

2 Outline of the Study Area

2.1 Natural conditions

2.1.1 Topography and geography

The topography in the Study Area is relatively diverse. The Study Area falls in the range of altitude between 240 m and 2,040 m: the lowest part distributes in the east while the highest in the north-west. The general feature of the topography is described such that the altitude gradually increases from north-east and south-west towards the central region. Almost 60 % of the total area belongs to the area over 1,000 m and 86 % between 600 m and 1,400 m according to a mesh analysis (Table I-2.1.1).

Table I-2.1.1 Topographical analysis on altitude

Altitude (m)	No. of mesh	Ratio (%)	Ratio (%)	Ratio (%)
201-400	56	0.6	5.8	39.7
401-600	482	5.2		
601-800	1,549	16.7	86.3	60.3
801-1,000	1,602	17.2		
1,001-1,200	2,834	30.5		
1,201-1,400	2,042	22.0		
1,401-1,600	587	6.3	7.9	
1,601-1,800	135	1.5		
1,801-2,000	14	0.2		
2,001-2,200	1	0.0		
Total	9,302	100.0		

Table I-2.1.2 Topographical analysis on slope

Slope (°)	No. of mesh	Ratio (%)
1 (0-10)	1,100	11.8
2 (11-20)	6,648	71.5
3 (21-30)	1,441	15.5
4 (31-40)	76	0.8
5 (41-)	37	0.4
Total	9,302	100.0

Regarding slope in the area, it is obvious that the low altitude area in the south-west is rather flat, whilst steep topography spreads out in the eastern area under protection, the southern part (the Mang Den FE management area) and the western part.

As 88 % of the total area falls into the area with more than 10°, it can be said that most area belongs to steep lands which are not appropriate for flat land agriculture (Table I-2.1.2).

From another viewpoint of the micro-topography, the area is characterised by hillside equilibrium spreading out in the steep area and a mosaic of hillside convex and hillside concave.

2.1.2 Meteorology

The climatic conditions in the central region are diverse. The Watler's climatic diagram and its original data in/around Kon Tum Province are presented in Figure I-2.1.1.

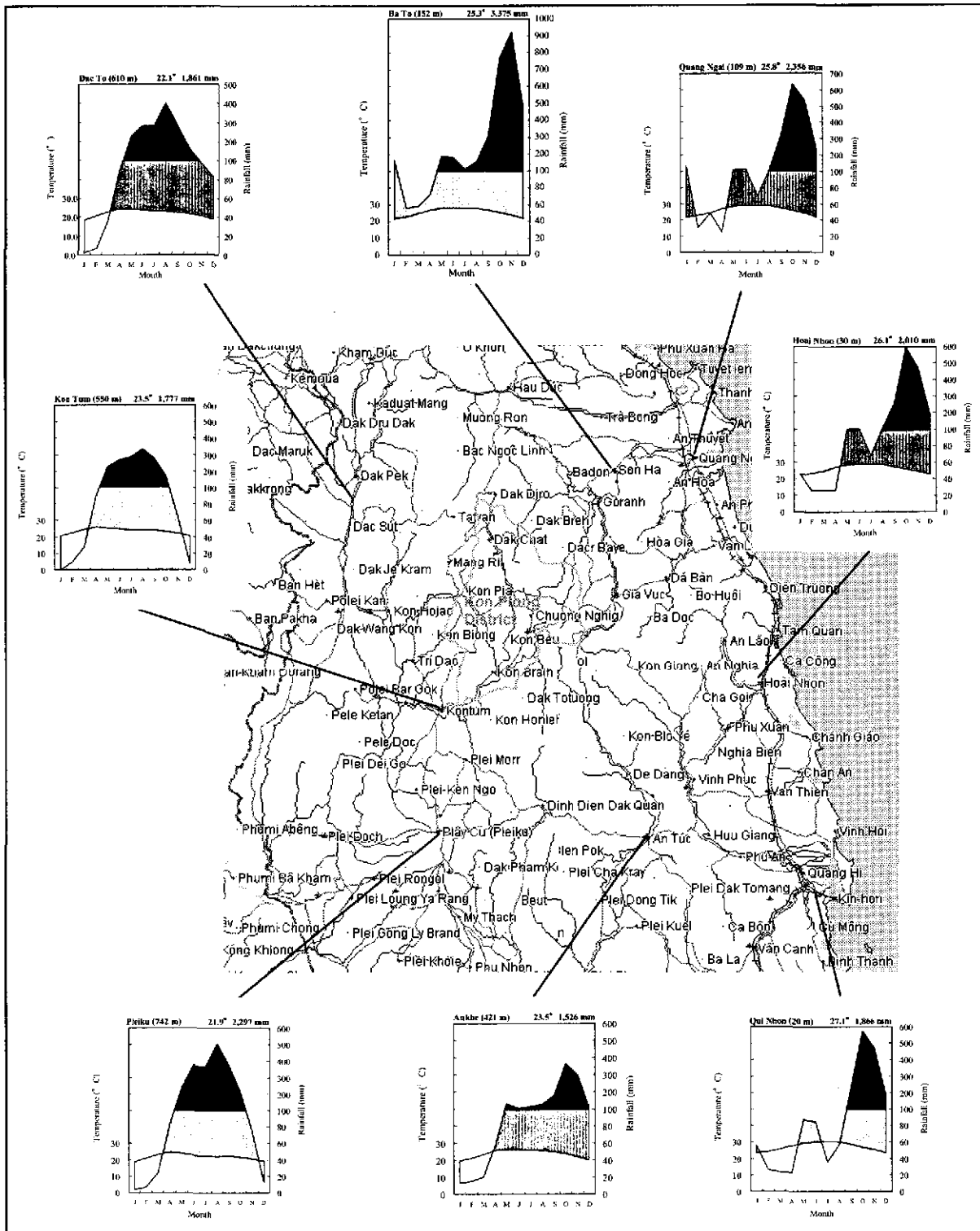


Figure I-2.1.1 The Watler's Climatic diagram in/around Kon Tum Province
 Source: adapted from National Centre for Hydro-meteorological Forecasts, 2000

There are two rainy seasons in the eastern coastal area (May to June, September to December) while there is the only rainy season in the highlands in a year (April to November/December). The peak of rainfall in the highlands comes two to three months earlier than the coastal area. Judging from the rainfall in the dry season, the dry season in the highlands is severer than the coastal area. The general climatic conditions in the northern part of the Central Highlands are summarised into a figure shown in Figure I-2.1.2 (Tan, 1984).

