V. sprengelii*, *Q. brandisiana*, *C. diversifolia*, *T. gymnanthera* and *H. nilagirica*. These ten tree species were accounted for 49.06% of the total IVI.

These fragmented forests were remained at the ridge or upper slopes of the high mountains where the sites were relatively dried during summer. The forest conditions were favorable for the pine (*P. kesiya*) and some broad-leaved tree species. Mycorrhizal fungi usually associate with the roots of these tree species and help for nutrient uptake and moisture absorption.

### (5) Similarity of Plant Communities

Deforestation often produces landscape-level changes in forest characteristics and structure, including area, distribution and forest habitat types. Changes in landscape pattern through fragmentation or aggregation of natural habitats can alter patterns of abundance for single species and entire communities (Quinn and Harrison, 1988). Some patches are still abundant while the others may be degraded through tree cutting and selective uses of non-wood products by local people. A decrease in the size and number of natural habitat patches increased the loss of species diversity whereas a decline in connectivity between habitat patches can negatively affect regional species persistence (Fahring and Merriam, 1985).

By using cluster analysis to find homogeneous groups of variables in fifteen fragmented forests. The dendrogram showed the four-cluster solution (Figure 3-8 and Table 3-11).

Cluster 1 composed of FF1 and FF2: the altitude was quite high, ranging from 1,440-1,470 m. Species richness was 16-21 species, and SWI was 3.01-3.37 which both values were lower than other fragmented forests because the areas were near the road so they had some disturbs by human through tree cutting. The dominant species were *P. kesiya*, *W. tinctoria*, *T. rufescens*, *L. elegans*, *S. wallichii* and *Q. vestita*.

Cluster 2 composed of FF3 and FF11: the altitude was intermediate in range from 1,390-1,395 m. Species richness was 40-42 species, and SWI was 4.15-4.65. These fragmented forests were still abundant. The dominant species were *P. kesiya*, *W. tinctoria*, *C. purpurea*, *S. wallichii*, *P. emblica*, *L. fenestratus*, *L. elegans*, *C. acuminatissima*, *C. diversifolia* and *D. cultrata*.

Cluster 3 composed of FF4, FF5, FF6, FF7, FF8, FF9 and FF10: the altitude was quite low in range from 1,222-1,345 m. Species richness was 16-34 species, and



SWI was 3.45-4.38. They were the disturbs in some fragmented forests through tree cutting. The dominant species were *P. kesiya*, *V. sprengelii*, *C. acuminatissima*, *Q. brandisiana*, *A. fragrans*, *T. rufescens* and *C. stellatum*.

Cluster 4 composed of FF12, FF13, FF14 and FF15: the altitude was quite high in range from 1,436-1,586 m. Species richness was 32-37 species, and SWI was 3.88-4.51. These fragmented forests were still abundant. Some small disturbance may be happened in these fragmented forests. The dominant species were *C. diversifolia*, *T. gymnanthera*, *W. tinctoria*, *H. nilagirica*, *A. fragrans*, *E. nitida*, *E. spicata*, *P. kesiya* and *C. acuminatissima*.

Fragmented forests in the same cluster had the nearest of distance with the same altitude. However, there were some variables of species richness, density, basal areas and species diversity among fragmented forests in the same cluster because of human disturbance through tree cutting.

