

## 2.4 Forest distribution and conditions

Considering its topographical and climatic conditions, the Study Area can be divided into four sites equivalent to natural geographical sites (Chien *et al.*, 1985, quoted in Con, 1998) (Figure I-2.4.1). Characteristics of each site are summarised in Table I-2.4.1.

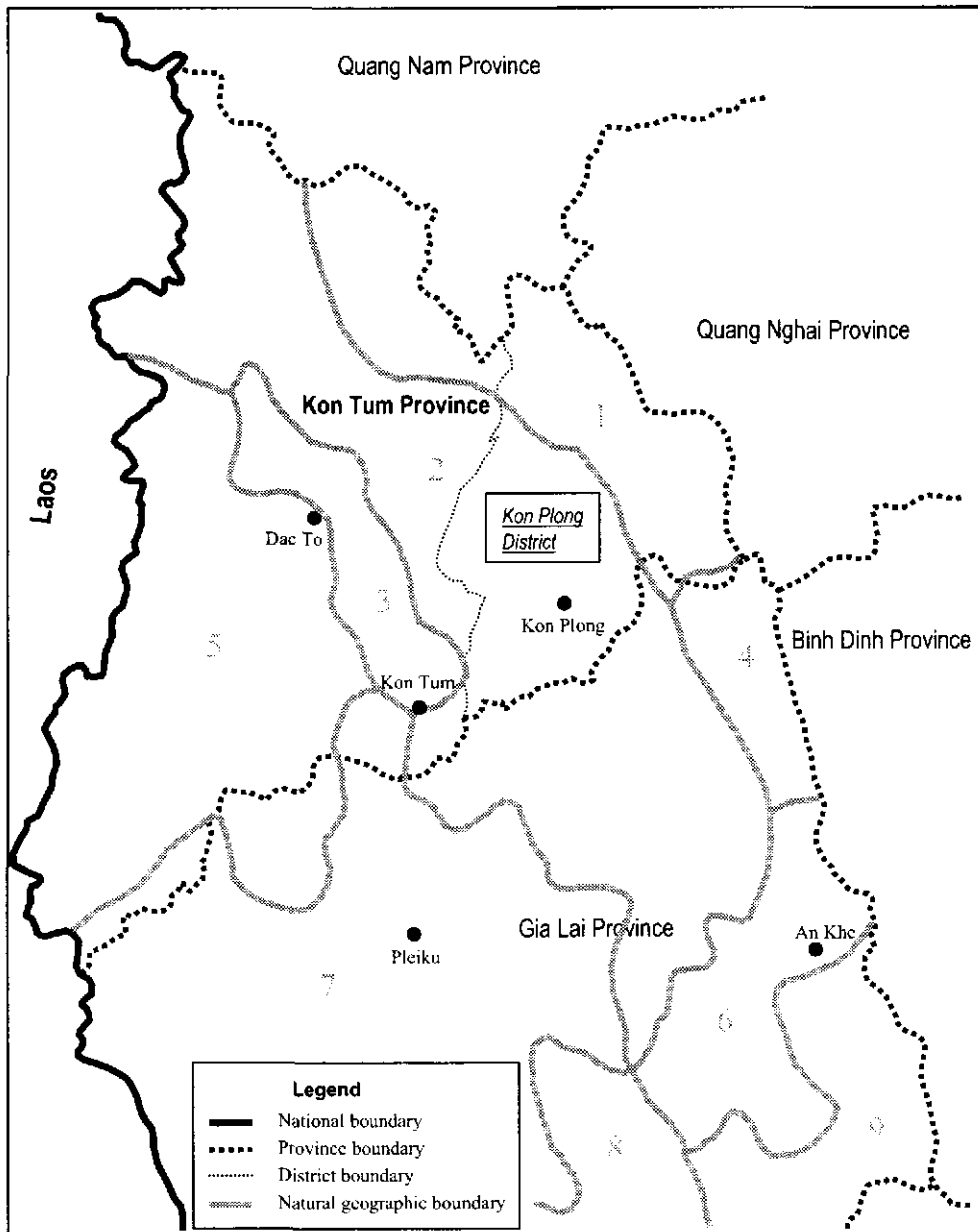


Figure I-2.4.1 Natural geographical sites in Kon Tum Province

Source: adapted from Con, 1998

**Table I-2.4.1 Site classification in Kon Tum Province**

No	Natural geographical site	Soils	Vegetation
1	Ngoc Linh mountainous area of medium height	Weathering crust of reddish yellow feralite is formed on degenerated eruptive rock or acid sediment, mainly granite. In the constructive components of this rock there are minerals which tend to be resistant to disintegration, mainly quartz, in areas that are covered with abrupt breaks. Therefore the weathering is weak, which makes the soil layer different in thickness, found in mountain ranges of medium and great height.	Humid sub-tropical area on mountains from 1,500- 1,800 m. <i>Pinus kesiya</i> , Fagaceae and Lauraceae are dominant. From 1,800- 2,000 m and above, <i>Rhododendron</i> sp., <i>Fokenia hodginsii</i> , <i>Illisium griffithi</i> and <i>Arundinaria spathiflora</i> are dominant.
2	South-western Ngoc Linh mountainous area of low height		Evergreen broad-leaved closed forests, humid on mountains cover 70-80%, great timber reserve.
3	Kon Tum depression	Weathering crust of yellowish brown feralite is formed on acid eruptive rock, sandy stone, old alluvial. Granite and old alluvial have complicated structure and minerals tending to be resistant to disintegration. On undulating topography or slight hills the weathering is weak, and therefore, forming soil layers of medium thickness. This weathering crust is not so large in area.	One-season wet tropical area. <i>Canarium Bengalensis</i> , <i>Elaeocarpus griffithii</i> and <i>Pometia</i> sp. are dominant.
4	Kon Ha Nung plateau	Weathering crust of brownish red feracite formed on neutral magma, mainly bazan. Primitive minerals are dissociated thoroughly down to a depth of 3 metres, sometimes even 10 metres down. This therefore forms a thick or very thick layer of soil, and is usually found in many places in the plateau.	Evergreen broad-leaved forest, great timber reserve.

Source: adapted from Con, 1998

### 2.4.1 Major forest types

In this section, the forest status in the Study Area is discussed mainly from an ecological point of view based on the results of the field forest survey.

The forests in Kon Plong District can be categorized broadly into eight types according to the composition of tree species (Table I-2.4.2, Figure I-2.4.2). In this classification, key tree species which determine the forest types are Dipterocarps, *Pinus merkusii* and Podocarps. Apart from the ‘evergreen broad-leaved humid forests’ which occur in the north-eastern lowland, the forests are also divided into just two types according to the biological attribute of trees: semi-deciduous forests and evergreen forests, and this corresponds to the altitude: less than 1,000 m and over 1,000 m respectively.

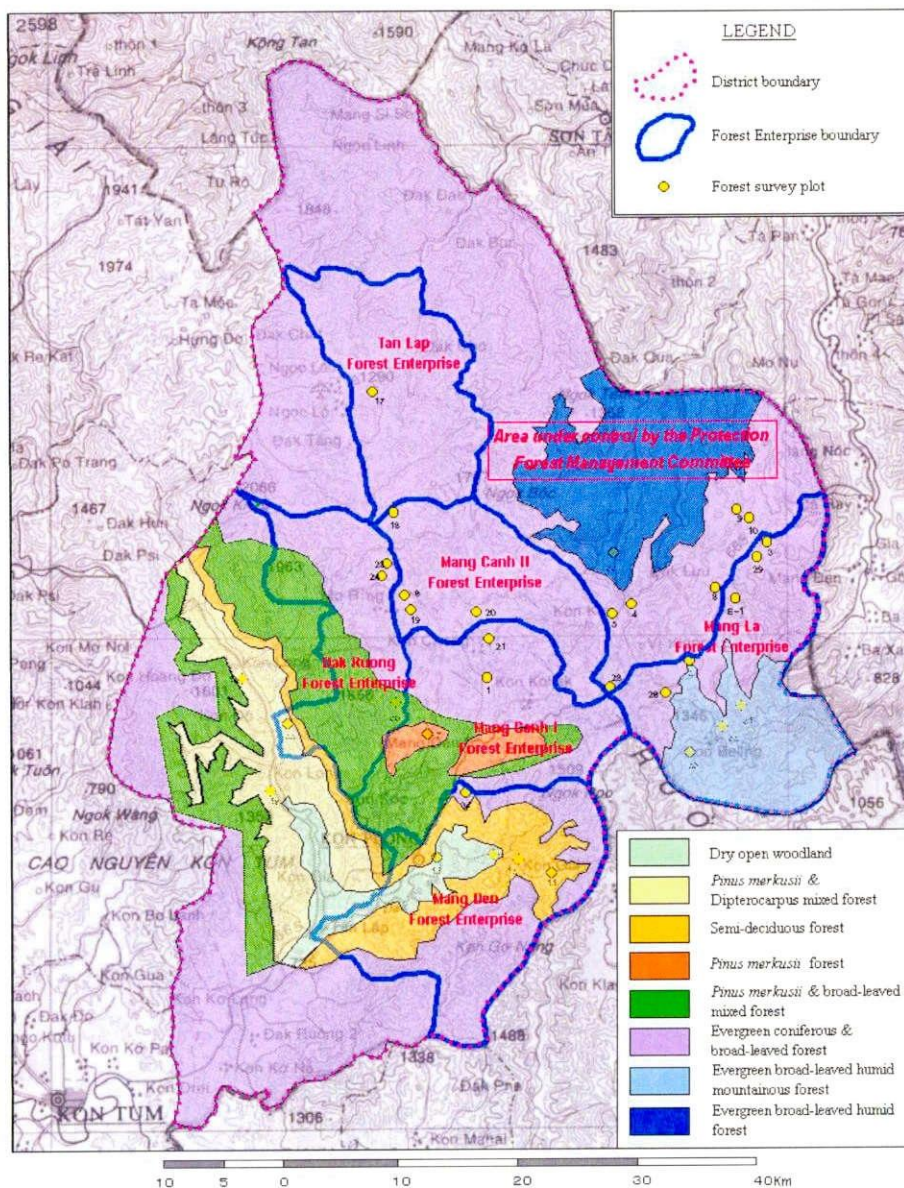


Figure I - 2.4.2 Vegetation map in Kon Plong District

Table I-2.4.2 Forest types and characteristics in the Study Area

Forest type	1. Dry open woodland	2. <i>Pinus merkusii</i> and Dipterocarp mixed forest	3. Semi-deciduous forest	4. <i>Pinus merkusii</i> forest	5. <i>Pinus merkusii</i> and Broad-leaved mixed forest	6. Evergreen coniferous and broad-leaved mixed forest	7. Evergreen broad-leaved humid mountainous forest	8. Evergreen broad-leaved humid forest	
Characteristics									
Altitude	700-800 m	700-1,000 m	800-1,000 m	1,000-1,200 m	1,000-1,200 m	1,000-1,200 m	1,000-1,200 m	400-900 m	
Distribution	Dak Ruong Commune, Mang Den FE	Dak Koi, Dak Ruong Communes, Mang Den FE	Mang Den FE, Dak Ruong FE, Dak Koi, Dak Ruong Communes	Mang canh I FE	Mang canh I FE, Dak Ruong FE	All the FEs, Thach Nham Protection Forest	Mang La FE	Thach Nham Protection Forest	
Major species composition	Upper storey	<i>Dipterocarpus obtusifolius</i> <i>Shorea siamensis</i> <i>Shorea obtusa</i> <i>Syzygium zeylanicum</i> <i>Castanopsis echinocarpa</i>	<i>Dipterocarpus obtusifolius</i> <i>Quercus pelforianum</i> <i>Shorea siamensis</i> <i>Lithocarpus ducampii</i>	<i>Lithocarpus ducampii</i> <i>Lagerstroemia calyculata</i> <i>Peltophorum dasyrrhachis</i> <i>Adinandra rubropunctata</i>	<i>Pinus merkusii</i>	<i>Lithocarpus ducampii</i> <i>Pinus merkusii</i> <i>Rhodoleia championii</i>	<i>Quercus bambusaefolia</i> <i>Rhodoleia championii</i> <i>Elaeocarpus dubius</i> <i>Cinnamomum iners</i> <i>Symplocos dolichotricha</i>	<i>Dacrydium pierrei</i> <i>Pinus dalatensis</i> <i>Lithocarpus hystrix</i> <i>Lithocarpus tubulosus</i> <i>Cryptocarya aff</i> <i>Lithocarpus ducampii</i> <i>Syzygium zeylanicum</i>	<i>Parashorea stellata</i> <i>Sterculia coccinea</i> <i>Beilschmiedia obovatifolia</i> <i>Dacryodes dungii</i> Burseraceae
	Medium storey	<i>Wendlandia glabata</i> <i>Micromelum hirsutum</i> <i>Miscanthus floridulus</i>	<i>Engelhardtia colebrookeana</i> <i>Ilex</i> sp.	<i>Horsfieldia amygdalina</i> <i>Vitex trifolia</i> <i>Vitex peduncularis</i> <i>Randia cochinchinensis</i>	<i>Symplocos</i> sp. <i>Wendlandia glabata</i>	<i>Lithocarpus dealbatus</i> <i>Lithocarpus tubulosus</i> <i>Artocarpus aff</i> <i>Elaeocarpus tonkinensis</i>	<i>Schefflera octophylla</i> <i>Rapanea cochinchinensis</i> <i>Ilex rotunda</i> <i>Helicia</i> sp.	<i>Helicia cochinchinensis</i> <i>Xanthophyllum hainanense</i> <i>Elaeocarpus</i> sp. <i>Cinnamomum burmannii</i> <i>Ardisia</i> sp. <i>Rubiaceae</i> <i>Camellia</i> sp.	<i>Helicia cochinchinensis</i> <i>Xanthophyllum hainanense</i> <i>Elaeocarpus</i> sp. <i>Cinnamomum burmannii</i> <i>Ardisia</i> sp. <i>Rubiaceae</i> <i>Camellia</i> sp.
	Lowest storey		<i>Wendlandia glabata</i> <i>Cratogeomys prunifolium</i> <i>Themada arumainacea</i>	<i>Euodia lepta</i> <i>Mallotus</i> sp. <i>Rhapis laosensis</i> <i>Amonum villosum</i> <i>Psychotria rubra</i> <i>Pandanus</i> sp.	<i>Rhodomytus tomentosa</i> <i>Melastoma</i> sp. <i>Dicranoptera</i> sp. <i>Imperata cylindrica</i>	<i>Canarium tetradactylus</i> <i>Pinanga paradoxa</i>	<i>Psychotria rubra</i> <i>Ardisia</i> sp. <i>Dendrocalamus patellaris</i> Brackens	<i>Dendrocalamus patellaris</i> <i>Smilax</i> sp. <i>Canthium bracteosum</i> <i>Pandanus humilis</i>	<i>Dendrocalamus patellaris</i> <i>Smilax</i> sp. <i>Canthium bracteosum</i> <i>Pandanus humilis</i>

Forest types and status in each management area are presented as follows:

### **1) Thach Nham Protection Forest**

Almost the whole area is isolated except for the area along National Road 24 which forms the boundary with the Mang La Forest Enterprise management area. The general forest status in the area is rich and represents the only area that primary forests still remain in Kon Plong District.