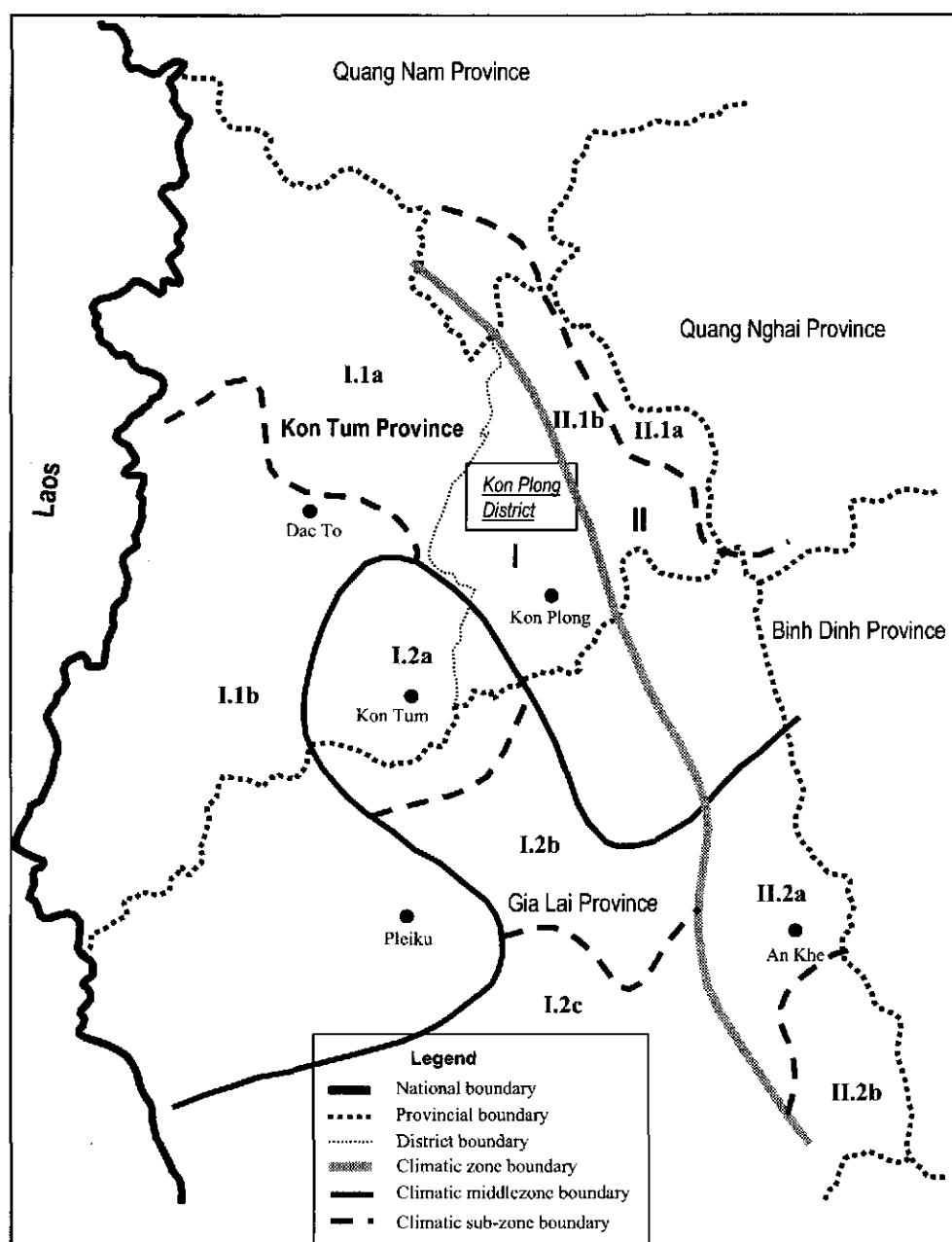


Figure I-2.1.2 General climatic conditions

Source: adapted from Tan, 1984

Table I-2.1.3 presents the description of each climatic zone indicated in Figure I-2.1.2. The climatic zones are differentiated based on the degree of annual mean humidity, annual mean rainfall and annual

accumulated temperature, i.e. humidity: 75%, rainfall: 2,000 mm and temperature: 8,000 °C respectively.

Table I-2.1.3 Climatic characteristics in Kon Tum - Gia Lai Provinces

Climate zone	Climate middle-zone	Climate sub-zone	Conditions	Characteristics
I	II	I1a	$C \geq 75\%$ $\Sigma R \geq 2,000 \text{ mm}$ $\Sigma t < 8000^\circ\text{C}$	- Rainy season from May to October - Temperature condition: limited - Total annual rainfall: 2,400-3,200 mm, generally 2,400-2,800 mm in many places - In the summer monsoon season: very humid. In the winter monsoon season: insufficient humidity.
		I1b	$C \geq 75\%$ $\Sigma R \geq 2,000 \text{ mm}$ $\Sigma t \geq 8000^\circ\text{C}$	- Rainy season from May to October - Temperature condition: fairly high - Total annual rainfall: 2,000-2,400 mm - In the summer monsoon season: excessive humidity. In the winter monsoon season: insufficient humidity.
	I2	I2a	$C \geq 75\%$ $\Sigma R < 2,000 \text{ mm}$ $\Sigma t \geq 8000^\circ\text{C}$	- Rainy season from May to October - Temperature condition: fairly high - Total annual rainfall: 1,600-2,000 mm, in some places < 1,600mm - In the middle of summer monsoon season: excessive humidity. At the beginning and the end of the summer monsoon season: sufficient humidity. In the winter monsoon season: insufficient humidity.
		I2b	$C \geq 75\%$ $\Sigma R < 2,000 \text{ mm}$ $\Sigma t < 8000^\circ\text{C}$	- Rainy season from May to October - Temperature condition: limited - In the summer monsoon season: excessive humidity. In the winter monsoon season: insufficient humidity.
		I2c	$C \geq 75\%$ $\Sigma R < 2,000 \text{ mm}$ $\Sigma t \geq 8000^\circ\text{C}$	- Generally rainy season is from May to November - Temperature condition: fairly high - Total annual rainfall: < 1,600 mm - Humidity is generally insufficient throughout the year except for August and September.
	II	III	II1a	$C < 75\%$ $\Sigma R \geq 2,000 \text{ mm}$ $\Sigma t \geq 8000^\circ\text{C}$
II1b			$C < 75\%$ $\Sigma R \geq 2,000 \text{ mm}$ $\Sigma t < 8000^\circ\text{C}$	- Rainy season: June to December - Temperature condition: limited - Total annual rainfall: 2,400-3,200 mm - Humidity is generally excessive and sufficient throughout the year.
II2		II2a	$C < 75\%$ $\Sigma R < 2,000 \text{ mm}$ $\Sigma t \geq 8000^\circ\text{C}$	- Rainy season: June to November - Temperature condition: fairly good - Total annual rainfall: 1,600-2,000 mm - Humidity is generally insufficient throughout the year except for August, September and October.
		II2b	$C < 75\%$ $\Sigma R < 2,000 \text{ mm}$ $\Sigma t < 8000^\circ\text{C}$	- Rainy season: June to November - Temperature condition: limited - Total annual rainfall: 1,600-2,000 mm - Humidity is generally higher than in II2a.

Note: C: annual mean humidity, R: annual mean rainfall, t: annual accumulated temperature

Source: Tan, 1984

The study area (Kon Plong District) falls in the climatic zones of I.1a, I.2a, II.1a and II.1b. The climatic zone in the study area is largely divided into the zones I (the western side) and II (the eastern side) by a mountain ridge that runs from the north to the south. The general feature of zone I is that the annual mean humidity is rather higher than that of zone II. Nevertheless, the humidity is variable in

zone I while it is stable in zone II throughout the year. There is also a difference in the period of the rainy season: May to October/November in zone I and June to November/December in zone II.

Distribution of the mean annual temperature and rainfall are indicated in Figure I-2.1.3 and I-2.1.4.