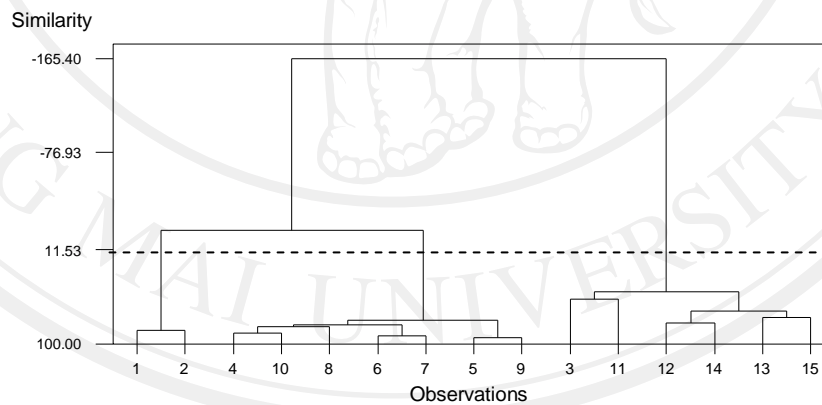


**Figure 3-6** Human disturbances through tree cutting in fragmented forests

Squared Euclidean Distance, Ward Linkage						
Amalgamation Steps						
Step	Number of clusters	Similarity level	Distance level	Clusters joined	New cluster	Number of Obs in new cluster
1	14	94.36	159.154	5	9	5
2	13	92.33	216.485	6	7	6
3	12	89.51	296.140	4	10	4
4	11	86.84	371.679	1	2	1
5	10	83.66	461.301	4	8	4
6	9	82.01	507.848	4	6	4
7	8	80.56	548.795	12	14	12
8	7	78.15	616.829	4	5	4
9	6	75.50	691.806	13	15	13
10	5	69.28	867.369	12	13	12
11	4	58.45	1173.063	3	11	3
12	3	51.32	1374.410	3	12	3
13	2	-5.74	2985.635	1	4	1
14	1	-165.40	7493.550	1	3	1

Final Partition				
Number of clusters: 4				
Cluster	Number of observations	Within cluster sum of squares	Average distance from centroid	Maximum distance from centroid
Cluster1	2	185.840	9.639	9.639
Cluster2	2	586.531	17.125	17.125
Cluster3	7	1128.879	12.664	14.387
Cluster4	4	1053.985	16.218	17.195



**Figure 3-7** Dendrogram for the cluster analysis of fragmented lower montane forests of Boakaew highland watershed. The horizontal dash line represents reference points for delimiting cluster 1, 2, 3 and 4.

**Table 3-11** Quantitative characteristics of tree species in clusters

Cluster	FF	Altitude (m)	No. of species	BA (m <sup>2</sup> /plot)	Density (trees/plot)	SWI
1	1, 2	1,440-1,470	16-21	4.02-5.06	191-240	3.01-3.37
2	3, 11	1,390-1,395	40-42	4.96-5.26	199-283	4.15-4.65
3	4, 5, 6, 7, 8, 9, 10	1,222-1,345	16-34	2.79-4.74	89-222	3.45-4.38
4	12, 13, 14, 15	1,436-1,586	32-37	3.98-5.85	140-256	3.88-4.51