Most of the area falls into 'evergreen coniferous and broad-leaved mixed forests', however, in the north-eastern lowlands (400-900m), there are 'evergreen broad-leaved humid forests' represented by Dipterocarp species. Tree height of the forest is very high, 30-35 m and this type of forests is categorized as high forest.

In the area beyond 900 m, 'evergreen coniferous and broad-leaved mixed forest' is dominant and there is a unique vegetation where by coniferous tree species occupy a higher ratio, interestingly, *Fokienia hodginsii* and *Pinus dalatensis*, extremely rare species even in the country, still remain in the forests. The forest is rich in undergrowth and there are various climber and palm species. Since the crown density is quite dense, natural regeneration of coniferous species is not properly enhanced.

### **2) Tan Lap Forest Enterprise**

As the area shares its boundary with the Thack Nham Protection Forest, the topographical features and forest type are similar to those in the Protection Forests. The whole area falls into 'evergreen coniferous and broad-leaved mixed forest'. The higher the altitude is, the more the rate of coniferous trees in the forests. The overall growing stock of forests is relatively high compared to the other forest enterprise management area. Yet, the forests are encroached by local people particularly in the northern area and a huge area is found as grasslands. In the grasslands, the Forest Enterprise has promoted reforestation with *Pinus kesiya*.

### **3) Mang Canh I Forest Enterprise**

Although the original vegetation in this area falls into the 'evergreen coniferous and broad-leaved mixed forest', there is a huge grassland area where paddy fields are developed in the downstream. In the area, the Forest Enterprise has been promoting reforestation of *Pinus kesiya* but the growth is not in a favourable condition.

Tree height of the area from the northern to eastern part is not high, 20-23 m, compared with that in the Mang Canh II Forest Enterprise. Natural *Pinus merkusii* forests expand in the western part

of the area but the forest status can not necessarily be said to be good due to frequent bush fires and over-collection of pine resin.

#### **4) Mang Canh II Forest Enterprise**

Most of the area falls into the 'evergreen coniferous and broad-leaved mixed forests'. The crown density is rather high and close in almost all the forests. Both the average diameter and tree height of trees are larger than those in the Tan Lap Forest Enterprise in which one of the richest forests still remains. The dominant tree species near the protection forest is *Podocarpus* spp., while natural *Pinus merkusii* forest distributes near Mang Canh Commune in the south and this forest expands to the Dak Ruong and Mang Canh I Forest Enterprise management area.

On the other hand, the forest type close to the Mang La Forest Enterprise management area appears to be slightly different. The most significant aspect is that the tree height is lower than the other area: 20 m on average.

#### **5) Dak Ruong Forest Enterprise**

The main feature of the area is that natural *Pinus merkusii* distributes in the whole area except the northern part. Particularly, in the area of the downstream of Dak Ne River, *Pinus merkusii* grows mixed with evergreen broad-leaved trees and the stocking volume is much higher than the other forests. In the forest, *Keteleeria davidiana* which is a precious species as mentioned in the next section was identified.

Meanwhile, in the lowlands of the western part of the area, a large area is covered with grasslands occurred by slash-and-burn farming. The forest in the area is categorised as semi-deciduous forests but heavily degraded. In the lower area of the semi-deciduous forests, the dry open woodlands appear with dominant species of Dipterocarps. However, as with the semi-deciduous forests, the Dipterocarp forests are deteriorated due to the long-term slash-and-burn farming. The average tree diameter is less than 25 cm and height is 10-15 m. In most cases, the undergrowth is dense and occupied by shrubs and bamboos.

#### **6) Mang La Forest Enterprise**

In general, the forests are characterized as dense but with low height trees (20 m approx.) compared to the other evergreen forests. However, toward the southern region where the altitude gets low, tree height gradually increases.

In the northern area, afforestation has been carried out in grassland the length of National Road

24. Major species planted are *Pinus kesiya* and *Acacia auriculiformis*. The growth of *Pinus kesiya* is much better, while *Acacia auriculiformis* suffers from white mould disease and shows unhealthy growth.

#### **7) Mang Den Forest Enterprise**

The area is located in the lowest part among all the forest enterprises in Kon Plong District. Along the Dak Phe River, a large area is used for cultivation, and bush and Dipterocarp forests/woodlands spread between the cultivation and 'semi-deciduous forests' which appear in the higher area. On the whole, the diameter of trees is small and tree height is low: 20 – 25 m. Dipterocarps in the 'dry open woodlands' are relatively short, 10-15 m, and density is very low as well. The undergrowth is occupied by shrubs and bamboo species.

### **2.4.2 Current forest status**

Forest status in the Study Area is explained mainly by data analyzed from satellite imagery including the field forest survey and observation, and then the status is further described by natural forests and man-made forests.

#### **(1) Forest status by forest type and forest management area**

In developing a category of forest status in the Study Area, satellite imagery data (shot in 1995/97) and aerial photographs (1991) were applied as base information, then forests were classified into eight categories by different status and other lands were classified into seven land use types. This data and information was revised based on the results of the forest sample plot survey (Table I-2.4.3 and Volume III 2), forest observation and some existing forest classification standards in Vietnam. As a result, forests were classified into six categories (Primary forest, Evergreen secondary forest I, Evergreen secondary forest II, Evergreen secondary forest III, Semi-deciduous forest, Dry open woodland) by different status, and other lands are classified into five land use types (Bush land, Grass land, Tree plantation, Agricultural land, Water body), and the standard stocking volume in each forest class was developed (Table I-2.4.4). The co-relation between the new categorization and other categorizations is indicated in Figure I-2.4.3. Based on the new categorization, the satellite imagery data were arranged as shown in Figure I-2.4.4 and Table I-2.4.5.

**Table I-2.4.3 Index of forest sample plot survey**

Plot no.	Forest enterprise / Area	Location		Altitude (m)	Forest type <sup>1)</sup>	Forest status <sup>2)</sup>	Forest status in satellite data	Stocking volume (m <sup>3</sup> /ha)
		N	E					
1	Mang Canh I	14°38.48	108°17.84	1,220	Evergreen coniferous and broad-leaved mixed	IIIA1	Forest 3	179
2	Mang La	14°39.18	108°25.98	1,200	Evergreen coniferous and broad-leaved mixed	IIIA2	Forest 2	323
3	Mang La	14°43.96	108°29.18	1,100	Evergreen coniferous and broad-leaved mixed	IIIA2	Forest 3	196
4	Mang La	14°41.08	108°23.96	1,290	Evergreen coniferous and broad-leaved mixed	IIIB	Forest 2	483
5	Mang La	14°40.82	108°23.11	1,350	Evergreen coniferous and broad-leaved mixed	IIIA3	Forest 3	344
6	Mang Canh II	14°41.69	108°14.56	1,290	Evergreen coniferous and broad-leaved mixed	IIIA2	Forest 3	279
7	Mang Canh I	14°35.95	108°15.71	1,180	<i>Pinus merkusii</i>	Th3,2	Grassland	164
8	Mang La	14°41.92	108°27.15	1,130	Evergreen coniferous and broad-leaved mixed	IIIA2/IIIB	Forest 2	339
9	Thach Nham Protect. Forest	14°44.47	108°28.17	1,090	Evergreen coniferous and broad-leaved mixed	IIIA2	Forest 2	371
10	Thach Nham Protect. Forest	14°44.32	108°28.33	1,070	Evergreen coniferous and broad-leaved mixed	IIIA2	Forest 3	295
11	Mang Den	14°30.26	108°20.19	750	Semi-deciduous	IIIA1	Bush	231
12	Mang Den	14°30.96	108°19.15	770	Semi-deciduous	IIIA2	Grassland	289
13	Mang Den	14°31.27	108°18.01	690	Dry open woodland	RIIA	Bush	76
14	Mang Den	14°31.11	108°15.49	690	Dry open woodland	RIIA	Grassland	75
15	Dak Koi Commune	14°38.62	108°07.94	780	<i>Pinus merkusii</i> and Dipterocarp mixed	IIB	Grassland	202
16	Dak Ruong Commune	14°34.13	108°09.05	760	<i>Pinus merkusii</i> and Dipterocarp mixed	IIIA2	Grassland	325
17	Tan Lap	14°47.52	108°13.47	1,240	Evergreen coniferous and broad-leaved mixed	IIIA3	Forest 1	593
18	Mang Canh II	14°45.15	108°14.41	1,260	Evergreen coniferous and broad-leaved mixed	IIIA2	Forest 3	336
19	Mang Canh II	14°40.91	108°14.97	1,320	Evergreen coniferous and broad-leaved mixed	IIIA3	Forest 1	505
20	Mang Canh II	14°40.47	108°18.04	1,200	Evergreen coniferous and broad-leaved mixed	IIIA2	Forest 1	414
21	Mang Canh I	14°39.77	108°17.89	1,180	Evergreen coniferous and broad-leaved mixed	IIIA2	Forest 2	386
22	Dak Ruong	14°36.38	108°09.32	870	<i>Pinus merkusii</i> and Dipterocarp mixed	RIIB	Bush	157
23	Dak Ruong	14°42.96	108°13.82	1,250	Evergreen coniferous and broad-leaved mixed	IIIA2	Forest 1	399
24	Dak Ruong	14°42.72	108°13.68	1,260	Evergreen coniferous and broad-leaved mixed	IIIA1	Forest 2	308
25	Mang La	14°35.19	108°25.28	1,220	Evergreen broad-leaved humid mountainous	IIIA2	Forest 1	374
26	Mang La	14°37.43	108°24.59	1,240	Evergreen coniferous and broad-leaved mixed	IIIA2 / 3	Forest 2	317
27	Thach Nham Protect. Forest	14°46.13	108°28.33	1,180	Evergreen coniferous and broad-leaved mixed	IIIB / IIIA3	Forest 1	481
28	Mang La	14°37.88	108°22.90	1,280	Evergreen coniferous and broad-leaved mixed	IIIA2	Bush	329
29	Mang La	14°42.18	108°28.36	1,050	Evergreen coniferous and broad-leaved mixed	IIIA2	Forest 2	200
30	Dak Ruong	14°37.36	108°13.87	1,200	<i>Pinus merkusii</i> and broad-leaved mixed	IVB	Forest 1	379
31	Mang La	14°36.93	108°27.68	1,180	Evergreen broad-leaved humid mountainous	IIIA2	Forest 2	351
32	Mang La	14°36.27	108°27.05	1,020	Evergreen broad-leaved humid mountainous	IVB	Forest 1	467
33	Thach Nham Protect. Forest	14°43.30	108°22.76	750	Evergreen broad-leaved humid	IVA	Forest 2	1,086
34	Mang Den	14°33.52	108°16.64	1,170	Evergreen coniferous and broad-leaved mixed	IIB	Forest 3	198

Notes :

1) Classification based on tree species composition

2) Classification by field observation based on FIPI's definition



**Table I-2.4.4 Standard stocking volume**

Satellite / Field survey		JICA Study		DARD		General category in Vietnam <sup>1)</sup>	
Forest class	Volume (m <sup>3</sup> /ha)	Forest class	Volume (m <sup>3</sup> /ha)	Forest class	Volume (m <sup>3</sup> /ha)	Forest class	Volume (m <sup>3</sup> /ha)
Forest 1	454	Primary forest	320	Forest 1	> 300	IVA IVB IIIB	210
Forest 2	336						
Forest 3	266	Secondary forest I	266	Forest 2	226 - 300		
Forest 4	217	Secondary forest II	197	Forest 3	151 - 225	IIIA3 IIIA2	150
Forest 5	179						
Forest 6	148	Secondary forest III	122	Forest 4	76 - 150		
Forest 7	122						
Forest 8	99						
Bushland	260	Semi- deciduous forest	180	Forest 2, 3, 4	—	—	—
	76	Dry open forest	76	Forest 5	< 75	IIA IIB	60
	—	Bush	—				

Note:

1) The category is listed just for a reference as the original purpose of the use is different from others.