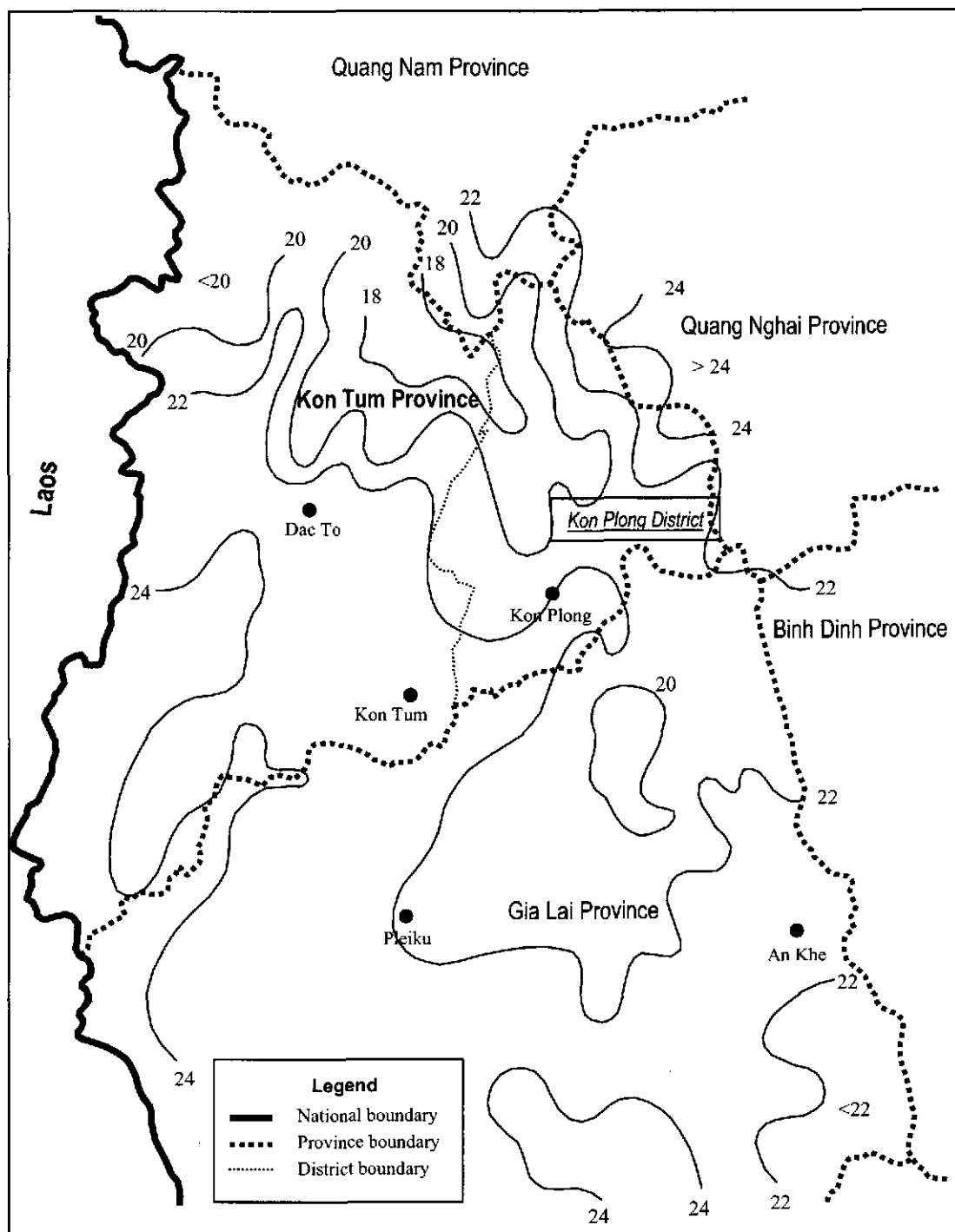


Figure I-2.1.3 Distribution of mean annual temperature in the northern Central Highlands
Source: adapted from Tan, 1984

Kon Plong District falls in the range of temperature: $<18 - >24$ °C and rainfall: $<1,600 - >3,200$ mm. The trend of annual temperature shows that it is lowest in the central region in which the altitude is highest. The rainfall increases from south-west towards north-east where the altitude is higher.

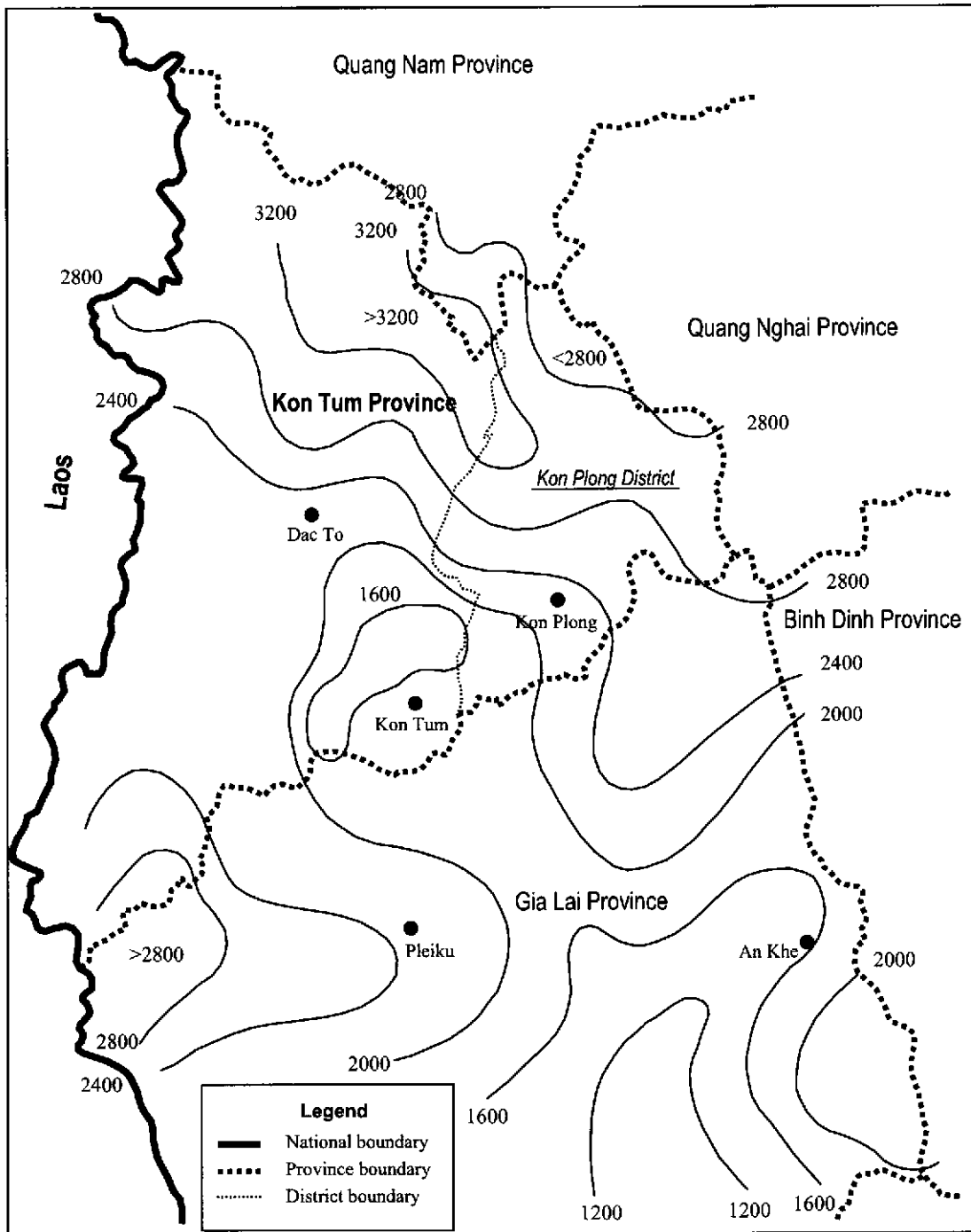


Figure I-2.1.4 Distribution of mean annual rainfall in the northern Central Highlands