**Table 3-12** Overall data of plant communities in fifteen fragmented forests

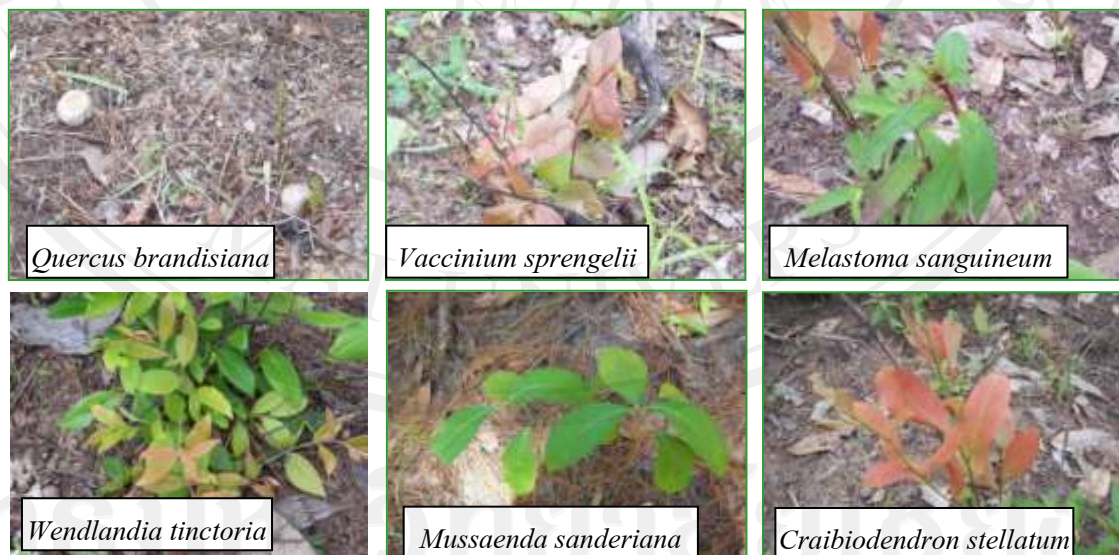
Parameters	Fifteen sample plots in fragmented forests															Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
1. Altitude (m)	1,440	1,470	1,395	1,259	1,300	1,253	1,345	1,250	1,222	1,234	1,390	1,436	1,556	1,545	1,586	
2. Number of Species	16	21	42	20	21	16	34	25	29	26	40	35	37	32	32	103
3. Number of Genus	15	18	35	19	18	13	29	20	23	22	35	32	33	28	29	82
4. Number of Families	10	13	21	13	12	10	18	13	14	13	22	22	24	18	19	44
5. Basal area (m <sup>2</sup> /ha)	31.65	25.12	32.88	29.61	27.96	26.22	22.59	23.32	25.85	17.46	31.01	32.80	36.58	27.02	24.85	27.66
6. Dominant tree (%)																
1) <i>Pinus kesiya</i>	63.57	53.73	25.67	33.88	16.51	38.67	31.33	33.57	25.99	39.39	-	7.33	0.91	7.00	-	24.10
2) <i>Castanopsis acuminatissima</i>	-	0.07	1.61	20.98	30.80	19.96	34.07	17.61	35.83	11.96	17.37	22.43	-	7.78	-	14.12
3) <i>Shima wallichii</i>	7.20	5.48	9.36	0.19	0.79	-	0.40	-	4.85	-	5.96	10.85	9.77	21.90	25.73	7.14
4) <i>Quercus brandisiana</i>	-	-	-	18.33	19.34	1.27	3.21	14.08	14.22	17.47	-	-	-	-	-	5.28
5) <i>Castanopsis diversifolia</i>	0.29	1.16	0.09	-	-	-	-	0.11	-	-	10.80	8.93	33.22	-	21.55	5.84
6) <i>Ternstroemia gymnanthera</i>	-	-	3.19	1.91	0.51	-	0.92	-	-	-	2.62	6.25	9.55	5.56	4.97	2.66
7) <i>Helicia excelsa</i>	3.65	1.11	0.91	-	-	-	0.49	-	1.10	-	1.17	7.62	9.71	10.90	0.01	2.77
7. IVI (%)																
1) <i>Pinus kesiya</i>	39.64	34.16	17.61	21.77	9.44	23.27	18.59	19.12	14.89	26.61	-	4.16	1.64	3.69	-	11.02
2) <i>Castanopsis acuminatissima</i>	-	0.24	1.31	16.01	22.80	16.72	22.22	13.80	23.32	9.12	9.39	14.45	-	4.47	-	7.36
3) <i>Shima wallichii</i>	5.69	5.24	8.95	1.13	0.99	-	0.87	-	3.50	-	4.04	10.90	8.14	17.00	23.94	5.11
4) <i>Quercus brandisiana</i>	-	-	-	11.23	13.22	1.20	2.51	10.71	15.49	14.71	-	-	-	-	-	3.31
5) <i>Castanopsis diversifolia</i>	0.41	0.79	0.30	-	-	-	-	0.72	-	-	7.34	7.45	20.16	-	17.56	3.28
6) <i>Ternstroemia gymnanthera</i>	-	-	4.11	3.02	0.85	-	1.36	-	-	-	2.72	9.09	10.39	5.12	2.84	2.62
7) <i>Helicia excelsa</i>	4.97	1.81	0.71	-	-	-	1.60	-	1.36	-	1.29	9.53	7.52	6.62	0.36	2.55
8. Density (trees/ha)	1,194	1,500	1,244	906	1,056	556	1,388	938	1,156	994	1,769	1,256	1,056	1,600	875	1,166
(1) gbh < 50 cm	905	1,249	898	617	694	316	1,177	717	950	825	1,447	870	733	1,319	596	888
(2) gbh 50-100 cm	157	170	254	165	278	163	134	139	134	110	268	295	235	217	221	196
(3) gbh 100-150 cm	113	81	79	81	66	47	45	50	40	40	40	50	31	43	33	56
(4) gbh 150-200 cm	19	-	13	44	13	25	31	31	26	19	15	34	31	22	19	23
(5) gbh 200-250 cm	-	-	-	-	6	6	-	-	6	-	-	6	13	-	6	3
(6) gbh 250-300 cm	-	-	-	-	-	-	-	-	-	-	-	-	13	-	-	1
9. Ground-covered species (individuals/plot)	77	107	49	149	48	62	52	59	37	35	35	91	48	19	73	62
10. Species diversity (SWI)	3.01	3.37	4.65	3.45	3.65	3.53	4.38	3.69	4.03	3.87	4.15	4.28	4.51	4.23	3.88	5.28