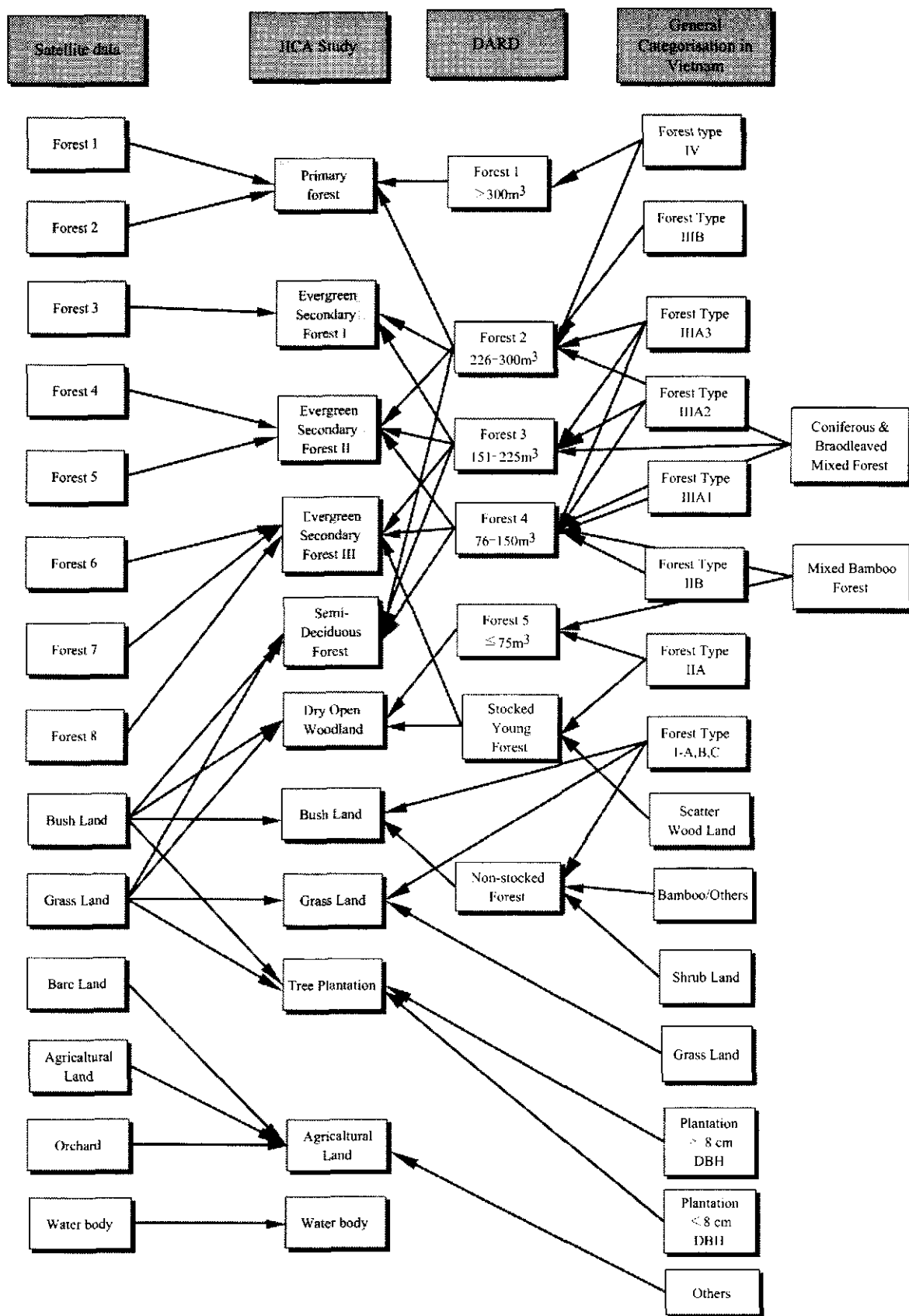


Figure I-2.4.3 Co-relation matrix of forest and land use categorization between the Study Team and other information sources

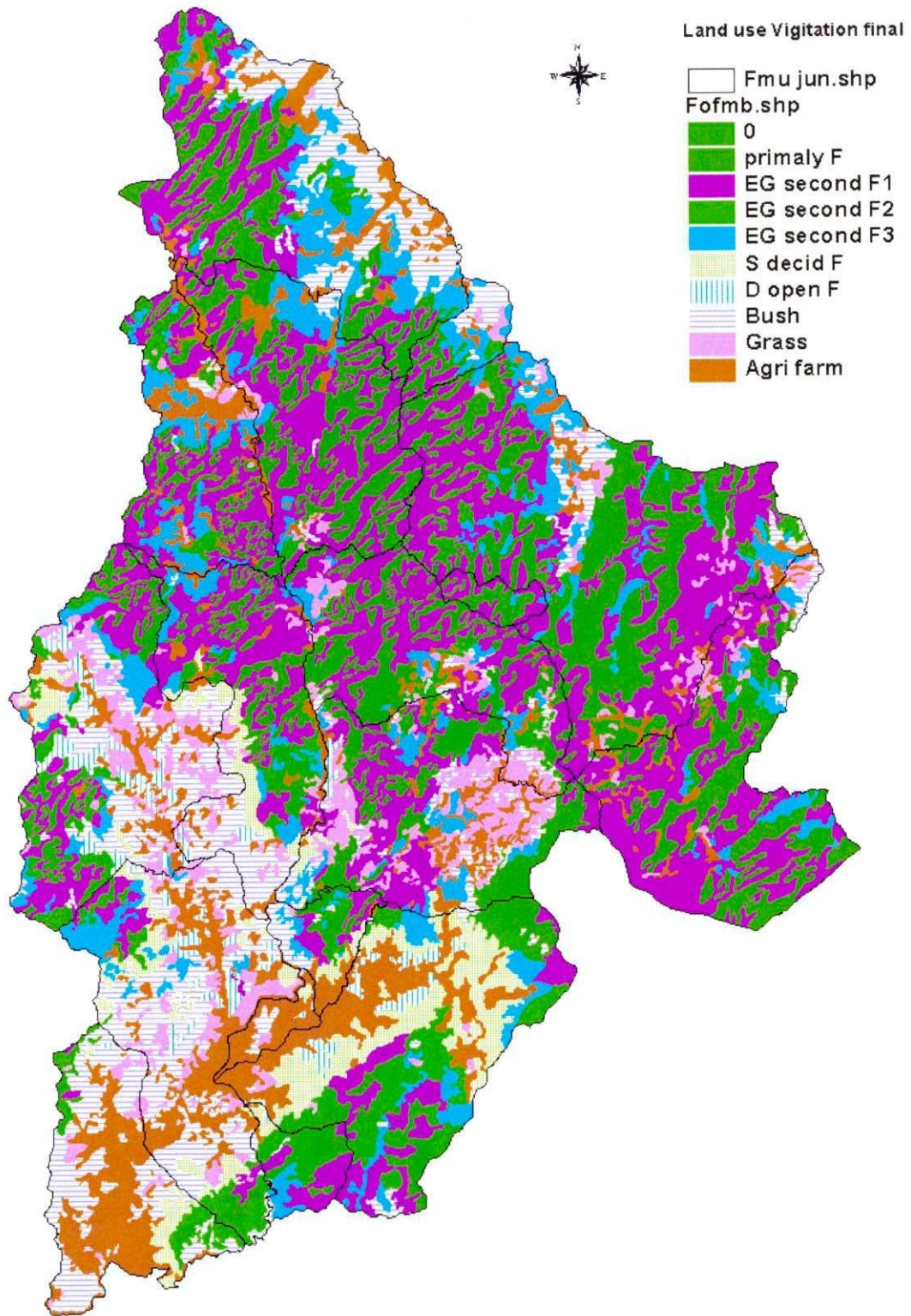


Figure I-2.4.4 Revised current land use and forest status in Kon Plong District

Table I-2.4.5 Area by forest management unit, forest type and land use

Management unit	Protection/production forest	Primary forest	Evergreen secondary I	Evergreen secondary II	Evergreen secondary III	Semi deciduous forest	Dry open forest	Man-made forest	Agri-farm	Bush	Grassland	Total
01PFM Area	Protect F	11,862.51	13,301.91	1,197.28	3,141.50	0.00	0.00	80.00	293.18	1,992.72	1,598.83	33,467.91
02Dak Ring C	Protect F	4,143.23	3,459.24	773.22	3,312.97	0.00	0.00	0.00	279.06	4,911.22	99.88	16,978.82
14Mang La	Protect F	1,411.07	2,102.95	83.68	734.62	0.00	0.00	309.20	72.69	371.27	613.25	5,698.73
11Mang Canh II	Protect F Cr	1,305.06	747.99	80.23	16.82	0.00	0.00	0.00	16.71	54.05	149.33	2,370.17
12Mang Canh I	Protect F Cr	1,411.78	541.01	235.29	291.62	7.63	166.	1,234.80	221.82	227.53	682.91	5,020.91
13Dak Ruong	Protect F Cr	1,076.19	1,868.19	636.89	878.73	298.47	0.00	0.00	66.20	106.03	507.66	5,438.36
15Mang Den	Protect F Cr	0.00	37.53	210.04	178.90	335.20	85.49	70.00	97.06	191.35	0.00	1,205.58
02Dak Ring C	Product F	1,349.39	2,129.27	172.09	626.04	0.00	0.00	0.00	140.97	2,093.97	156.53	6,668.25
03Ngoc Tem C	Product F	1,039.95	1,061.09	342.55	656.04	0.00	0.00	0.00	29.61	700.11	175.10	4,004.46
04Mang But C	Product F	2,081.13	4,121.93	643.73	1,737.36	0.00	0.00	549.20	516.31	371.63	925.02	10,946.30
05Dak Koi C	Product F	710.38	3,631.25	2,861.37	1,326.28	889.43	1,621.73	177.00	381.59	4,510.82	3,270.46	19,380.32
06Dak Ruong C	Product F	253.46	932.45	1,175.73	1,247.48	1,763.36	916.08	0.00	942.83	7,654.88	3,261.97	18,148.23
07Kon Plong C	Product F	549.27	615.77	279.27	282.05	268.86	1.38	60.00	100.61	788.71	39.41	2,985.33
08Tan Lap C	Product F	273.53	850.99	963.29	345.75	208.12	40.91	0.00	261.41	1,182.11	137.50	4,263.61
09Dak Tre C	Product F	124.59	78.95	1,050.39	0.00	690.13	24.53	0.00	1,342.42	7,081.46	746.15	11,138.62
10Tan Lap	Product F	5,978.46	7,017.99	266.00	1,217.91	0.00	0.00	0.00	245.01	866.62	531.19	16,123.19
11Mang Canh II	Product F	3,190.86	4,730.02	714.07	617.00	0.00	0.00	420.80	191.98	505.18	1,153.57	11,523.48
12Mang Canh I	Product F	2,072.67	3,739.14	326.60	1,054.68	337.12	19.49	1,513.05	283.56	710.11	1,855.39	11,911.80
13Dak Ruong	Product F	1,584.09	2,910.49	115.42	321.70	553.02	187.39	726.30	49.65	1,471.88	908.14	8,828.10
14Mang La	Product F	4,626.28	6,331.04	286.78	425.07	0.00	0.00	0.00	197.34	162.01	328.28	12,356.79
15Mang Den	Product F	1,726.69	2,845.82	3,789.94	1,605.93	4,582.97	858.45	160.90	1,053.35	887.31	2,675.79	20,187.14
<b>Total</b>		<b>46,770.57</b>	<b>63,055.00</b>	<b>16,203.87</b>	<b>20,018.43</b>	<b>9,934.30</b>	<b>3,921.99</b>	<b>5,301.25</b>	<b>6,783.37</b>	<b>36,840.95</b>	<b>19,816.36</b>	<b>228,646.11</b>

Mean Annual Increment (MAI) of evergreen forests in the Central Highlands has been studied by FIPI and it is estimated by forest class as shown in Table I-2.4.6.

**Table 2.4.6 Mean Annual Increment of evergreen forests in the Central Highlands**

Forest class	MAI (%)
IVA	1.5019
IIIB, IIIA3	1.8938
IIIA2	2.3367
IIIA1	3.0700
IIIB	3.0700

Source: Forest Inventory and Planning Institute (FIPI), Qui Nhon (unpubl.)

## (2) Forest status in natural forests

The composition of woody species in natural forests of the Study Area is completely diverse and a total of 273 species were identified from the results of the forest sample plot survey and observation (Table I-2.4.7 and 2 in Volume III).

**Table I-2.4.7 Number of woody species identified by the field survey**

	Family	Genus	Species
GYMNOSPERMEA	4	6	8
ANGIOSPERMEA	62	120	265
<b>Total</b>	<b>66</b>	<b>126</b>	<b>273</b>

Among the species, there are five families which include more than ten species, i.e. Lauraceae (28 species), Fagaceae (20), Euphorbiaceae (16), Myrtaceae (11), Clusiaceae (10). It is significant that seven species are categorised as the special rare and precious trees in Vietnam by Decree No. 18-HDBT (Council of Ministers, 1992) (Volume III 5), i.e. *Aquilaria crassna* (IA), *Pinus dalatensis* (IA), *Podocarpus nerifolius* (IA), *Dalbergia oliveri* (IIA), *Dalbergia cochinchinensis* (IIA), *Diospyros* spp. (IIA), *Fokenia hodgensii* (IIA). These are the most distinct species in Vietnam and it is strictly prohibited to harvest them (Group I) or their exploitation is limited to exploit (Group II). Although it is not included in the above category, *Keteleeria davidiana* is also considered as a unique species as it is reportedly found only in the north-western region in northern Vietnam (Agricultural Publishing House, 1996).

Meanwhile, major commercial tree species in Kon Plong District are defined by FIPI as shown in Table I-2.4.8 and almost all the species were identified during the course of the field survey.

**Table I-2.4.8 Major commercial tree species in Kon Plong District**

	Family	Botanical name	Local name
1	Pinaceae	<i>Keteleeria davidiana</i>	Du sam, May hinh
2		<i>Pinus kesiya</i>	Thong ba la
3		<i>Pinus merkusii</i>	Thong nhua, Thong hai la
4	Cupressaceae	<i>Fokienia hodginsii</i>	Po mu
5	Podocarpaceae	<i>Podocarpus fleuryi</i>	Kim giao
6		<i>Podocarpus imbricatus</i>	Thong nang, Thong long ga
7		<i>Dacrydium pierrei</i>	Hong tung
8	Fagaceae	<i>Castanopsis indica</i>	Cie gai an do
9		<i>Lithocarpus ducampii</i>	Die do
10	Magnoliaceae	<i>Michelia faveolata</i>	Gioi do, Gioi la nhan
11		<i>Michelia mediocris</i>	Gioi xanh, Gioi tanh
12	Theaceae	<i>Schima wallichii (P. crenata)</i>	Voi thuoc
13	Hamamelidaceae	<i>Rhodoleia championii</i>	Hong quang, soi gia
14	Leguminosae	<i>Dialium cochinchinensis</i>	Xoay, La met
15		<i>Pterocarpus macrocarpus</i>	Giang huong qua to
16	Euphorbiaceae	<i>Endospermum sinensis</i>	Vang trung
17	Burseraceae	<i>Canarium album</i>	Tram trang
18		<i>Dacryodes dungii</i>	Coc da, Coc chua
19	Apocynaceae	<i>Alstonia scholaris</i>	Sua, Mo cua
20	Liliaceae	<i>Schizobasopsis</i> sp.	Lo o
21	Bambusaceae	<i>Oxytenanthera</i> spp.	Le
22	?	<i>Neohouzeana</i> sp.	Nua

Source: adapted from Forest Inventory and Planning Institute – Qui Nhon, 2000

Note: '*Dacrydium pierrei*' is added to the original list as it is a well-known commercial species.

### (3) Forest status in man-made forests

There was 5,500 ha of afforestation carried out by forest enterprises during the period from 1979 to 1999 (Forest Development Department, Kontum Province, 2000). Major planting species and planted areas are presented in Table I-2.4.9.