Source: adapted from Tan, 1984

2.1.3 Hydrology

The Study Area can be split into two large watersheds: the north-eastern part and south-western part (Figure I-2.1.5). The north-eastern watershed (Son Tra Khuc Basin) includes almost the whole area of the Thack Nham Protection Forest and Mang La Forest Enterprise, and the partial area of Tan Lap, Mang Canh I and II Forest Enterprises and forests managed by communes, while the south-western watershed (Dak Bla Basin) covers the whole area of the Dak Ruong, Mang Den Forest Enterprises and area managed by commune forest units, and the partial area of Tan Lap, Mang Canh I and II Forest Enterprises.

In the north-eastern watershed, there are several main rivers which are merged into the Son Tra Khuc River in the downstream and flow into the South China Sea. On the other hand, in the south-western watershed, the Dak Bla River is the only main river that joins the Mekong River in the downstream.

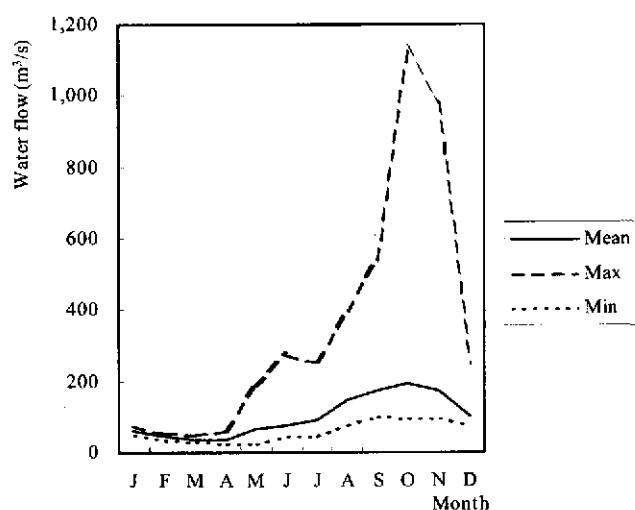
The results of a mesh analysis on river system density confirm that the south-eastern region under the Mang La Forest Enterprise is the most complicated in the whole Study Area.

Although there is little hydrological data available, according to the data recorded at the Kon Tum meteorological station, the Dak Bla River has the highest water flow with 191.6 m³/second in October and the lowest 34.0 m³/second in April (Figure I-2.1.6). Meanwhile, at the Kon Plong station, the highest is 115.2 m³/second in November and the lowest is 16.3 m³/second in April. It is assumed that the difference of water flow trend between the two stations derives from the gap of the rainy season period.



Figure I-2.1.5 Major watersheds and river system in the Study Area

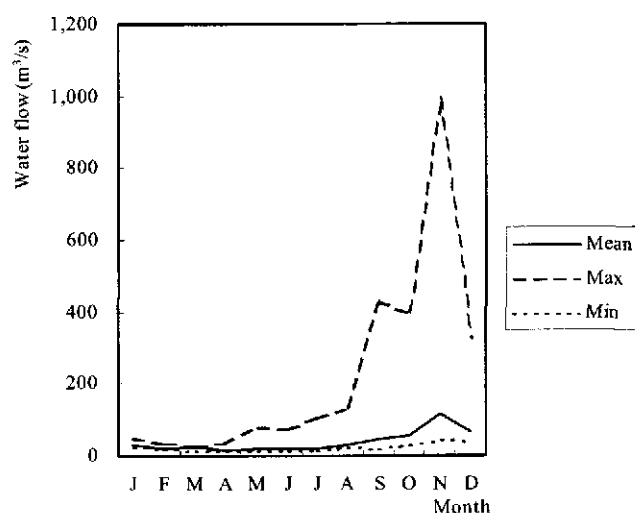
1. Kon Tum station (1978-1999)



Unit: m³/s

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
Mean	61.6	44.9	34.9	34.0	67.9	74.0	90.1	148.6	171.6	191.6	170.5	103.3	99.4
Max	76.1	54.6	51.4	62.3	189.5	275.0	251.8	398.4	538.6	1,133.6	978.8	249.1	354.9
Min	51.5	37.9	28.9	25.4	26.1	47.3	46.9	74.7	101.1	96.4	97.8	74.0	59.0

2. Kon Plong station (1996-1999)



Unit: m³/s

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
Mean	31.2	22.5	26.0	16.3	18.9	17.7	22.2	31.7	46.2	53.9	115.2	67.3	39.1
Max	49.2	33.4	29.9	35.8	81.1	73.8	104.3	129.3	429.3	400.8	989.3	327.8	223.6
Min	25.9	19.9	14.9	13.5	13.8	14.2	13.6	24.2	20.6	29.1	43.8	38.2	22.6

Figure I-2.1.6 Water flow on the Dak Bla River

Source: adapted from National Centre for Hydro-meteorological Forecasts, 2000

2.1.4 Geology and soils

The main lithological feature in the Study Area is defined as the Kon Tum massif. The basement rock consists of gneiss, granite, gabbro, epidiorite and quartzite which in the southwest are covered with basalts (FAO/UNESCO, 1979).

There are ten types of soil existing in the Study Area (Table I-2.1.4). Among all the soil types, as it is deemed that soils suitable for agriculture are 'Eutric Fluvisols', 'Cambic Fluvisols' and 'Humic Gleyic Ferralsols', which cover only 2.15 %, all the other soils are to be managed as forests from the soil conservation point of view.