### 3.3.1.4 Natural Regeneration and Ground-covered Species

The total number of seedling and ground-covered species existed in the whole fragment forests were 96 species which could be separated to 74 species of tree, 13 species of herb, 8 species of climber and one species of fern. The average number of seedling and ground-covered species was 780 individuals/ha, and varied within a wide range among fragmented forests, 231-1,856 individuals/ha (Table 3-13). They were very few in the good forests and very dense in canopy gaps of degraded forests. The common seedlings of woody species were *Micromelum minutum*, *Phoebe cathia*, *P. paniculata*, *Dillenia aurea*, *Terminalia chebula* and *Euodia roxburghiana*. The herb species were *Orthosiphon aristatus*, *Asparagus filicinus*, *Chromolaena odoratum* and *Ageratina adenophora*. The regeneration of *Q. brandisiana* was better than other oaks, but usually on the dry site.

The natural regeneration is considerably poor in most fragmented forests, and mainly plant species adapted to the dry site were dominated on the forest floor according to moisture limitation and forest fire during summer. Moreover, nutritional differences in forest soils are important in influencing the species composition of seedlings regeneration (Brandani, *et al.*, 1988). The regeneration of climax species in such sites depended upon existing seedlings. The climax species do not germinate or establish well in the large gaps (Howe *et al.*, 1985; Tomboc and Basada, 1978; Turner, 1990), and are notoriously poorly dispersed (Burgess, 1970), whereas pioneer species show their highest levels of germination in large gaps and seedlings may grow very rapidly in full light (Raich and Gong, 1990; Kennedy and Swaine, 1992).



**Figure 3-8** Some seedlings and ground-covered species in fragmented forests

**Table 3-13** Total numbers of seedling and ground-covered species in fifteen fragmented forests

No	Species	Growth forms*	Density of individuals ground-covered species in fifteenth fragmented forests (individuals/ha)															
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Average
1	<i>Micromelum minutum</i>	S	19	25	0	275	131	25	6	50	44	81	0	0	0	0	6	44
2	<i>Phoebe cathia</i>	S	0	31	0	488	31	0	0	56	19	13	0	0	0	0	0	43
3	<i>Phoebe paniculata</i>	S	375	38	13	6	0	0	13	19	0	6	0	0	0	0	0	31
4	<i>Dillenia aurea</i>	S	25	0	0	56	44	138	63	81	6	0	0	0	0	0	0	28
5	<i>Terminalia chebula</i>	S	13	156	0	163	0	44	0	6	0	0	0	0	0	0	6	26
6	<i>Euodia roxburghiana</i>	S	0	0	0	188	44	19	6	38	31	25	0	0	0	0	0	23
7	<i>Anneslea fragrans</i>	S	0	0	69	0	6	0	44	13	13	0	100	25	0	0	0	18
8	<i>Beilschmiedia gammieana</i>	S	88	0	0	13	44	25	6	6	25	0	0	0	6	0	0	14
9	<i>Semecarpus albescens</i>	S	0	0	0	0	6	25	25	113	31	0	0	0	0	0	0	13
10	<i>Blumea balsamifera</i>	S	19	0	38	88	13	0	0	0	0	0	38	0	0	0	0	13
11	<i>Rapanea porteriana</i>	S	0	50	0	0	19	75	6	0	25	0	0	0	0	0	0	12
12	<i>Desmodium megaphyllum</i>	S	0	0	0	6	19	6	50	25	38	0	6	6	6	0	0	11
13	<i>Diospyros glandulosa</i>	S	0	6	0	0	6	19	44	0	6	25	38	19	0	0	0	11
14	<i>Quercus semiserrata</i>	S	44	0	13	19	25	0	13	31	0	6	6	0	0	0	0	10
15	<i>Castanopsis acuminatissima</i>	S	6	0	0	19	0	38	44	6	19	13	0	0	0	0	0	10
16	<i>Castanopsis purpurea</i>	S	0	0	0	13	31	38	0	13	31	0	0	0	0	0	0	8
17	<i>Castanopsis diversifolia</i>	S	0	0	69	0	0	0	0	0	0	0	0	0	0	25	13	7
18	<i>Lithocarpus fenestratus</i>	S	13	6	0	0	0	13	13	0	6	0	25	6	13	0	13	7
19	<i>Lithocarpus elegans</i>	S	0	0	0	0	0	0	0	94	0	0	0	0	0	0	0	6
20	<i>Quercus brandisiana</i>	S	38	0	13	0	0	0	25	0	0	13	0	0	0	0	0	6
21	<i>Quercus vestita</i>	S	0	0	0	13	0	69	6	0	0	0	0	0	0	0	0	6
22	<i>Albizia odoratissima</i>	S	0	0	0	0	0	19	0	13	0	0	0	6	31	6	6	5
23	<i>Phyllanthus reticulatus</i>	S	0	0	0	0	0	0	0	0	0	0	0	0	19	13	38	5
24	<i>Styrax benzoides</i>	S	0	19	0	0	0	0	13	0	0	0	0	0	38	0	0	5
25	<i>Dalbergia assamica</i>	S	0	0	0	0	0	0	0	0	0	0	0	63	0	0	0	4
26	<i>Mussaenda sanderiana</i>	S	0	19	0	0	0	0	0	0	0	0	0	0	6	0	31	4