**Table I-2.4.9 Major planting species and planted area**

Tree species	Planting area (Forest enterprise)
<i>Pinus kesiya</i>	All the enterprises
<i>Pinus merkusii</i>	Mang Canh I
<i>Acacia auriculariformis</i>	All the enterprises
<i>Cassia</i> spp.	Mang Canh II
<i>Aquillaria carassna</i>	Mang Canh I, Mang Canh II, Mang La

Most of the plantation is occupied by *Pinus kesiya* and its old plantation (15-16 years stand) exists in the Mang Canh I Forest Enterprise management area. Although the sample plot survey was not conducted in the forests, the average stocking volume of the forest can be estimated at 120-150 m<sup>3</sup>/ha with average DBH of 15cm and tree height of 8m. Although the soil is suitable for *Pinus kesiya* (granite or gneiss stone), the growth does not seem firm. In the plantation by the Tan Lap Forest Enterprise, *Pinus kesiya* suffers from poor growth due to degraded and unsuitable soil which is basalt stone (Con, 1998). On the other hand, *Pinus kesiya* was also applied in the Mang Den Forest Enterprise where the altitude is about 650m, though the site belongs to a natural distribution area of *Pinus merkusii*. One of the reasons for the *Pinus kesiya* plantation was that it was technically difficult to raise the seedlings of *Pinus merkusii*. More research is recommended to be conducted on Pine species, e.g. altitude, soil and other aspects.

Regarding some other species, *Acacia auriculiformis* is the second species for reforestation. In the Mang La Forest Enterprise management area, there is a five year-old *Acacia auriculiformis* plantation at 1,200 m altitude but the growth is not necessarily firm in terms of not only the growth rate but also survival rate. It is estimated that the average tree height is about 2m and the survival rate is less than 70%. There are several factors considered to affect the growth, e.g. i) altitude: the appropriate range for growth of *Acacia auriculiformis* in Kon Plong District is considered to be from 600 to 900m, ii) soil: the area is considered to have been grassland for a long time, and the soil is therefore compact and contains much clay, iii) tending: the area is covered with heavy weeds and those are an indicator of degraded lands, and tending activities, such as weeding, do not seem to have been carried out in the area.

*Aquillaria carassna* is a well-known tree like Agalwood or Eagle Wood which have high commercial value. Roots can be used as incense wood, cosmetic preparation and medicine (Agricultural Publishing House, 1996). In the plantation, *Aquillaria carassna* is planted as an enrichment planting species under the tree shade in natural forests and the growth seems moderate.

Apart from afforestation by the forest enterprises, there are a number of plantations by local households, particularly in the lower area, around Kon Plong Town. The most popular species planted are Boi Loi trees consisting of *Machilus odoratissima*, *Litsea lancilimba* and *Litsea vang*. These are indigenous, fast-growing and multi-purpose trees. Local people's main concern is bark that is sold for making perfume and gelatine. The timber is preferable for furniture, paper pulp, etc. The trees are also good for agroforestry practice, as leaves can be used for fodder and people cultivate maize and cassava for two years in the plantation before the crown closes.

## 2.5 Forest Products

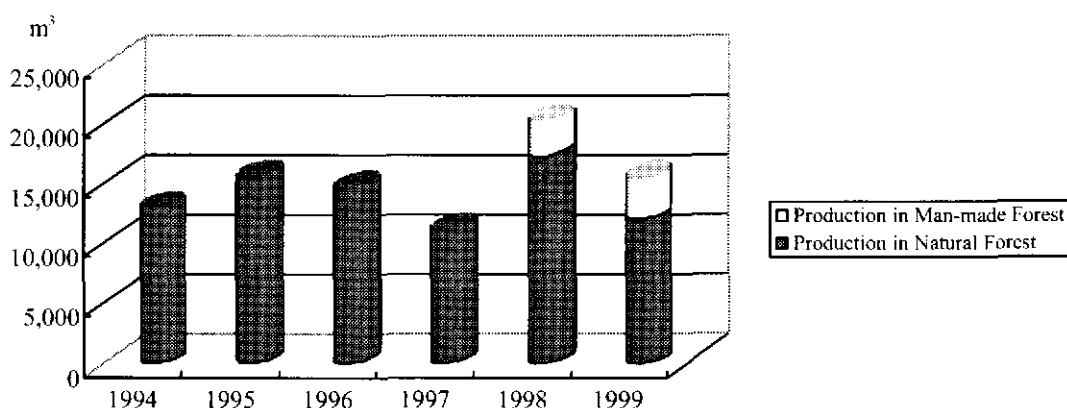
Production structure, demand and price movement of logs, fuel wood and NTFPs are analyzed below.

### 2.5.1 Log production and market conditions

This sub-section is about logs, the main products among forest products. It includes the production condition of logs in Kon Plong District, the log buyers and wood produced from six (6) FEs' jurisdictions in the Study Area and their condition, selling prices of standing trees, and the minimum selling price of logs, sawn timber and refined wood.

#### (1) Log production condition

There are two methods for log production in Kon Plong District. One is under the FEs' direct management and the other is by the company the FEs sold standing trees to and which can conduct log production in Kon Tum Province.



**Figure I-2.5.1 Log production volume in Kon Plong District**

Figure I-2.5.1 shows the log production total volume by the FEs' projects from the natural forest and man-made forest in Kon Plong District from 1994 to 1999. The log production volume from natural forests is the sum of the total sales volume of standing trees and round logs, in addition, the converted volume of round wood, calculated by dividing the total sales volume of sawn timber by 0.62, which is the averaged yield rate of sawn timber. Log production volume of man-made forest is from thinning.

The volume of 11,260 m<sup>3</sup> is the lowest in 1997 and the sum of 20,275 m<sup>3</sup> is the highest in 1998; 17,412 m<sup>3</sup> of which is from natural forest and 2,863 m<sup>3</sup> is from planted forest.

The annual averaged log production volume from natural forest for 6 years is 14,060 m<sup>3</sup>. The area for



cutting to produce 14,060 m<sup>3</sup> of the annual averaged log production volume is approximately 415 ha based on the averaged cutting volume of 34 m<sup>3</sup> per ha within six years. Considering that natural forest area in the production forests under the FEs' management is 60,819 ha and required annual area for cutting is 415 ha, the cutting cycle is estimated at 146 years and this figure sufficiently covers the cutting cycle stipulated by the government regulation.

Log production volume to this extent may have a huge negative impact on the future supply of forest. However, there is a need to examine forest that should be excluded from cutting for reasons such as steep slopes where actual operation is difficult and/or upkeep of forest functions described later etc.

According to the results of the socio-economic survey conducted by the Study Team in 2000, the annual log production volume by the inhabitants in Kon Plong District is 625m<sup>3</sup>. In addition, because these logs are mainly used for house construction and they are not for sale, the production volume equals the demand volume. Whenever inhabitants procure woods, a government specification says that they need to take provincial government permission for log production and/or to purchase woods from FEs. However, there is high possibility of illegal cutting.

## **(2) Buyers of woods**

Kontum Import Export and Investment Company (KOTIMEX) as a buyer has a large share of standing trees and logs in Kon Tum province. The KOTIMEX company is 100% government owned. Activities include: logging, sawing, wood processing, clothes manufacturing, coffee plantation, and road and bridge construction. A bank loan covers 100% of operational costs. The details of KOTIMEX activities in the field of forestry are described below.

Logging activities are carried out in Kon Tum province. The production volume by logging in 1999 was approximately the sum of 12,000m<sup>3</sup>: 7,000m<sup>3</sup> in Kon Plong District, 2,000m<sup>3</sup> in Dak To District and 3,000 m<sup>3</sup> in Dak Gley District. In 2000 it was approximately the sum of 10,000 m<sup>3</sup>: 5,000m<sup>3</sup> in Kon Plong District, 2,000m<sup>3</sup> in Dak To District and 3,000m<sup>3</sup> in Dak Gley district. Due to the current insufficient round wood supply, sawn timber has been procured from Dak Lac Province.

The annual sawn timber production volume is approximately 1,000m<sup>3</sup>. Sawn timber has been sold for construction and ships. The sawn timber process machines are very old web saws. Made in Vietnam, they are imitations of the sawn timber process machines introduced by France approximately in 1900. In addition, KOTIMEX has band saws. KOTIMEX also owns a drying machine, which dries sawn timber to 12% water content within 10 to 12 days. For wood processing, KOTIMEX owns the necessary machines including a molding machine. The company mainly manufactures chairs and desks and exports to neighboring Asian countries and Europe.

Because the international market price of plywood had fallen, plywood is not produced now. However, veneers dried naturally are sold to Ho Chi Minh City and sufficient income can be obtained. Two containers of plywood were exported to Japan in 1998.

Buyers of standing trees, round wood and sawn timber of the each FE from 1994 to 1999 are shown below.

Tan Lap FE sold standing trees to KOTIMEX from 1994 to 1998.

Kon Plong Forestry Agriculture Industry Investment Development and Service Company (formerly Mang Canh II FE) have more than 100 buyers. Fifty percent of those were from Ho Chi Minh City and thirty percent from Quang Ngai Province. However, eighty percent were from Kon Tum Province in 2000. The reason was those buyers introduced high-performance sawing machines. As for standing tree sales, a trial bid system was introduced since 1999. Although widely publicized in and out of the Province, only companies in Kon Tum Province tendered and Rang Dong Company made a successful bid.

Standing trees of Mang Canh I FE in 1994 and 1995 were sold to KOTIMEX, and those in 1998 were sold to Kon Plong Forestry Agriculture Industry Investment Development and Service Company (former Mang Canh II FE).

Standing trees of Dak Ruong FE from 1994 to 1999 were sold to KOTIMEX.

Mang La FE's sawn timber in 1994 and 1995 was sold to ship building companies and furniture factories in Gia Lai Province and Qui Nhon City. Standing Trees in 1996 were sold to KOTIMEX and those in 1999 were sold to Kon Plong Forestry Agriculture Industry Investment Development and Service Company.

Standing Trees of Mang Den FE from 1996 to 1999 were sold to KOTIMEX and BUSKO in Kon Tum Province.

### **(3) Trends of log prices**

The government of Kon Tum Province controls the selling price of standing trees. They define the standard price in each tree group . Table I-2.5.1 shows prices of standing trees. Trees can be divided into eight groups (Volume III 6), and each group can be further divided. There are two diameter classes; one is 25 to 50 cm and the other is 50 cm and more. In addition, according to the transport distance and road conditions, there is an area coefficient in each district of Kon Tum Province. For

example, the price of standing trees in Kon Plong District can be calculated by multiplying the defined value by 0.9.

**Table I-2.5.1 Selling price list of standing trees from natural forest**

Unit: 1,000VND/m<sup>3</sup>

No	Categories	Round wood		Note
		25cm<D<50cm	D>=50cm	
<b>I</b>	<b>Group I</b>			1. the price of <i>Keteleeria davidiana</i> , <i>Melanorrhoea laccifera</i> , <i>bong lau</i> in group I is the same as the price of other species in group III
1	Except noted woody species	1,100	1,150	
<b>II</b>	<b>Group II</b>			
1	<i>Xylia xylocarpa</i> , <i>Maduca pasquieri</i>	530	580	
2	<i>Hopea</i> spp.	530	580	
3	<i>Hopea pierre</i> , <i>Dialium cochinchinensis</i>	310	360	
4	Others	250	310	
<b>III</b>	<b>Group III</b>			
1	<i>Talauma gioi</i> , <i>Anisoptera cochinchinensis</i> , <i>Lagerstroemia calyculata</i>	330	400	
2	Others	300	365	
<b>IV</b>	<b>Group IV</b>			
1	<i>Dipterocarpus</i> , <i>sao cat</i>	330	365	
2	<i>Shorea cochinchinensis</i> , <i>shorea henryana</i>	365	430	
3	<i>Pinus kesiya</i> , <i>podocarpus imbricatus</i>	235	230	
4	Others	170	230	
<b>V</b>	<b>Group V</b>			
1	<i>Dipterocarpus</i> spp.	360	400	
2	<i>Pinus merkusii</i>	290	330	
3	Others	175	250	
<b>VI</b>	<b>Group VI</b>			
1	<i>Machilus bonii</i> , <i>Canarium</i> sp., <i>Pygeum arboreum</i> , <i>Rhodoleia championh</i>	215	250	
2	Others	140	220	
<b>VII</b>	<b>Group VII</b>			
1	<i>Endospermum sinensis</i> , <i>Syzygium wightianum</i> , <i>Alstonia scholaris</i> , <i>Wrightia annamensis</i>	140	220	
2	Others	100	120	
<b>VIII</b>	<b>Group VIII</b>			
1	All species	100	120	

- Prices of foot, and root are 50% (a half) of standing tree prices respectively.

- Regional coefficient: Kontum, Dak Ha, Dak To : 1  
Sa Thay, Ngoc Hoi : 0.98  
Kon Plong, Dak Gley : 0.9

The provincial government defines the minimum selling prices of round wood, sawn timber and refined wood for each tree group. The minimum prices are for taxation and for preventing companies from trading at unreasonable low prices in attempts to lower the tax. Accordingly, companies must pay at least the price calculated by multiplying the minimum price by tax rate . Table I-2.5.2 shows the list of the minimum prices. Similarly to Table I-2.5.1, there are eight tree groups and each group is further sub divided . There are two diameter classes; one is 25 to 50 cm and the other is 50 cm and more. If

forest products are sold outside Kong Tum Province, the lowest tax price is increased by 10%. Also, if the market price changes by more than 10%, the Provincial People's Committee will meet to discuss the adjustment of the minimum price for the taxation.