Table I-2.1.4 Soil types and characteristics in Kon Plong District

	Soil type	Characteristics	Sym-bols	Area (ha)	Ratio (%)
A. Low zone (500m-1,000m)				33,463	15.21
1	Eutric Fluvisols	Alluvial soil	Py	2,344	1.05
2	Cambic Fluvisols	Yellowish brown soil on old alluvial	Fq	1,450	0.65
3	Rhodic Ferralsols	Dark reddish brown (or brownish black) soil on basalt, porphyry, andesite stones)	Fu	5,761	2.59
4	Orthic Ferralsols	Dull reddish brown (or yellowish brown) soil on gneiss stone	Fs	10,440	4.69
5	Acric Ferralsols	Yellowish brown soil on granite stone	Fa	11,840	5.32
6	Ferralic Acrisols	Dull yellow (or Dull yellow orange) soil on granite stone (rich SiO ₂ mineral)	Xa	1,628	0.73
B. High zone (over 1,000m)				188,910	84.95
7	Humic gleyic Ferralsols	Gleyic diluvial soil (plus alluvial soil)	DG	1,010	0.45
8	Humic Rhodic Ferralsols	Humus, brown (or reddish brown) soil on basalt, porphyry, andesite stones)	Hu	9,993	4.49
9	Humic Orthic Ferralsols	Humus, yellowish brown soil on gneiss, mica-schist stones	Hs	106,747	48.00
10	Humic Acric Ferralsols	Humus, yellowish brown (or bright yellowish brown) soil on granite, iolite stones	Ha	71,160	32.00
Total				222,373	100.00

Source: adapted from FAO/UNESCO, 1979

The soil in the Study Area was further examined by a soil profile survey with 18 plots in different biophysical conditions (Figure I-2.1.7 and I-2.1.8 in Volume III). From the results, some significant aspects are pointed out as follows:

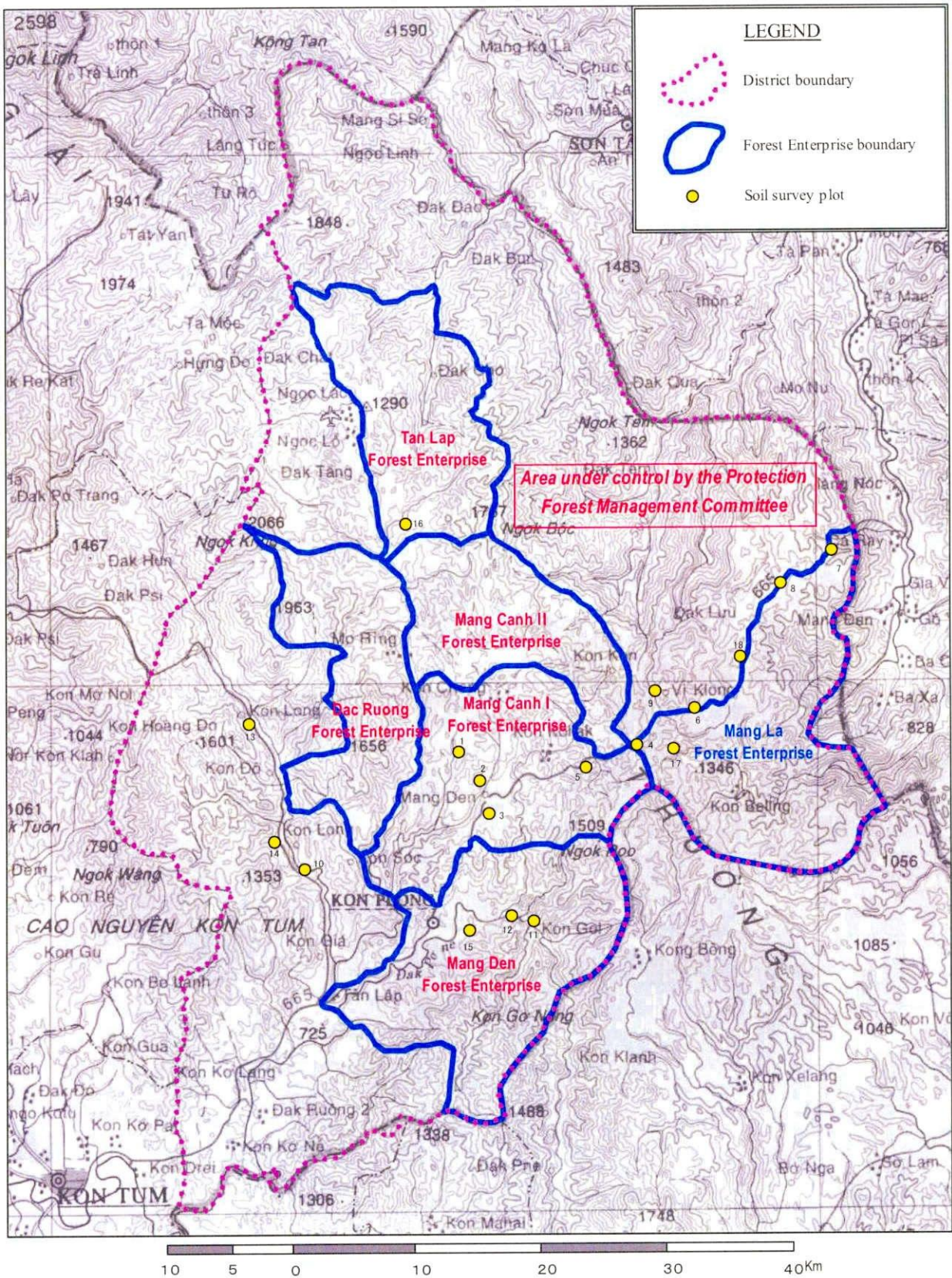


Figure I-2.1.7 Location of soil profile survey plots

1) Area below 1,000 m a.s.l.

- On the surface soil, there is no litter layer (A_0 layer)
- Colour transition among the soil layers happens gradually
- Due to climatic character and mineral composition of mother stone, the soil in Kon Plong distributed in the low altitude has characteristics of humid tropical, and usually is brown mixing with red or yellow colour (except grey soil on granite stone)
- Among degraded soils, due to human effect a few apparition layers contain concretion of Fe, Al in soil profile
- Soil has acid or strongly acid reaction ($\text{pH}_{(\text{KCl})} = 3.87$ to 4.79) which means basic saturation level is low
- Soil has average humus content or poor humus content (humus content is from 1.53% to 3.41%) which is lower than the soil distributed in the area above 1,000 m. Humus content soil depends on clay content. The more clay content is, the more humus soil can accumulate but unlike high areas it depends a little on species composition of forest vegetation, such as coniferous and broad-leaved forest
- Total N content is usually poor, or average ($\text{N}\% = 0.06\% - 0.19\%$)
- C/N ratio in soil is not so high compared with soils distributed in the area above 1,000 m a.s.l., and this means that organic material decomposition level happens faster
- Available P_2O_5 content in soil is usually poor, and changes a little according to soils types
- Hardness of soil is often higher than soil types distributed in the area above 1,000 m, especially on the surface soil layer
- Soils are often thick or average thick.

2) Area over 1,000 m a.s.l.

- On the surface soil, there is always a leaf litter layer covering over ground and the higher the altitude is, the colder the climate is, and the leaf litter layer is thicker (sometimes up to 9cm)
- Under the litter layer, a humus accumulation layer (A layer) which has interlaced roots appears
- Transmission among the soil layers is clear in colour
- Due to climate characteristics and mineral composition formed parent rock, soils have brown colour mixed with red and yellow. It is quite different with subtropical soils in mountain areas in the north
- Regarding degraded soils because of human influence and location affected by underground water, in soil profile concretion ($\text{Fe}_2\text{O}_3 + \text{Al}_2\text{O}_3$) layer usually appears in the soil profile. Especially in brown soil or brown reddish soil on basalt stone
- Soil acidity or strong acidity reaction (pH_{KCl} is from 3,4 to 4.48) shown in degree of basic saturation is low
- Soils contain rich humus, even extremely rich humus (humus content is from 3.57% to 8.67%). Humus content depends not only on climate character variation according to altitude but also clay content. The more clay content is, the more humus soil can accumulate. Apart from that, humus content also depends on flora composition of the forests. In conifer dominant forests, the

humus content is normally less than in broad-leaved forests. Furthermore, soils in coniferous forests have the specific and outstanding character of producing “coarse” humus, different from broad-leaved forests which have mull humus

- Total N content is rather rich and rich (N% from 0.20% to 0.31%)
- C/N ratio is quite high from 13.9 to 21.9. It means organic decomposition occurs slowly and humus is poor in Nitrogen
- The variation of soil character and fertility according to soil degradation under human influence can be clear
- In general, P₂O₅ available content is poor and variation is low and degradation level is not clear
- Most of soils are thick or very thick, even beyond 3 m and this character is favourable for tree growth .