**Table 3-13 (Continued)**

No	Species	Growth forms*	Density of individuals ground-covered species in fifteenth fragmented forests (individuals/ha)															
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Average
27	<i>Ternstroemia gymnanthera</i>	S	0	0	0	0	0	0	0	0	0	0	0	0	0	56	0	4
28	<i>Litsia glutinosa</i>	S	31	0	13	0	0	0	13	0	0	0	0	0	0	0	0	4
29	<i>Helicia nilagirica</i>	S	0	6	25	0	0	0	13	6	0	0	0	0	0	6	0	4
30	<i>Pavetta tomentosa</i>	S	0	0	0	0	19	6	13	6	13	0	0	0	0	0	0	4
31	<i>Leea guineensis</i>	S	0	0	0	0	0	0	0	0	0	0	0	0	0	31	19	3
32	<i>Wendlandia tinctoria</i>	S	0	0	0	0	6	31	13	0	0	0	0	0	0	0	0	3
33	<i>Tephrosia purpurea</i>	S	0	0	19	0	0	0	0	31	0	0	0	0	0	0	0	3
34	<i>Melia azedarach</i>	S	0	0	44	0	0	0	0	0	0	0	0	6	0	0	0	3
35	<i>Pinus kesiya</i>	S	0	0	0	0	0	0	6	0	0	0	6	19	0	0	13	3
36	<i>Olea salicifolia</i>	S	0	0	0	0	0	0	0	0	0	0	44	0	0	0	0	3
37	<i>Gardenia sootepensis</i>	S	0	0	0	0	0	0	13	0	0	0	0	0	0	31	0	3
38	<i>Vaccinium sprengelii</i>	S	0	0	0	0	44	0	0	0	0	0	0	0	0	0	0	3
39	<i>Aporosa wallchii</i>	S	0	0	0	0	0	0	0	0	0	38	0	0	0	0	0	3
40	<i>Catunaregam tomentosa</i>	S	0	0	0	0	0	0	0	0	38	0	0	0	0	0	0	3
41	<i>Tristania rufescens</i>	S	0	0	0	0	0	0	0	0	0	0	0	6	31	0	0	3
42	<i>Aporosa villosa</i>	S	0	6	6	0	0	0	0	19	0	0	0	0	6	0	0	3
43	<i>Symplocos racemosa</i>	S	0	0	0	0	0	0	0	0	0	6	19	0	0	6	0	2
44	<i>Engelhardtia serrata</i>	S	0	19	0	0	0	0	0	0	0	13	0	0	0	0	0	2
45	<i>Stereospermum neuranthum</i>	S	0	0	0	19	0	0	6	0	0	0	0	0	0	0	0	2
46	<i>Glochidion acuminatum</i>	S	0	0	6	0	0	0	0	6	6	0	0	6	0	0	0	2
47	<i>Ardisia attenuata</i>	S	0	0	0	6	0	0	0	6	0	6	0	0	0	0	0	1
48	<i>Viburnum sambucinum</i>	S	0	0	0	0	6	6	0	0	0	0	6	0	0	0	0	1
49	<i>Zingiber zerumbet</i>	S	0	0	0	0	0	0	0	0	0	0	13	6	0	0	0	1
50	<i>Craibiodendron stellatum</i>	S	0	0	6	0	0	6	0	0	0	0	0	0	0	0	0	1
51	<i>Lindera metcalfiana</i>	S	0	0	0	0	13	0	0	0	0	0	0	0	0	0	0	1
52	<i>Cratoxylum formosum</i>	S	0	0	0	0	0	0	0	0	0	13	0	0	0	0	0	1