**Table I-2.5.2 List of the minimum prices for the round wood, sawn timber and refined wood**

Unit: 1,000VND/m<sup>3</sup>

No	Categories	Round wood		Note
		25cm<D<50cm	D>=50cm	
<b>I</b>	<b>Group I</b>			1. The prices for taxation of <i>Keteleeria davidiana</i> , <i>Melanorrhoea laccifera</i> , <i>bong lau</i> in group I are the same as the prices of other species in group III 2. Price of wood cutting by axe or saw (group I) for being taxed is 3,700,000VND/m <sup>3</sup>
1	Except noted woody species	2,900	3,000	
<b>II</b>	<b>Group II</b>			
1	<i>Xylia xylocarpa</i> , <i>Maduca pasquieri</i>	1,600	1,700	
2	<i>Hopea</i> spp.	1,600	1,700	
3	<i>Hopea pierre</i> , <i>Dialium cochinchinensis</i>	1,200	1,300	
4	Others	1,100	1,200	
<b>III</b>	<b>Group III</b>			
1	<i>Talauma gioi</i> , <i>Anisoptera cochinchinensis</i> , <i>Lagerstroemia calyculata</i>	1,100	1,200	
2	Others	1,000	1,100	
<b>IV</b>	<b>Group IV</b>			
1	<i>Dipterocarpus</i> , <i>sao cat</i>	1,050	1,100	
2	<i>Shorea cochinchinensis</i> , <i>Shorea henryana</i>	1,100	1,200	
3	<i>Pinus kesiya</i> , <i>podocarpus imbricatus</i>	900	950	
4	Others	800	900	
<b>V</b>	<b>Group V</b>			
1	<i>Dipterocarpus</i> spp.	1,050	1,100	
2	<i>Pinus merkusii</i>	900	950	
3	Others	750	850	
<b>VI</b>	<b>Group IV</b>			
1	<i>Machilus bonii</i> , <i>Canarium sp.</i> , <i>Pygeum arboreum</i> , <i>Rhodoleia championh</i>	800	850	
2	Others	700	800	
<b>VII</b>	<b>Group VII</b>			
1	<i>Endospermum sinensis</i> , <i>Syzygium wightianum</i> , <i>Alstonia scholaris</i> , <i>Wrightia annamensis</i>	700	800	
2	Others	500	600	
<b>VIII</b>	<b>Group VIII</b>			
I	All species	500	600	

## **2.5.2 Fuelwood supply and demand**

The government of Vietnam officially prohibits the sale of charcoal, but actually some residents must make and sell charcoal to maintain their living. However, the amount of charcoal has been decreasing. It is difficult to obtain data of charcoal in such a situation. Therefore, the supply and demand structure of firewood and the selling price situation are analyzed in this sub-section.

### **(1) Supply and demand situation and structure of firewood**

According to the results of an examination by UNDP/ESMAP in 1992, the annual firewood demand in the Central Highlands is 1.42 million tons. The fuel wood demand per person per day is 1.3 kg, which can be calculated by dividing 1.42 million tons by 365 days and 3,098,800, which is the number of the total population of the Central Highlands in 1994. The number 1.3 kg is obtained through calculations taking into account the demand amount and urban population. The firewood demand is moderately decreased in the urban area compared with the 1.3 kg figure because many urban people depend on other fuel such as kerosene . It is expected that firewood demand per person per day in the area excluding urban area is somewhat larger than 1.3 kg. Accordingly, it is expected the firewood demand in Kon Plong District (local area) is somewhat larger than 1.3 kg.

On the other hand, according to the results of the socio-economic survey in the Study, the volume of firewood production in the total area of Kon Plong District is 46,667 stere. The amount of annual firewood demand in stere units in Kon Plong District will be calculated on the basis of the above-mentioned 1.3 kg, applying the total population of 32,743 as the of the Kon Plong District in 2000, 0.5 t/m<sup>3</sup> of assumed specific gravity of firewood, and 0.7 m<sup>3</sup>/stere conversion rate. As at result, it will become 44,390 stere. This number is somewhat smaller than the 46,667 stere above. However, considering the difference between the urban area and the local area described above, the number of 46,667 stere may be appropriate for the volume of production in the Central Highlands.

Also, according to the socio-economic survey, the total production volume is used for self-consumption, and all the supply volume was provided from only the district. Accordingly, the amount of production equals the supply amount and/or demand amount in this district. Supply and demand of firewood may be well balanced. Firewood is not supplied by sales outside Kon Plong District because costs such as transportation are too expensive. Therefore, it is not profitable to sell firewood in Kon Tum Town area the main firewood consumer.

Where firewood is produced, carrying branches for firewood from the logged-over land in the FEs' jurisdiction is acceptable with a permit. However, logged-over land is remote and much labor is necessary for transport. Also there is no need to supply firewood from such a remote place because

there are many local forests. For this reason firewood is not supplied from the logged-over land. In addition, there has been no engagement in sales of firewood by the FEs even though farmers do not take wood such as branches for firewood from the logged-over land. The reason is because the production is not profitable due to the high transportation cost of firewood. The transportation cost is more expensive than the firewood selling price.

## **(2) Trend of firewood price**

The firewood selling price in Kon Tum Province is from 2,000 to 2,200 VND per bound. Because the average weight of a bound is 4.5 kg, the price per kg is from 444 to 489 VND. Farmers living close to a seller deliver firewood to the seller. Because the profit of sellers is approximately 15%, farmers get 1,700 to 1,870 VND per bound.

### **2.5.3 NTFP production and market**

The local people in the forest are collecting, harvesting and hunting useful non-timber forest products (NTFPs) from their surrounding areas for mainly their own daily consumption. Also people can sell the NTFPs for cash.

#### **(1) NTFP production**

The quantity and commercialization of NTFPs are still limited and amount is small in the total forest production. Nevertheless, one of the things that forest dwellers rely on in daily life is NTFPs. The peasants heavily rely on NTFPs for materials for fuel, food, forage, medicine, incense, glue, resin, utensils, etc. Table I-2.5.3 shows production of main NTFPs by each commune in Kon Plong District based on the results of the socio-economic survey in the Study.

The total production of each NTFP in the table is 457,500 poles of bamboo, 1,820 kg of mushroom, 8,810 kg of Boi Loi (*Machilus odoratissima*, *Litsea* spp.) and 390 liters of honey. It is obvious that production of bamboo is dominantly made in Mang Canh, Hieu and Po E communes. Regarding production of mushroom, Dak Koi, Dak Phe, Mang Canh and Dak Ring are the most productive communes with the amount of 180 kg. Production of Boi Loi is chiefly practised in Dak Koi and Dak Tre Communes. Boi Loi is an exportable product to external markets as well as local markets. Production of honey is significant in Mang Canh and Dak Koi Communes. Overall, the most active communes on NTFPs production are Dak Koi and Mang Canh, whilst Mang But and Ngoc Tem Communes are low in activity .

**Table I-2.5.3 Production of major NTFPs in Kon Plong District**

Communes	NTFPs			
	Bamboo (poles)	Mushroom (kg)	Boi Loi (kg)	Honey (lit)
<i>Total</i>	<i>457,500</i>	<i>1,820</i>	<i>8,810</i>	<i>390</i>
Kon Plong Town	17,500	60	1,200	0
Tan Lap	20,600	150	180	0
Dak Ruang	35,000	120	700	0
Dak Tre	30,300	150	1,500	20
Dak Koi	37,600	180	2,600	100
Dak Pnc	25,700	180	1,040	50
Mang Canh	48,200	180	120	120
Hieu	47,800	120	570	40
Po E	45,500	160	900	60
Mang But	43,000	170	*	*
Ngoc Tem	42,600	170	*	*
Dak Ring	43,700	180	*	*

Sources: Inventoried Data by FIPI Working Group in 3,4,5/2000

Apart from the above-mentioned NTFPs, resin from Cay Tram Houg (*Aquilaria crassna* and *Rhamnoneuron balansea*) is one of the most important products in NTFPs in the Study Area. The productive site for the highest quality of the resin from Cay Tram Houg is the Central Highlands. Therefore, even now many plant hunters from outside regions are looking for the plant.

## (2) Market condition of NTFPs

Cinnamon, resin, honey, medicinal plants, mushroom, bamboo, bamboo shoot, bamboo grass, rattan, flowers, latex, and wild animals are significantly marketable NTFPs.

Regarding natural minor NTFPs such as raw material of perfume, incense, spices, medicine, and other special uses, the prices are rising because of shortage of supply. On the other hand, the price of plantation products fell due to over-production and ample supply in the world market except for Boi Loi. Boi Loi is mainly being transformed and supplied to the domestic market so it does not have competitors and no pressure for price fluctuation. Po E Commune will change the land use from coffee plantation to Boi Loi plantation. Although coffee is a well-known plantation crop in Kon Plong District since 1996, it suffers from low price and many traders in the Kon Tum Province cannot find suitable markets.

Wild honey is still a minor forest product in the region. It has high demand in the local and domestic market and is an exportable product to Taiwan, Hong Kong and Japan as well.

As another potentiality of domestic market development of NTFPs, it is noted that National Road 24 is currently under reconstruction for repaving from Kon Tum Town to Quang Ngai Province throughout central Kon Plong District. The trading capacity and total quantity of NTFPs might be increasing and much progress on marketability would be brought by a national road network. It means local people can have much commercial opportunity by NTFP production.

## **2.6 Forest management organization**

This section mentions analysis of the present conditions and problems regarding forest enterprises, etc. (FEs & PFMC) are regarded as the core of forest management organization in the Study Area. The mentioned FEs & PFMC are Thach Nham Protection Forest Management Committee (PFMC), Tan Lap FE, Kon Plong Forestry Agriculture Industry Investment Development and Service Company (formerly Mang Canh II FE), Mang Canh I FE, Dak Ruong FE, Mang La FE and Mang Den FE.

All of these FEs & PFMC are now managed and operated by Provincial Government. Until 1995, however, Mang La FE and Mang Den FE were managed as Koh Hanung Forestry-Agriculture-Industry Union under the direct control of Central Government and the present two (2) FEs were similar to the branch office. In 1995, the Union was completely divided into the two FEs to be under the control of Provincial Government. Areas managed by the Union consisted of the present areas managed by eight (8) FEs of Gia Lai Province and the two (2) FEs of Kon Tum Province.

To confirm management ability of six (6) FEs in Kon Plong District has a great influence on future planning tasks. This sub-section finds present circumstances, problems and issues of the FEs' management through organization and fund equipment of each FE, the present conditions of control and management of each FE according to activity accounts and each activity volumes from 1994 to 1999 and interviews with the director of each FE regarding future activity operations. The results of the interviews and detailed data of this analysis are shown separately in Volume III 14 and Volume III 15 respectively. Control organization and activities of Thach Nham PFMC are also simply analyzed.

Figures and tables in relation to the following activity accounts are drawn under the following preconditions: 1) Any direct expenses for activities regarding Decision 327 and 661 mainly for silviculture and forest management and protection activities and indirect expenses for salaries of the staff are subsidized from Provincial People's Committee to FE. 2) Any earnings regarding standing tree sales are remitted to Provincial People's Committee. Accordingly, 1) the amount of subsidized money is appropriated only for expenses but not counted up for incomings; 2) Earnings in standing tree sales are counted up only for incomings but not for outgoings. (If these subsidies are counted up for incomings and earnings in standing tree sales is counted up for outgoings, the account balances of Mang Canh I FE, Dak Ruong FE, Mang La FE and Mang Den FE which do not have any profitable



activity, are equalized and therefore, the figure has no meaning.) As for Tan Lap FE and Kon Plong Forestry Agriculture Industry Investment Development and Service Company which have profitable activity, the figure is calculated by adding up earnings and expenses in profitable activity under the same preconditions for the necessity of according with conditions. In this figure, therefore, the values can mean an activity scale of each FE on an amount base but not show profit and loss.

However, on application of Decision 187, activities in production forest should be implemented by FE's owned capital and accordingly the above-mentioned figure will be informative for activity evaluation as profit-and-loss estimation, presuming that future FE's activities will be implemented in only production forest on the same scale as activity from 1994 to 1999.

On the other hand, in seeing values regarding incomings and outgoings, the followings need to be taken into consideration: 1) Practically, governmental subsidy will continuously be allotted to silviculture activity and forest management and protection activity in protection forest under Decision 661. 2) It is assumed that there is a high possibility that silviculture activity and forest management and protection activity will be implemented only in protection forest.

This means that there is a low possibility that the FEs which do not have any protection forest will implement silviculture activity and forest management and protection activity. It also means that future activity tasks may be changed. Therefore, in description about the FEs, profit-and-loss account is estimated by a method to externally economize activities regarding Decision 661, in other words, to deduct direct expenses other than Decision 661-related activities and gross indirect expenses including staff's salaries from gross incomings including earnings in standing tree sales and in other profitable activities.

#### **2.6.1 Thach Nham Protection Forest Management Committee (PFMC)**

Management areas of Thach Nham PFMC are located in the northeast of Kon Plong District; the northern boundary is Ngoc Tem Commune where areas managed by the Committee mainly lay. The eastern boundary is adjacent to Quang Ngai Province, the western boundary to Tan Lap FE's area and Kon Plong Forestry Agriculture Industry Investment Development and Service Company's area and the southern boundary to Mang La FE's area. The total size of the management areas is 33,469 ha and all the area is functionally classified as protection forest. As for area by forest constitution, natural forest is 29,725 ha, man-made forest 21 ha, the remaining other land such as agricultural land 3,723 ha.

Any logging activity has not been conducted up to now in the area under the direct management of this PFMC.

Organization of the PFMC consists of two persons, chairman and accountant: The Chairman holds concurrently Vice Director (Acting Director) of Mang La FE and a part of Mang La FE's office is used as the PFMC office.

The PFMC has silviculture activity, forest management and protection activity and forestry extension activity. The PFMC implemented the silviculture activity with species of *Pinus kesiya* in 1999 in the jurisdiction area in collaboration with Mang La FE. The volumes of forest management and protection activity are shown in Fig. 2.6.1. Regarding silviculture activity, the volume is shown in the description of Mang La FE in 2.6.2 (6).

The PFMC is implementing forest management and protection activity in an area several times as wide as the area for the activity conducted by FEs. Accordingly, the PFMC puts more emphasis on enlightenment activity to villagers about importance of illegal logging exposure and negative influence of logging activity than the FEs. The rate of ethnic minority households assigned with the forest management and protection activity is 100%, intended for all the households in the management area.

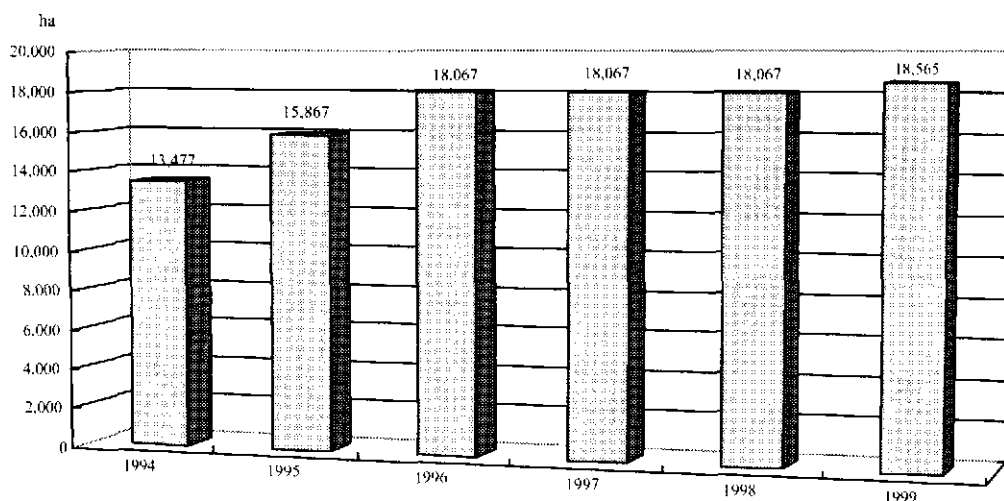


Figure I-2.6.1 Thach Nham PFMC's forest management and protection activity volume

All the expenses for these activities including indirect expenses such as salaries are financed out of the government budget. In this connection, the gross amount of budget allotment in 1999 is 1,289,964,000 VND.