Summarising the soil condition in the Study Area mentioned above, in addition to the geological and climatic conditions, forest status and human activities are more important factors affecting the soil conditions.

Relationship among the seven forest soil types, altitude and vegetation was also examined based on the results of the survey (Table I-2.1.5 and I-2.1.6).

Table I-2.1.5 Relationship among forest soil types, altitude and vegetation

Altitude (m)	Topography	Soil type	Survey plot no	Altitude (m)	Vegetation	
1,500 m Subtropical climate on high plateau	Kon Plong Highlands 188,910 ha (85%)	(Hu) Humus, brown (or reddish brown) soil on basalt, porphyry stones	4	1,280	Humid subtropical evergreen broad-leaved forest type	
			8	1,100	Humid subtropical coniferous and broad-leaved mixed forest type	
			2	1,180	Natural secondary forest (<i>Pinus merkusii</i> forest)	
			3	1,240	Man-made forest: <i>Pinus kesiya</i> , 20 ages	
			18	1,180	Man-made forest: <i>Acacia auriculiformis</i> : 5 ages	
			(Hs) Humus, yellowish brown soil on gneiss, mica-schist stones	9	1,206	Humid, subtropical coniferous and broad leaved mixed forest (<i>Dacrydium elatum</i> + Lauraceae, Fagaceae)
			(Ha) Humus, yellowish brown (or bright yellowish brown) soil on granite stones	6	1,200	ditto
		16		1,536	ditto (<i>Podocarpus imbricatus</i> + <i>Quercus castanopsis</i>)	
		17		1,579	ditto (<i>Dacrydium elatum</i> + Lauraceae, Fagaceae)	
		5		1,120	Grasses scattered brushes land	
1,000 m Humid tropical climate on high plateau	Kon Tum High land 33,463 ha (15%)	(Fu) Dark reddish brown (or brownish black) soil on basalt, porphire stones	10	850	Natural secondary tropical forest (restored forest after shifting cultivation) (<i>Dipterocarpus obtusifolius</i> + <i>Shorea obtusa</i>)	
		(Fs) Dull reddish brown (or yellowish brown) soil on gneiss, mica-schist stones	7	850	Natural secondary tropical forest after selective cutting	
			11	650	ditto	
		(Fa) Yellowish brown soil on granite, iolite stones	14	715	Natural secondary tropical forest (Restored forest after shifting cultivation) (<i>Pinus merkusii</i> + <i>Dipterocarpus obtursifolius</i> + <i>Shorea obtusa</i>)	
			13	637	ditto (<i>Pinus merkusii</i> + <i>Shorea obtusa</i>)	
		(Xa) Dull yellow (or dull yellow orange) soil on granite stones (Rich SiO ₂ mineral)	12	700	ditto (<i>Dipterocarpus obtusifolius</i> + <i>Shorea obtusa</i>)	
		15	642	ditto (<i>Dipterocarpus obtusifolius</i> + <i>Shorea obtusa</i> + <i>Lagerstroemia tomentosa</i>)		
600m						

Table I-2.1.6 Relationship among forest soil fertility, forest type and indicator plants

Vegetation	soil altitude	Climax forest (little affected)	Poor natural forest, secondary forest restored after shifting cultivation	Secondary forest restored on bare land	Bush	Grassland
		Rich	Rather rich	Medium	Poor	Very poor
Natural indicator plants	1,500m	1) Fagaceae 2) Lauraceae 3) Magnoliaceae 4) <i>Dacrydium elatum</i> 5) <i>Podocarpus imbricatus</i> 6) <i>Keteleeria davidiana</i>	1) Lauraceae 2) Fagaceae 3) <i>Pygeum arboreum</i> 4) <i>Trema orientalis</i>	1) <i>Betula alnoides</i> 2) <i>Schima wallichii</i> 3) <i>Pinus kesiya</i>	1) <i>Wedlantia paniculata</i> 2) <i>Melastoma candidum</i> 3) <i>Rhodomyrtus tomentosa</i>	1) <i>Dicranopteris linearis</i> 2) <i>Imperata cylindrica</i>
	1,000m	1) <i>Hopea odorata</i> 2) <i>Hopea dealbata</i> 3) <i>Dipterocarpus costatus</i> 4) <i>Dialium cochinchinensis</i> 5) <i>Aglaia silvestris</i> 6) <i>Canarium album</i>	1) <i>Pygeum arboreum</i> 2) <i>Litsea lancilimba</i> 3) <i>Machilus aderatissima</i> 4) <i>Lagerstroemia tomentosa</i> 5) <i>Lagerstroemia calyculata</i> 6) <i>Mallotus / Macaranga</i> spp. 7) <i>Oxynanthera</i> sp.	1) <i>Pinus merkusii</i> 2) <i>Dipterocarpus obtusifolius</i> 3) <i>Shorea obtuse</i> 4) <i>Syzygium</i> sp.	1) <i>Phyllanthus emblica</i> 2) <i>Randia dumetorum</i> 3) <i>Cratoxylon</i> sp. 4) <i>Memexylon fruticosum</i> 5) <i>Melastoma candidum</i> 6) <i>Rhodomyrtus tomentosa</i>	1) <i>Imperata cylindrica</i> 2) <i>Saccharum spontanum</i> 3) <i>Miscanthus japonicus</i> 4) <i>Dicranopteris linearis</i>
	700m	1) <i>Dipterocarpus alatus</i> 2) <i>Dipterocarpus</i> spp. 3) <i>Dalbergia cochinchinensis</i> 4) <i>Dalbergia bariaensis</i> 5) <i>Pterocarpus pedatus</i> 6) <i>Pahudia cochinchinensis</i>	1) <i>Litsea lancilimba</i> 2) <i>Machilus aderatissima</i> 3) <i>Mallotus / Macaranga</i> spp. 4) <i>Oxynanthera</i> sp. 5) <i>Schizostachyum zollingeri</i>	1) <i>Dipterocarpus obtusifolius</i> 2) <i>Dipterocarpus tuberculatus</i> 3) <i>Shorea obtusa</i> 4) <i>Lagerstroemia tomentosa</i>	1) <i>Rhodomyrtus tomentosa</i> 2) <i>Melastoma candidum</i> 3) <i>Cratoxylon</i> sp.	1) <i>Chrysopodon aciculatus</i> 2) <i>Imperata cylindrica</i> 3) American grasses
	500m					

2.2 Socio-economic conditions

Kon Plong District comprises 11 communes and one town (Figure I-2.2.1). The district center is located in Kon Plong Town where governmental institutions and social services offices are located. Six communes located in the eastern part: Dak Ring, Ngoc Tem, Po E, Hieu, Mang But, Mang Canh, are rather isolated and have abundant forests. Five communes and one town in the western part: Kon Tre, Tan Lap, Dak Ruong, Dak Phe, Dak Koi Communes, Kon Plong Town are located along the national road 24 and its branch roads, and are rather more developed in terms of economic aspects than villages in the eastern communes.