**Table 3-13 (Continued)**

No	Species	Growth forms*	Density of individuals ground-covered species in fifteenth fragmented forests (individuals/ha)															
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Average
53	<i>Vitex pinnata</i>	S	6	0	0	0	0	0	0	0	0	0	0	0	0	6	0	1
54	<i>Schima wallichii</i>	S	0	0	0	0	0	0	0	6	0	0	0	6	0	0	1	
55	<i>Ilex umbellulata</i>	S	0	0	0	0	0	0	0	6	0	6	0	0	0	0	1	
56	<i>Horsfieldia tomentosa</i>	S	0	0	13	0	0	0	0	0	0	0	0	0	0	0	1	
57	<i>Colona sp.</i>	S	0	0	0	0	0	0	0	0	0	0	6	0	6	0	1	
58	<i>Eriolaena candollei</i>	S	0	0	6	0	0	0	0	0	0	0	6	0	0	0	1	
59	<i>Glochidion hirsutum</i>	S	0	0	0	0	6	0	0	6	0	0	0	0	0	0	1	
60	<i>Pittosporum nepaulense</i>	S	0	0	0	0	0	0	0	0	0	0	13	0	0	0	1	
61	<i>Acacia megaladena</i>	S	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0.4	
62	<i>Ardisia pilosa</i>	S	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0.4	
63	<i>Clausena wallichii</i>	S	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0.4	
64	<i>Turpinia cochinchinensis</i>	S	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0.4	
65	<i>Phyllanthus emblica</i>	S	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0.4	
66	<i>Archidendron clypearia</i>	S	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0.4	
67	<i>Buchanania lanzan</i>	S	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0.4	
68	<i>Syzygium albiflorum</i>	S	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0.4	
69	<i>Rhus javanica</i>	S	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0.4	
70	<i>Flemingia lineata</i>	S	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0.4	
71	<i>Glochidion sphaerogynum</i>	S	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0.4	
72	<i>Antidesma acidum</i>	S	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0.4	
73	<i>Eurya nitida</i>	S	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0.4	
74	<i>Melastoma sanguineum</i>	S	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0.4	
75	<i>Orthosiphon aristatus</i>	H	188	900	31	338	0	0	0	0	0	50	0	0	0	0	100	
76	<i>Asparagus filicinus</i>	H	13	0	13	0	0	0	0	0	0	19	0	331	31	738	76	
77	<i>Chromolaena odoratum</i>	H	0	0	0	0	0	0	0	0	0	0	463	6	0	0	31	
78	<i>Ageratina adenophora</i>	H	38	13	81	63	13	38	106	0	0	0	0	50	0	0	27	

**Table 3-13** (Continued)

No	Species	Growth forms*	Density of individuals ground-covered species in fifteenth fragmented forests (individuals/ha)															
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Average
79	<i>Amorphophallus corrugatus</i>	H	0	0	0	0	0	0	0	0	0	0	13	331	6	0	0	23
80	<i>Mucuna pruriens</i>	H	31	13	0	6	0	0	50	0	0	125	0	0	0	0	0	15
81	<i>Costus speciosus</i>	H	6	13	0	50	0	94	0	0	0	0	0	0	0	0	0	11
82	<i>Paris polyphylla</i>	H	0	0	0	13	38	31	0	38	6	13	6	0	0	13	0	10
83	<i>Curcuma sessilis</i>	H	0	0	19	0	6	0	0	0	6	0	25	31	13	0	6	7
84	<i>Tadehagi triquetrum</i>	H	0	0	0	0	0	6	6	31	31	0	0	0	0	0	6	5
85	<i>Codariocalyx motorius</i>	H	0	0	19	0	0	0	0	0	0	0	13	0	6	0	0	3
86	<i>Hemigraphis alternata</i>	H	0	0	0	0	0	0	25	0	0	13	0	0	0	0	0	3
87	<i>Laportea bulbifera</i>	H	13	19	0	0	0	0	0	0	0	0	0	0	0	0	0	2
88	<i>Cyclea barbata</i>	C	0	0	0	13	0	0	0	0	0	0	0	31	0	0	0	3
89	<i>Canthium sp.</i>	C	0	0	0	0	0	0	0	0	0	0	44	0	0	0	0	3
90	<i>Smilax ovalifolia</i>	C	0	0	0	0	0	0	0	0	0	0	0	31	0	0	0	2
91	<i>Milletia pachycarpa</i>	C	0	0	13	0	0	0	0	0	0	0	0	13	0	0	0	2
92	<i>Celastrus paniculata</i>	C	0	0	25	0	0	0	0	0	0	0	0	0	0	0	0	2
93	<i>Argyreia splendens</i>	C	0	0	0	0	0	0	0	0	0	0	0	19	0	0	0	1
94	<i>Ampelocissus martinii</i>	C	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0.4
95	<i>Amalocalyx microlobus</i>	C	0	0	25	0	0	0	0	0	0	0	0	0	0	0	0	2
96	<i>Adiantum capillus-veneris</i>	F	0	0	0	0	25	0	0	13	63	0	0	0	0	0	0	7
Total			963	1,338	606	1,856	594	769	650	731	456	438	438	1,138	594	231	906	780