There is a big problem in management, which can be said throughout Kon Plong District, that the PFMC's area is more inconvenient in road network, especially access to the northern area than other FEs' and visits to hamlets occasionally take 3 days one way. However, it can also be said that abundant remaining natural forest of good quality is attributed to the undeveloped road network.

### 2.6.2 Tan Lap FE

Management area of Tan Lap FE is located in the north of Kon Plong District. The northern and eastern border is adjacent to the areas managed by Thach Nham PFMC and the southern border to the jurisdiction of Konplong Forestry Agriculture Industry Investment Development and Service Company. The western side is Mang But Commune in which there is mainly the jurisdiction of Tan Lap FE. The total size of management area is 16,123 ha. All of the area is allocated to production forests in functional classification. By the composition of forests, the area of natural forests is 14,063 ha, that of man-made forests is 210 ha and that of the remaining other lands such as agricultural lands is 1,850ha.

The organization of this FE consists of one (1) Director, one (1) Vice director, one (1) Accountant, one (1) Cashier, two (2) Technicians and one (1) Driver. FE has been operated by a total of seven (7) persons. In addition to the above persons, 6 permanent workers for wood processing and necessary numbers of temporary workers have been employed. Only Tan Lap FE and Konplong Forestry Agriculture Industry Investment Development and Service Company (formerly Mang Canh II FE) have both Director and Vice director. They have relatively firm organization, although the organizational structure of FEs is weak as a whole. As for the characteristics of capital equipment, they have a sawmill.

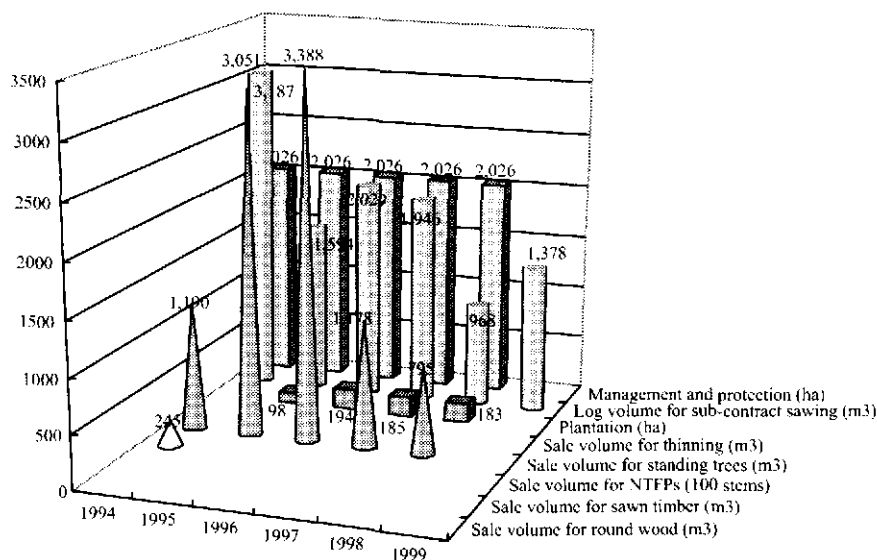


Figure I-2.6.2 Operation volume of Tan Lap FE

Figure I-2.6.2 represents the operation volume by each activity from 1994 to 1999 by Tan Lap FE. The characteristic of Tan Lap FE is that it has implemented profitable operations using a sawmill under direct management. Companies such as KOTIMEX and Rang Dong Company in Kon Tum Province have logged standing trees purchased generally through the sales system of standing trees in the jurisdiction of the FEs in Kon Plong District. For sawing these logs, these companies have contracted

with Tan Lap FE. Tan Lap FE has sawed about 1,000 to 3000 m<sup>3</sup> logs every year and they have obtained the profits from the charges for this work. At present, Tan Lap FE has not carried out the profitable operations of selling the sawn timber through logging and sawing operation by the FE itself.

Tan Lap FE pays 30% out of the final profits obtained by this sawing operation as taxes to the Provincial People's Committee. Out of the remaining 70%, 50% is used for new equipment investment and equipment maintenance. Out of the remaining 20%, each one-third is used for bonuses to workers, welfare programs for workers and loss provision for the following year respectively. Loss provision for the following year is used for equipment investment unless the loss does not occur in the following year.

Sales operations of standing trees were implemented in the range of 800 to 3,400 m<sup>3</sup> of trees every year in 1994 to 1998. Regarding the sales of NTFPs, 24,465 stems of Rattan were sold at 24.5 million VND in 1994.

The total area of reforestation implemented for 6 years was 660 ha and the trees species was *Pinus Kesiya*. At first, reforestation was implemented at protection forests, but the place of reforestation was changed to production forests by establishing functional classification again in 1998. Regarding reforestation in 1997 and 1998, Tan Lap FE implemented reforestation in Mang Bat Commune outside its jurisdiction although it had not the suitable lands for reforestation inside its jurisdiction because Tan Lap FE was requested to carry it out by the Provincial Government from the standpoint of securing the inhabitants' income.

Forest management and protection activity had been implemented for the area of 2,000 ha until 1998, but in 1999, they were not implemented. This may be because Tan Lap FE has only production forests and the subsidies for forest management and protection activities at production forests are not provided in accordance with Decision 661. Moreover, the proportion of ethnic minorities out of households assigned forest management and protection activities is 100%.

Forestry extension activities have not been implemented except for those to enlighten farmers on the importance of forest protection.

Figure I-2.6.3 represents the income and expenditure of Tan Lap FE in 1994 to 1999. This figure should be analyzed based on the preconditions mentioned above. In the case of the calculation on the assumption that future activities will be implemented in only production forests on the same scale as in 1994 to 1999, the balance of business will fall into a deficit of 2,329 million VND as the total of 6 years. If profit and loss in the total of 6 years are calculated on the condition that the activities related to Decision 661 are conducted through external economies, a surplus of 333 million VND will be

reached.

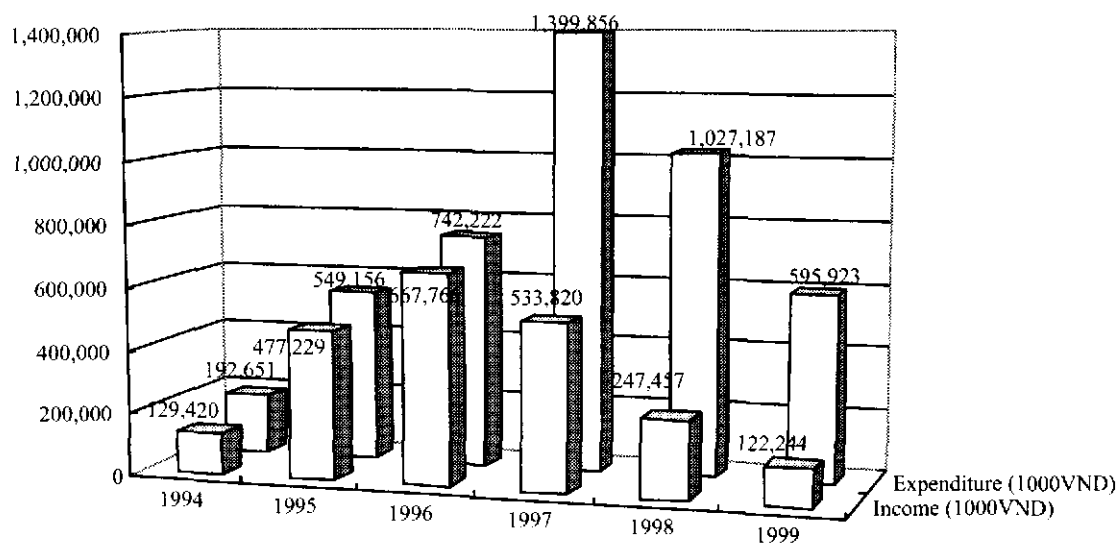


Figure I-2.6.3 Income and Expenditure of Tan Lap FE

### 2.6.3 Konplong Forestry Agriculture Industry Investment Development and Service Company (formerly Mang Canh II FE)

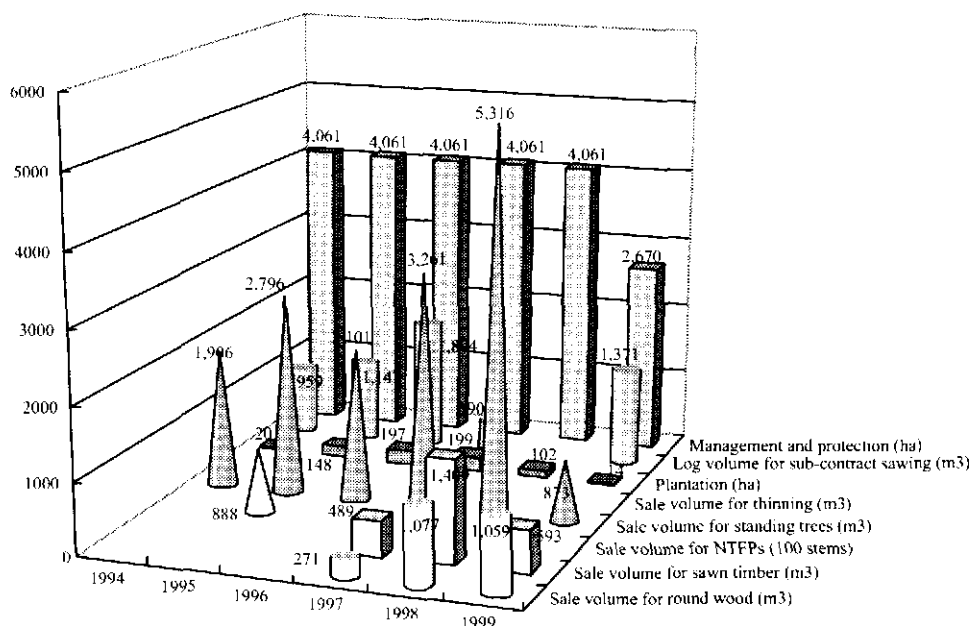
Management area of Konplong Forestry Agriculture Industry Investment Development and Service Company is located in the center of Kon Plong District. The northern border is close to the jurisdiction areas of Tan Lap FE and the eastern border is close to the district managed by Thach Nham PFMC. The southern border is close to the jurisdiction of Mang Canh I FE and the western border is close to the jurisdiction of Dak Ruong FE. The total size of management area is 13,894ha. Of this, the area of production forests is 11,524ha and that of protection forests is 2,370ha by functional classification. By the composition of forests, the area of natural forests is 11,528ha, that of man-made forests is 569ha and that of the remaining other lands such as agricultural lands is 1,797ha.

Konplong Forestry Agriculture Industry Investment Development and Service Company changed the name from the former Mang Canh II FE in January 1997 and also changed the organizational form from FE to a limited company. Through the formation of a limited company, it became possible to implement profitable operations such as import and export business, hydroelectric power business, tourist industry and construction industry of roads, which FEs cannot implement due to various restrictions. In addition, because from outside, the company is regarded as an organization where the businesses mentioned above can be implemented, the formation of a limited company contributes to the expansion of business. However, this is not complete privatization and only the government has limited liability, the assets and profits belong to the government. The company also takes

responsibility for the activities related to Decision 661 as FE.

The organization of this company consists of one (1) Director, one (1) Vice Director, three (3) Accountants, one (1) Cashier, three (3) Technicians and two (2) Drivers. This company has been operated by the total 11 persons. In addition to the above persons, 20 to 100 regular workers have been employed. Only this company and Tan Lap FE have both Director and Vice Director. They have relatively firm organization, although the organizational structure of FEs is weak as a whole. As for the characteristics of capital equipment, the company has machinery and materials for logging, a sawmill and an approximately 90 km-long forest road network.

Figure I-2.6.4 represents the operation volume by each activity in 1994 to 1999 by this company. The characteristic of business is that this company has promoted the diversification of business as mentioned above after the formation of a limited company and has implemented logging operations and sawing operations for the sales of logs and sawn timber. The logging and sawing operations include 2 types as follows: one is to saw round wood logged by the company and sell the sawn timber and the other is to sub contract sawing logs of other companies in the same way as Tan Lap FE. In the future, the diversification of business will develop. The sales of both logs and sawn timber started from 1997. Logs and sawn timber have been sold in the range of 300 m<sup>3</sup> to 1,100 m<sup>3</sup> and 500 m<sup>3</sup> to 1,400 m<sup>3</sup> every year respectively. Logging operations have been implemented not only using standing trees in the forests in its jurisdiction, but also by purchasing standing trees from Mang Canh I FE and Mang La FE.



**Figure I-2.6.4 Operation volume of Konplong Forestry Agriculture Industry Investment Development and Service Company**

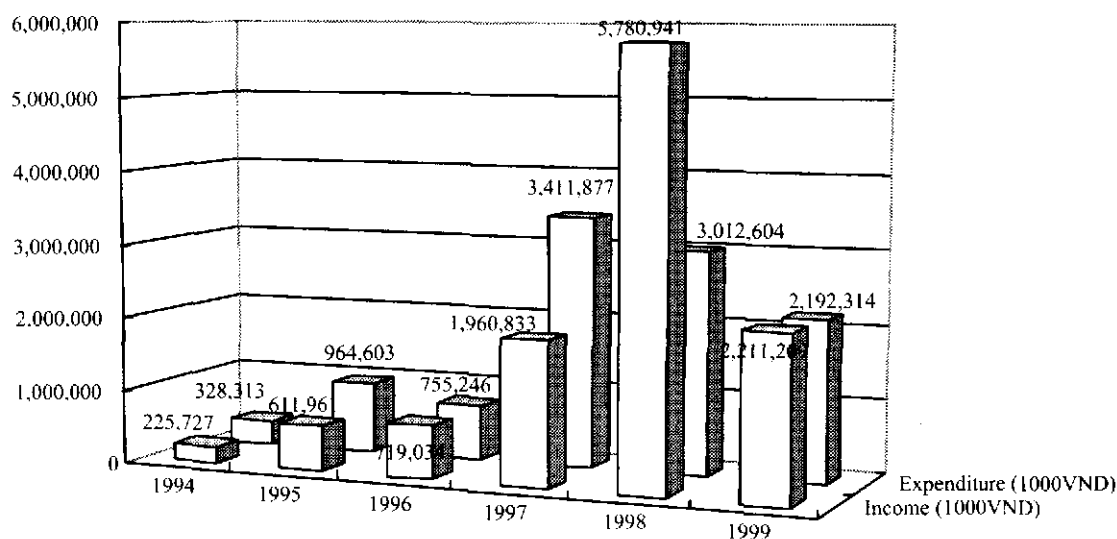
Sales operations of standing trees were implemented in the range of 900 m<sup>3</sup> to 5,300 m<sup>3</sup> trees every

year in 1994 to 1999. Regarding the sales of NTFPs, 88,750 stems of Rattan were sold at 71 million VND in 1995.