There are many isolated villages as the public road network in the district is very poor. Transportation is particularly difficult in the rainy season. Only nine communes have access from the commune center to Kon Plong Town by four-wheel-drive vehicles.

There are 118 villages in total, and four to 13 villages for each commune. A village is the smallest unit of the administrative function. In general, a village is formed with a core large family and other families of mostly the same ethnic group with 15-150 households.

The women's role in the family is momentous in that they are involved with firewood collection, rice pounding and vegetable picking, and they also catch fish in the streams. Children usually are not responsible for any specific work except for looking after their younger siblings when their parents go to the fields. However, the children also know how to gather food, pick vegetables, catch fish, and set primitive traps. Thus, children's contribution as a labor force in the family is not negligible. Meanwhile, men go to forests to clear lands for cultivation or hunt animals. Men also deal with making crossbows and baskets, building granaries for rice and collecting wood for house construction.

Note: Although Kon Plong District was split into two districts; i.e. Kon Lay and Kon Plong Districts in 2002, in this report, Kon Plong District denotes the administrative area of the former Kon Plong District, as the Master Plan is to be prepared for the whole area of the former Kon Plong District.

2.2.1 Basic features of the district

(1) Population

The population in the district is mainly distributed along rivers or streams and is estimated at approximately 30,000 to 32,000 in different statistics. Basically, village level population is reported by the village leader to the commune authority every year. Table I-2.2.1 shows the reports in 1999, 2000 and 2001 of the village level population. If the data show real features of the trend, population increase is rather high (in total 4%), especially in Kon Plong Town, Tan Lap and Dak Tre Communes. On the

other hand, Dak Ring and Dak Ruong Communes indicate a decrease of the population (see also Table I-2.2.2).

Table I-2.2.1 Population by commune (1999, 2000 and 2001)

Communes	No. of Households in 2001	Population		
		1999	2000	2001
Kon Plong Town	923	4,026	4,307	4,446
Tan Lap	577	2,301	2,336	2,773
Dak Ruong	776	3,997	3,782	3,893
Dak Tre	496	2,644	2,298	2,982
Dak Koi	376	1,728	1,726	1,767
Dak Phe	252	1,190	1,166	1,225
Mang Canh	582	2,839	2,766	2,986
Hieu	366	1,913	1,815	2,031
Po E	287	1,464	1,388	1,496
Mang But	752	3,886	3,886	4,116
Ngoc Tem	504	2,167	2,484	2,264
Dak Ring	526	3,093	2,793	2,782
Total	6,417	31,248	30,747	32,761

Source: Statistic Data from the Communal People's Committee 1999, 2000 and 2001.

This population change shows that the increase occurs in the southwest low elevation areas, and the decrease is observed in isolated remote communes. It may mean the population change within Kon Plong District does not show a natural increase but is strongly affected by migration and/or sedentarization policies of Vietnam. Other factors also need to be taken into account including that the government is expanding local villagers especially through its ethnic minority support policy that is strengthening health and education to increase the number of teachers, public health nurses and other civil servants.

Table I-2.2.3 shows the population density by commune. Higher density is found in Kon Plong Town, Tan Lap, Dak

Ruong and Dak Tre Communes with more than 20 persons/km² and the lowest density is in Dak Koi Commune with 5 persons/km². Far isolated communes such as Mang But, Ngoc Tem and Dak Ring Communes have 10 to 12 persons/km².

Table I-2.2.2 Population change in Kon Plong District (1999-2001)

Communes	Increase 1999-2001	%
KonPLong T	420	10.4
Tan Lap	472	20.5
Dak Ruong	-104	-2.6
Dak Tre	338	12.8
Dak Koi	39	2.3
Dak Pen	35	2.9
Mang Canh	147	5.2
Hieu	118	6.2
Po E	32	2.2
Mang But	230	5.9
Ngoc Tem	97	4.5
Dak Ring	-311	-10.1
Total	1,513	4.8

Those communes which have advantages in accessibility by roads and agricultural land development show rather high population density. On the other hand, lower population density is found in Dak Koi, Ngoc Tem, Dak Pne, and Hieu Communes with less than 10 persons/km².

Table I-2.2.3 Population density (2001)

	Area (ha)	Population	Density (person/sqKm)
KonPLong	5130	4446	87
Tan Lap	8513	2773	33
Dak Ruong	19112	3893	20
Dak Tre	11055	2982	27
Dak Koi	32294	1767	5
Dak Pen	14784	1225	8
Mang Kanh	27813	2986	11
Hieu	19735	2031	10
Po E	11607	1496	13
Mang But	32489	4116	13
Ngoc Tem	23770	2264	10
Dak Ring	22344	2782	12
Total	228647	32761	14

Source: Area : 2001 satellite data by this study
 Population: 2001 Communal People's Committee
 (annual report to district authority)

(2) Ethnic minorities

In the study area, traditional land use practices and culture are one of the most important social factors to conserve forest. To change forest by slash-and-burn farming is connected with activities of ethnic minorities and immigrants of the front areas of the natural forests.

There are nine ethnic groups found in the Study Area. The Xe Dang is the largest group mainly distributed in remote areas of Mang But and Dak Ring. The Ba Na ethnic group accounts for the second largest population size. The X Ra, Mo Nam and other smaller ethnic groups are distributed in the whole area.

The people of Xe Dang, Ba Na, X Ra and Mo Nam have been indigenous in the area over the years. Thus, their production practice is closely connected with the whole area. The Kinh people who are the majority group in Vietnam immigrated to the study area, especially Kon Plong Town and several new villages such as the new economic zone in Dak Ruong, Tan Lap and Dak Tre Communes in the southern part of the district. Other groups: Tay and Muong who emigrated from the northern provinces are recognized as a new group into the region and most of them settled down in the town and accessible communes.

Table I-2.2.4 shows population by commune and ethnic group. To focus on the activities of ethnic minorities concerned with forests and exploitation of forest lands, it is necessary to analyze these people's distribution at hamlet level because small or separated families within a village have to follow the customs or traditional rules of the majority ethnic group of the village.

Table I-2.2.4 Ethnic groups and population

Communes	Xe Dang	Kinh	Ba Na	X Ra	Mon Nam	Others	Total
Kon Plong T	284	2,228	947	74	173	101	3,807
Tan Lap	110	1,722	380	0	0	124	2,336
Dak Ruong	1,756	753	575	242	211	245	3,782
Dak Tre	1,424	38	413	206	137	80	2,298
Dak Koi	1,082	0	310	155	108	71	1,726
Dak Pnc	719	0	163	131	92	61	1,166
Mang Canh	1,734	0	497	248	174	113	2,766
Hieu	1,138	0	326	163	114	74	1,815
Po E	870	0	249	124	87	58	1,388
Mang But	2,436	0	699	349	139	263	3,886
Ngoc Tem	1,557	0	447	223	156	101	2,484
Dak Ring	1,751	0	502	251	175	114	2,793
Total	14,861	4,741	5,508	2,166	1,566	1,405	30,247
Ratio	49.1%	15.7%	18.2%	7.2%	5.2%	4.6%	100.0%

Source: Master Plan of Socio-Economic Development of Kon Plong District (1999-2000).