**Note:** \* S = Seedlings, H = Herb, C = Climber, F = Fern



### 3.3.2 Potential Roles of Fragmented Forests on Succession in Pine Plantations

The fragmented montane forests nearby the pine plantations in highland watershed have important roles on natural succession in plantations as the sources of seeds/fruits. The natural succession begins as seeds/fruits of various species are dispersal into the plantations, germination and establishing seedlings. The saplings and small trees may grow slowly beneath pine canopy for many years until they grow up to be mature trees. Some individuals of pine may be died during the successional stages, and finally most areas will be covered by broad-leaved tree species and some pine trees may be remained particularly on the ridge areas.

#### 3.3.2.1 Seed/Fruit Characteristics and Dispersal Potential

The seed/fruit characteristics of 103 tree species and their possible seed dispersal agents were identified (Table 3-1), and used to describe about the potential roles of tree species on plant succession in adjacent *P. kesiya* plantations of Boakaew Watershed Management Station.

Thirty-five tree species in the fragmented forests had seed dispersal by wind such as *P. kesiya*, *S. wallichii*, *B. alnoides*, *D. serrulata*, *S. neuranthum*, *C. stellatum*, *E. serrata*, *E. spicata*, *A. chinensis*, *T. rufescens*, *R. javanica*, etc. The seeds of 49 tree species were identified as animal dispersal such as those in the families of Fagaceae, Lauraceae, Euphorbiaceae, Burseraceae, Proteaceae, etc. The explosion dispersal was found for 12 species such as *M. malabathricum*, *W. tinctoria*, *C. arborea*, *V. pinnata*, *M. henryi* and those in the family of Leguminosae. Some heavy-seed tree species dispersed the seeds surrounding the mother trees including *P. diospyricarpa*, *A. fragrans*, *T. cochinchinensis*, *S. arboretum*, *E. subcoriacea*, *B. gammieana* and *S. albescens*.

Wind dispersal is prevalent in open forests and among pioneers, but also some climax rain forest species whereas animal dispersal occurs in all forest types but is most prevalent in closed and stable forests (Schmidt, 2000). Sri-ngernyuang, *et al.* (2007) found that seed dispersal distance of Lauraceae including two pioneer species (*Litsea cubeba* and *Lindera metcalifiana*) and two shade-tolerant species (*Cinnamomum soegengii* and *Cryptocarya densiflora*) was short (less than 12 m), and the density of seed dispersal had a mode at 0-2 m from mother tree caused by heavy fresh seeds. Each seed contains the potential for becoming a full grown tree, but in nature most seeds succumb from germination failure (Schmidt, 2000). Dispersers of large fruited species are often the larger bodied wildlife, species themselves most often at risk from forest fragmentation and have tended to lack of regeneration (Tucker and Murphy, 1997; Parrotta *et al.*, 1997; Corlett and Hau, 2000). Small mammals and forest birds are unlikely to move across inhospitable habitats among forest fragments (Grant, 1971). Remaining fragments of old-growth forest may be critical for some species and should be protected and rehabilitated (Vanclay, 1992).