Regarding reforestation operations, the tree species was *Pinus Kesiya* in 1994 to 1998 and *Aquilaria crassna* in 1998 to 1999. *Aquilaria crassna* has been planted under trees. Reforestation has been implemented to the area of 679 ha for a total of 6 years (of which 22 ha are for *Aquilaria crassna*). All of them have been planted at protection forests.

Forest management and protection activities were conducted for the area of about 4,000 ha in 1994 to 1998 and for that of about 2,700 ha in 1999. The proportion of ethnic minorities out of households assigned forest management and protection activity at protection forests was 86% and 100% respectively in 1994 to 1998 and in 1999. The proportion of ethnic minority households assigned the activity at production forests in 1994 to 1998 was 92%.

Forestry extension activities have not been conducted except for those to enlighten farmers on the importance of forest protection. In the future, there will be a plan to examine reforestation of the tree species with high value under the cooperation of the Science Industry Environment Committee in Kon Tum Province and the Tropical Rain Forest Institution in Ho Chi Minh City. If the reforestation succeeds, the seedlings will be distributed to farmers.



**Figure I-2.6.5 Income and expenditure of Konplong Forestry Agriculture Industry Investment Development and Service Company**

Figure I-2.6.5 represents income and expenditure in 1994 to 1999 by this company. This figure should be analyzed based on the preconditions mentioned above. In the case of the calculation on the assumption that future activities will be implemented in only production forests on the same scale as in

1994 to 1999, a surplus of 845 million VND will be reached as the total of 6 years. If profit and loss in the total of 6 years are calculated on the condition that the activities related to Decision 661 are conducted through external economies, a surplus of 3,783 million VND will be reached.

#### 2.6.4 Mang Canh I FE

Management area of Mang Canh I FE is located a little to the southern side of the center of Kon Plong District. The northern border is close to the jurisdiction of Konplong Forestry Agriculture Industry Investment Development and Service Company. The southern border is close to the jurisdiction of Mang Den FE and the western border is close to the jurisdiction of Dak Ruong FE. The total size of management area is 16,932 ha. Of this, the area of production forests is 11,912 ha and that of protection forests is 5,020 ha by functional classification. By the composition of forests, the area of natural forests is 9,993 ha, that of man-made forests is 2,130 ha and that of remaining other lands such as agricultural lands is 4,809 ha.

The organization of this FE consists of one (1) Vice director (Acting Director), two (2) Accountants, four (4) Technicians and one (1) Driver. This FE has been operated by a total of eight (8) persons. Regarding capital equipment, there is nothing except for offices and vehicles.

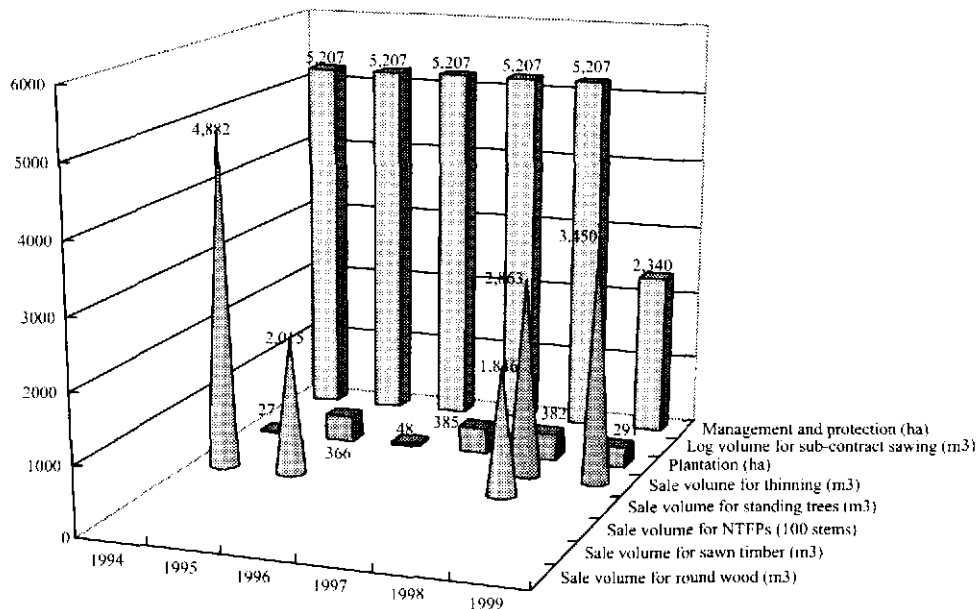


Figure I-2.6.6 Operation volume of Mang Canh I FE

Figure I-2.6.6 represents the operation volume by each activity in 1994 to 1999 by Mang Canh I FE. This FE has not carried out logging activities for development. The sales of standing trees were implemented in the range of 1,800 m<sup>3</sup> to 4,900 m<sup>3</sup> of trees only in 1994, 1995 and 1998.

Regarding reforestation operations, *Pinus Kesiya* was planted for the area of 1,208 ha, *Pinus Merkusii*



for that of 291 ha and *Aquilaria crassna* for that of 0.2 ha by tree species in the total of 6 years. *Aquilaria crassna* has been planted under the trees. Two thirds of afforested lands are in protection forests and the remaining one third of them is in production forests.

This FE has implemented reforestation operations for the longest time compared to other FEs in the Kon Plong District. According to the existing data, in 1979, reforestation started and had been implemented for the area of 783 ha until the end of the 1980s by using *Pinus Kesiya*. As for the characteristics of Mang Canh I FE, with the history of reforestation, thinning has been carried out. The other FEs have not conducted thinning. Mang Canh I FE has thinned out about 6,300 m<sup>3</sup> in the area of about 200 ha for *Pinus Kesiya* for the 2 years of 1998 and 1999 and has sold them. The activities for thinning should be implemented using the governmental budget fundamentally. However, the FE has appropriated the income by selling timber thinned out to cover the expenses for thinning under special permission of the Provincial Government due to the lack of the governmental budget.

Forestry extension activities such as the following activities, as well as those to enlighten farmers on the importance of forest protection, have been carried out. This FE has been provided seedbeds of *Litsea* for aromatic ingredients called Boi Loi in Vietnamese from the agriculture section and the staff of the FE has conducted technical guidance for the planting.

Forest management and protection activities were implemented for the area of about 5,200 ha from 1994 to 1998 and for that of about 2,300 ha in 1999 both at protection forests and at production forests. The proportion of ethnic minorities out of households assigned forest management and protection activities is 70%.

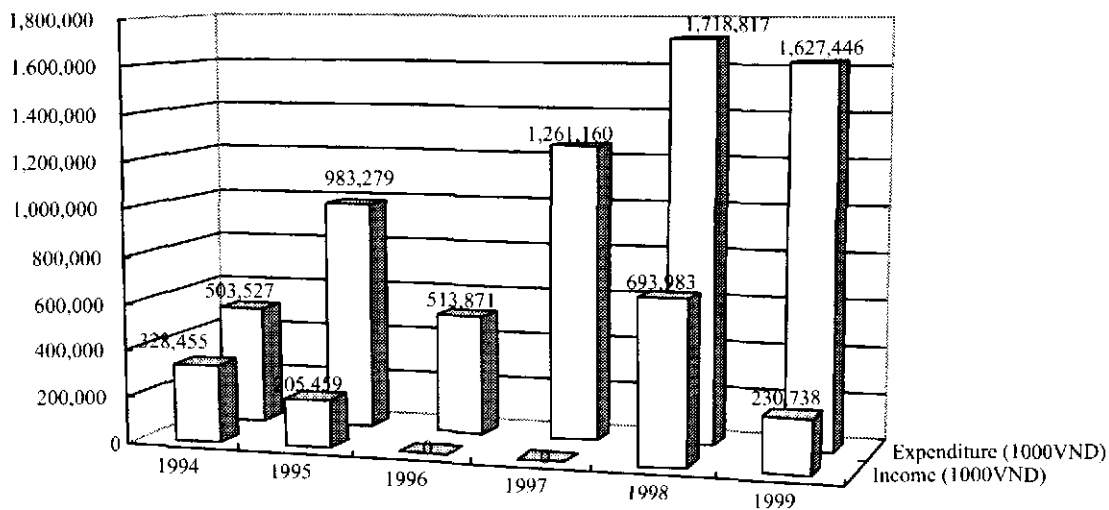


Figure I-2.6.7 Income and expenditure of Mang Canh I FE

Figure I-2.6.7 represents the income and expenditure in 1994 to 1999 by Mang Canh I FE. This figure

should be analyzed based on the preconditions mentioned above. In the case of the calculation on the assumption that future activities will be implemented in only production forests on the same scale as in 1994 to 1999, the balance of business will fall into a deficit of 5,149 million VND in the total of 6 years. If profit and loss in the total of 6 years are calculated on the condition that the activities related to Decision 661 are conducted through external economies, a surplus of 238 million VND will be reached.

### 2.6.5 Dak Ruong FE

Management area of Dak Ruong FE is located in the western side of the center of Kon Plong District. The northern border is close to Mang But Commune and the eastern border is close to the jurisdiction of Konplong Forestry Agriculture Industry Investment Development and Service Company and Mang Canh I FE. The southern border is close to Dak Ruong Commune and the western border is Dak Koi Commune in which there is mainly the jurisdiction of Dak Ruong FE. The total size of management area is 14,266 ha. Of this, the area of production forests is 8,828 ha and that of protection forests is 5,438 ha by functional classification. By the composition of forests, the area of natural forests is 9,954 ha, that of man-made forests is 653 ha and that of remaining other lands such as agricultural lands is 3,659 ha.

The organization of this FE consists of one (1) Director, three (3) Accountants, one (1) Cashier, and three (3) Technicians. This FE has been operated by a total of eight (8) persons. Regarding capital equipment, there is nothing except for offices and vehicles.

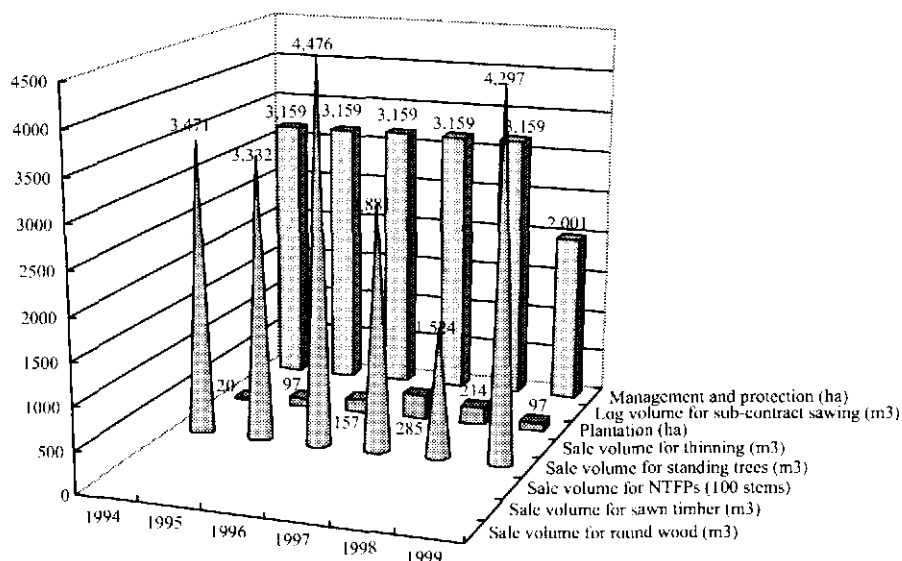


Figure I-2.6.8 Operation volume of Dak Ruong FE

Figure I-2.6.8 represents the operation volume by each activity in 1994 to 1999 by Dak Ruong FE.

Sales operations of standing trees have been implemented rather constantly in the range of 1,500 m<sup>3</sup> to 4,500 m<sup>3</sup> every year.

Reforestation operations were implemented for the area of 870 ha in the total of 6 years. The tree species was *Pinus Kesiya* and all were planted at protection forests.

Forest management and protection activities were implemented for the area of about 3,200 ha in 1994 to 1998 and for that of about 2,000 ha in 1999 mainly at protection forests. The proportion of ethnic minorities out of households assigned forest management and protection activities is 100%.

Forestry extension activities have not been conducted except for those to enlighten farmers on the importance of forest protection.

Figure I-2.6.9 represents the income and expenditure in 1994 to 1999 by Dak Ruong FE. This figure should be analyzed based on the preconditions mentioned above. In the case of the calculation on the assumption that future activities will be implemented in only production forests on the same scale as in 1994 to 1999, a surplus of 1,907 million VND in the total of 6 years will be reached. If profit and loss in the total of 6 years are calculated on the condition that the activities related to Decision 661 are conducted through external economies, a surplus of 5,137 million VND will be reached.

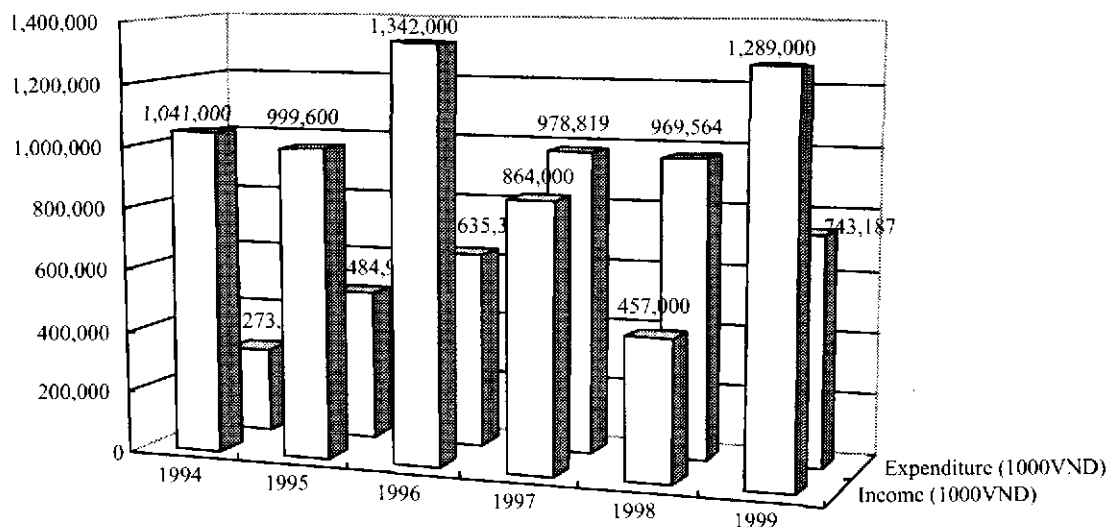


Figure I-2.6.9 Income and expenditure of Dak Ruong FE

### 2.6.6 Mang La FE

Management area of Mang La FE is located in the east of Kon Plong District. The northern border is close to the area managed by Thach Nham PFMC and the eastern border is close to Quang Ngai Province. The southern and western borders are close to Gia Lai Province. The total size of management area is 18,055 ha. Of this, the area of production forests is 12,357 ha and that of protection forests is 5,698 ha by functional classification. By composition of forests, the area of natural forests is 16,285 ha, that of man-made forests is 72 ha and that of remaining other lands such as agricultural lands is 1,698 ha.

The organization of this FE consists of one (1) Vice director (Acting Director), three (3) Accountants, one (1) Cashier, three (3) Technicians and one (1) Driver. This FE has been operated by a total of nine (9) persons. Regarding capital equipment, there is nothing except for offices and vehicles.

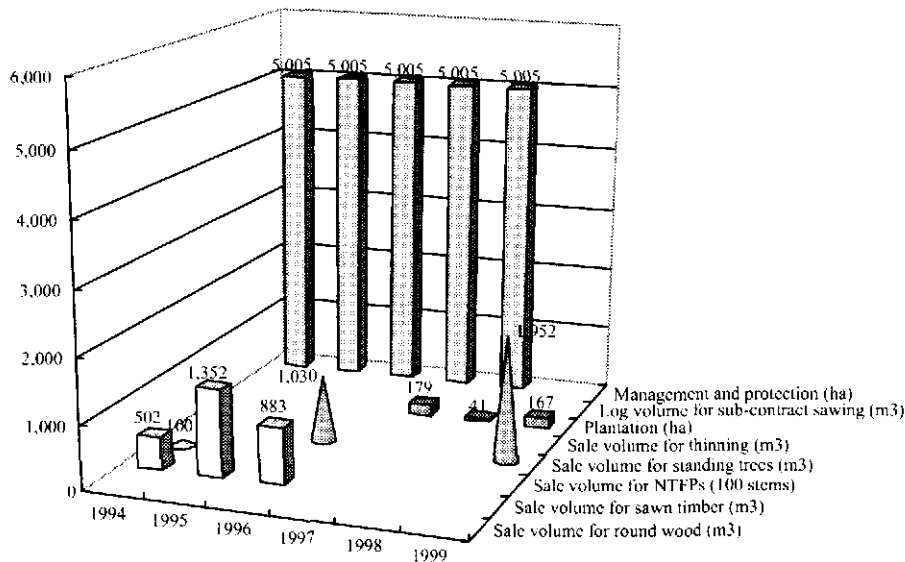


Figure I-2.6.10 Operation volume of Mang La FE

Figure I-2.6.10 represents the operation volume by each activity in 1994 to 1999 by Mang La FE. This FE has scarcely implemented logging activities for exploitation. The sales of standing trees were implemented by about 1,000m<sup>3</sup> and 2,000m<sup>3</sup> in 1996 and 1999 respectively. In addition, in the days under the control of Koh Hanung Forestry-Agriculture-Industry Union until 1995, logging and sawing operations had been conducted. In 1994 to 1996, the sales of sawn timber were implemented in the range of 500 m<sup>3</sup> to 1,400 m<sup>3</sup>. When the said Union was divided into each FE in 1995, equipment of the sawmill was moved to Kon Tum Town. Moreover, sawn timber sold in 1996 is what was produced in 1995. Regarding the sales of NTFPs, 10,000 stems of Rattan were sold at 3 million VND in 1994 under the control of the said Union.

Reforestation operations were implemented for the area of 387 ha in the total of 3 years from 1997 to 1999. By tree species planted, *Pinus Kesiya* was planted in the area of 377 ha and *Aquilaria crassna* in that of 9 ha. *Aquilaria crassna* was planted under trees, but a part was planted with coffee. Reforestation operations were conducted in protection forests.

Forest management and protection activities were implemented for the area of about 5,000 ha in 1994 to 1998 at production forests. The proportion of ethnic minorities out of households assigned forest management and protection activities is 95%.

Forestry extension activities have not been conducted except for those to enlighten farmers on the importance of forest protection.

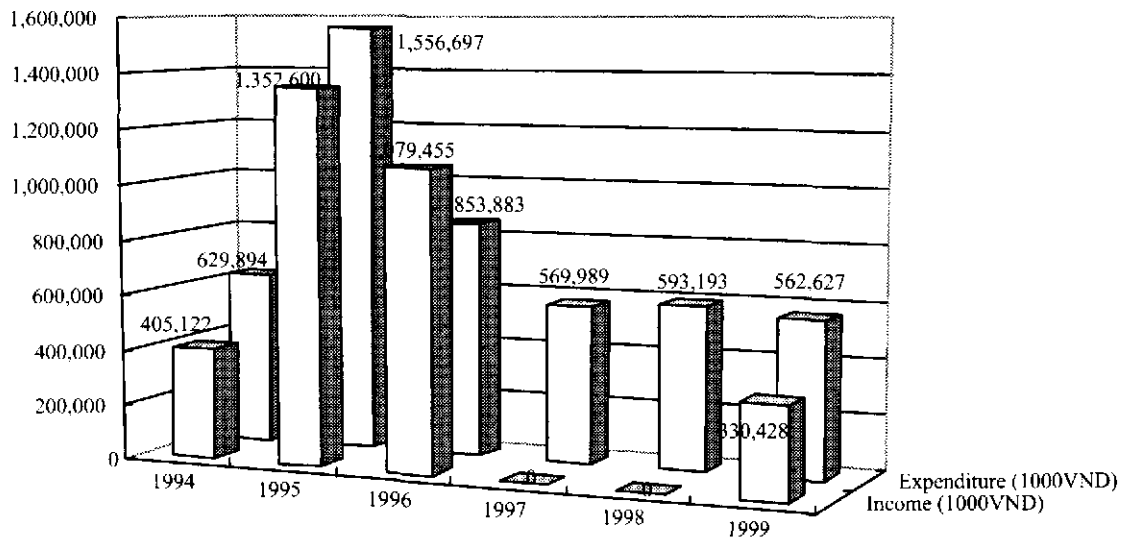


Figure I-2.6.11 Income and expenditure of Mang La FE

Figure I-2.6.11 represents the income and expenditure in 1994 to 1999 by Mang La FE. This figure should be analyzed based on the preconditions mentioned above. In the case of the calculation on the assumption that future activities will be implemented in only production forests on the same scale as in 1994 to 1999, the balance of business will fall into a deficit of 1,599 million VND in the total of 6 years. If profit and loss in the total of 6 years are calculated on the condition that the activities related to Decision 661 are conducted through external economies, a surplus of 213 million VND will be reached.

### 2.6.7 Mang Den FE

Management area of Mang Den FE is located in the south of Kon Plong District. The northern border is close to Konplong Forestry Agriculture Industry Investment Development and Service Company. The north of the eastern and southern border is close to Gia Lai Province and the western border is close mainly to Dak Ruong Communc. The total size of management area is 21,393 ha. Of this, the area of production forests is 20,187 ha and that of protection forests is 1,206 ha by functional classification. By composition of forests, the area of natural forests is 13,502 ha, that of man-made forests is 13 ha and that of remaining other lands such as agricultural lands is 7,878 ha.

The organization of this FE consists of one (1) Director, two (2) Accountants, one (1) Cashier, and seven (7) Technicians. This FE has been operated by a total of 11 persons. Regarding capital equipment, there is nothing except for offices and vehicles.

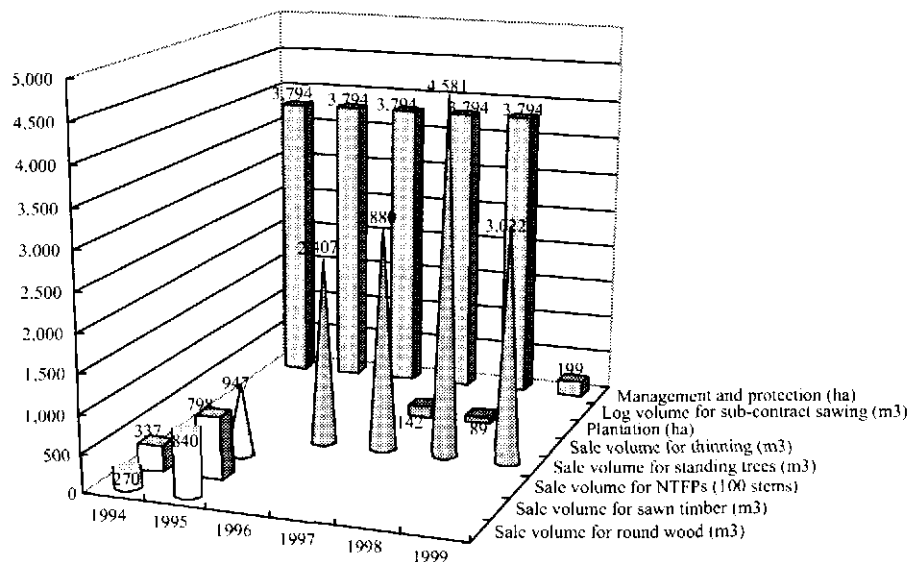


Figure I-2.6.12 Operation volume of Mang Den FE

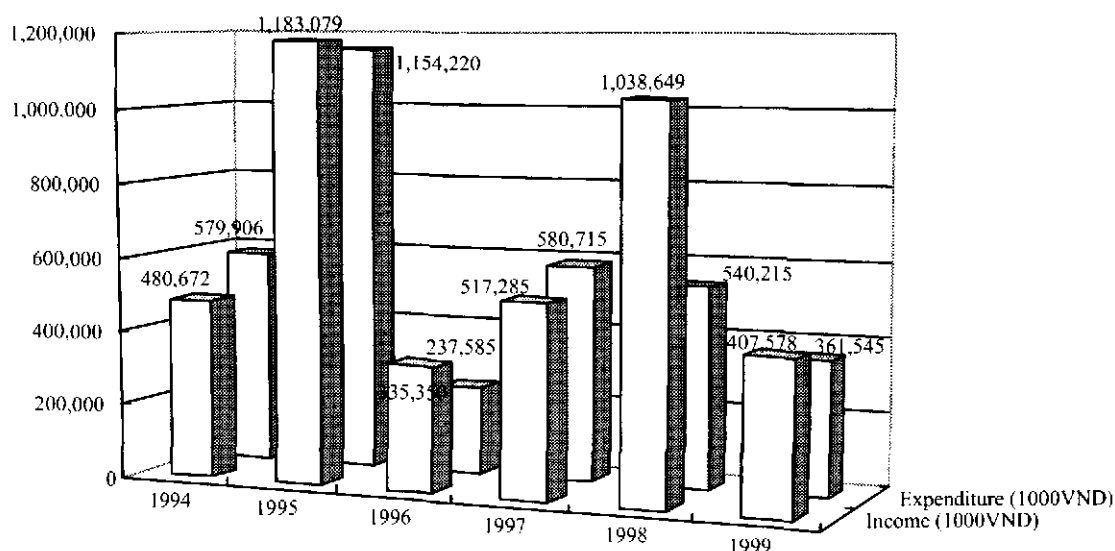
Figure I-2.6.12 represents the operation volume by each activity in 1994 to 1999 by Mang Den FE. The sales of standing trees were implemented in the range of about 2,400 m<sup>3</sup> to 4,600 m<sup>3</sup> in 1996 to 1999. In addition, in the days under the control of Koh Hanung Forestry-Agriculture-Industry Union until 1995, logging and sawing operations had been conducted. In 1994 and 1995, round wood sold totaled about 270 m<sup>3</sup> and about 840 m<sup>3</sup> respectively, while sawn timber sold was about 340 m<sup>3</sup> and about 800 m<sup>3</sup> respectively. After the said Union was divided into each FE in 1995, logging and sawing operations have not been conducted. Regarding the sales of NTFPs, 9,115 stems of bamboo were sold at 14 million VND in 1994 and 94,700 stems of Rattan were sold at 95 million VND in 1995 under the control of the said Union.

Reforestation operations were implemented for the area of 231 ha in the total of 2 years from 1997 to

1998. Regarding tree species, *Pinus Kesiya* and *Acacia auriculiformis* were planted by mixture with the ratio of 2 rows to 1 row respectively. Reforestation operations were all conducted in the abandoned site after slash and burn within protection forests.

Forest management and protection activities were implemented for the area of about 3,800 ha in 1994 to 1998 at production forests and for the area of about 200 ha in 1999 at protection forests. The proportion of ethnic minorities out of households assigned forest management and protection activities was about 80% in 1994 to 1998. In 1999, 8 households out of 9 households were ethnic minorities.

Regarding forestry extension activities, the following activities were conducted as well as those to enlighten farmers on the importance of forest protection. To farmers, demonstration of coffee plantation with technical guidance, and free provision of seedlings of *Litsea* and sugarcane were carried out, but they were not particularly successful.



**Figure I-2.6.13 Income and expenditure of Mang Den FE**

Figure I-2.6.13 represents the income and expenditure of Mang Den FE in 1994 to 1999. This figure should be analyzed based on the preconditions mentioned above. In the case of the calculation on the assumption that future activities will be implemented in only production forests on the same scale as in 1994 to 1999, the balance will be in surplus by 508 million VND in the total of 6 years. If profit and loss in the total of 6 years are calculated on the condition that the activities related to Decision 661 are conducted through external economies, a surplus of 1,788 million VND will be reached.