Figure 3-9 Modes of fruits/seeds dispersal

### 3.3.2.2 Succession Tree Species in Pine Plantations

The tree species in fragmented forests were important for natural succession in pine plantations on highland watershed areas. It is found that there were 87 tree species common to both fragmented forests and pine plantations (Table 3-14). The common tree species in both sites were *S. wallichii*, *W. tinctoria*, *G. acuminatum*, *P. emblica*, *G. sphaerogunum*, *C. diversifolia*, *P. kesiya*, *C. purpurea*, *T. rufescens*, etc. The numbers of tree species (16 species) were found in fragmented forests which were the rare species in these areas such as *Artocarpus gomezianus*, *C. armata*, *Combretum punctatum*, *Radermachera ignea*, *Schefflera bengalensis*. The number of 111 species were found in pine plantations such as *Melastoma sanguineum*, *Dalbergia assamica*, *Mallotus paniculatus*, *Memecylon celastrinum*, *Litsea cubeba*, *Blumea balsamifera*, *Elaeocarpus sphaericus*, *Neolitsea zeylanica*, *Gluta obovata*, etc.

**Table 3-14** Species richness among fragmented forest and pine plantations

Type	No. of species		
	FF + PP	FF	PP
Tree species	87	16	111
Ground-covered species	76	20	111

**Note:** FF = fragmented forests, PP = pine plantations

### 3.4 Discussion

The natural process of forest succession can take place on disturbed forest and opened land after forest clearing. In disturbed and degraded forests, protection and maintenance of existing trees are a technologically simple and cost-effective by weeding, mulching and application of fertilizer. These will accelerate tree growths and natural regeneration. The more rapid restoration usually requires by planting of fast growing tree species which consist of pioneer and local tree species. Pioneer species can grow rapidly and forming forest canopy in order to change microclimate near ground level, whereas native trees species can enrich biodiversity. This will be led to the development of more intensive systems of forest restoration. However, development and design of appropriate management options to assist this process are important.

As the succession begins, the pioneer colonization of annual plant species which had short life spans (one growing season) occurred in the gaps. The plants which had the high densities included *Curcuma sessilis*, *Ageratina adenophora* and *Amorphophallus sp.*, whereas those of woody species were *Vaccinium sprengelii*, *Quercus brandisiana* and *Glochidion hirsutum*. The tree species which had light seed and produced a lot of seeds could establish well in full sunlight such as *V. sprengelii*, *Tristania rufescens*, *Craibiodendron stellatum*, *Leea guineensis*, *Wendlandia tinctoria*, *Rhus javanica*, *P. kesiya*, etc. The oak species, *Q. brandisiana* had the good succession in some fragmented forests of dry site whereas the other oaks (Fagaceae) had the poor succession.

In the early stage of forest succession in pine plantations, fast growing native pioneer species are important for improving microenvironment favorable for other new native tree species. The density of planted pine might be declined during the successional stages, whereas the overall tree density had increased. In all age class plantations, the pine trees were still the most dominant, while the succession tree species developed slowly to form dominant trees in the future stages. The forest structure of forest plantations will be changed to the climax montane forest. In the montane forest, most dominant trees are oaks whereas understory tree species may compose of diversified broad-leaved tree species. Pine trees will be remained in the forest only in the ridge areas as dominant trees, and xeric oaks as co-dominant trees. Therefore, the recovery process of forest plantations to be the climax montane forest may needs a long period of times, many decades or hundred years.

Many sivicultural practices usually apply to manage forest plantations to improve productivity per unit area such as weeding, thinning, making fire lines, etc. However, reforestation by pine plantation was terminated for many years according to the national policy. Planting of some pionner species and native tree species in the deteriorated forest is now practiced to recover the watershed forest. Selection of these tree species requires knowledge about their spatial distribution along altitude gradient. As the results, many tree species were found in fragmented forests with different altitude ranges: *P. kesiya* and *C. acuminatissima*; 1,200-1,500 m msl, *Q. brandisiana* and *A. fragrans*; 1,200-1,300 m, *L. elegans*, *T. gymnanthera* and *C. purpurea*; 1,300-1,400 m, and *C. diversifolia*, *T. gymnanthera*, *H. nilagirica*, *S. wallichii*, *Q. vestita* and *E. nitida*; 1,400-1,500 m.

The similarity of plant communities in fragmented forests which was classified by cluster analysis showed the results that cluster 2 (FF3 and FF11) and cluster 4 (FF12, FF13, FF14 and FF15) were abundant and relatively high species diversity, whereas cluster 1 (FF1 and FF2) and cluster 4 (FF4, FF5, FF6, FF7, FF8, FF9 and FF10) had some disturbances through tree cutting. It is important to preserve and has enrichment planting in these fragmented forests as seed/fruit sources for natural succession in shifting cultivated areas and adjacent plantations.