Table I-2.2.5 indicates the ethnic population at village level. In Table I-2.2.5, the population of small groups is included in the population of the major ethnic group as the group represents the village.

Table I-2.2.5 Ethnic population by unit of village

Commune	Xe Dang	Ba Na	He Le	Mo Nam	Ko Dong	Xra	Kinh	Total
Kon Plong	178	213	679				3,376	4,446
Tan Lap	272	452					2,049	2,773
Dak Ruong		1,227				1,705	961	3,893
Dak Tre	171	2,520					291	2,982
Dak Koi	1,767							1,767
Dak Pnc		1,225						1,225
Mang Canh				2,986				2,986
Hieu				2,031				2,031
Po E			265	1,231				1,496
Mang But	4,116							4,116
Ngoc Tem			478		1,786			2,264
Dak Ring	2,782							2,782
Total	9,286	5,637	1,422	6,248	1,786	1,705	6,677	32,761
Ratio	28.3%	17.2%	4.3%	19.1%	5.5%	5.2%	20.4%	100.0%

Table I-2.2.5 indicates that Kon Plong Town, and communes of Dak Ruong, Tan Lap and Dak Tre are effected by newly immigrated Kinh people. They have practical knowledge of agriculture and strong intentions to develop their lands and to secure their land ownership. Dak Koi, Mang But, Ngoc Tem and Dak Ring Communes are to be considered to be influenced by the traditional rules under the Xe

Dang (X Ra and Co Dong ware originally almost the same group as Xe Dang) . It is assumed that Man Canh, Hieu, and Po E Communes are mainly managed by the Mo Nam rule, and Dak Pne Commune is controlled by the Ba Na rule.

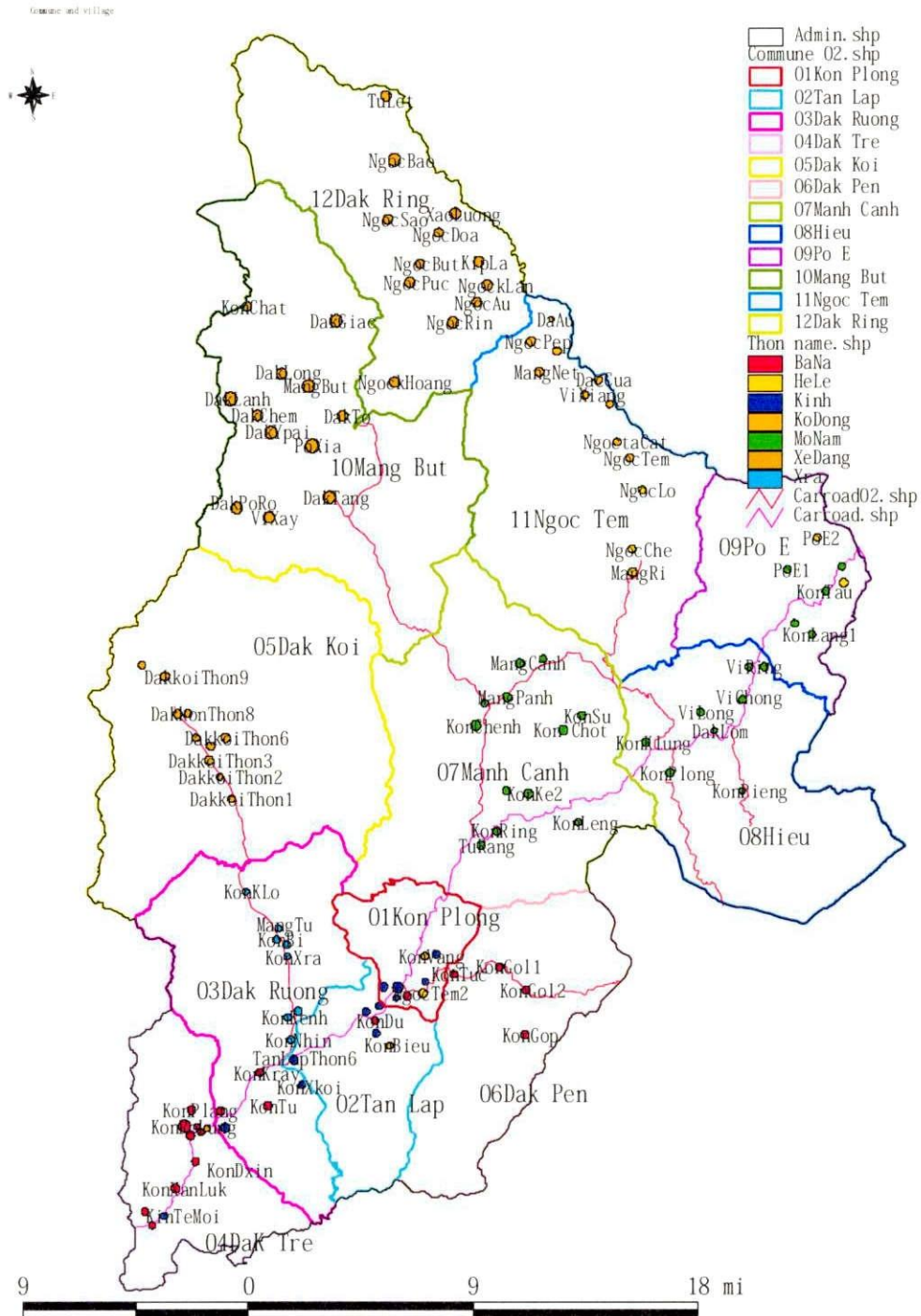


Figure I-2.2.1 Village distribution and major ethnic groups by village

(3) Livelihood of ethnic minorities

a. Xe Dang (Ko Dong and Xra are separated groups from Xe Dang)

The Xe Dang are native in the Central Highlands, and they have roots stretching as far back as Cambodia at the end of the 19th century. The unit of settlement was the village “ploi”, a population center comprising many houses and comparable to the hamlet of the “Viet”. A village is located surround by forests and separated from neighboring villages by a kind of no-man’s, no owner land and it belongs to nobody. The farming system of Xe Dang is swidden cultivation especially at the initial settlement. Submerged paddy fields are involved and the soil is turned over with hoes and trampled by buffaloes after watering. Horticulture and animal husbandry are well developed. Gathering natural food is an important part of livelihood.

The Xe Dang live in long large houses made of wood or bamboo with rectangular thatched roofs. The floor is about one meter above the ground. The principal door opens upwards like a *blind window*, in the center of the front of the house. There is an elevated drying yard outside the door. A tree trunk with steps is used as a ladder to the door. Houses are built around a communal house located in the middle of the village.

The village chief and the council of elders settle all village affairs in accordance with their customs. In the case of an important issue, decision is made with the consensus of all villagers. The discussion is continued until reaching unanimity. There is a principle idea that each person has the right to enjoy the fruits of their labor. Members of the village have the right to *ownership and utilization of slash-and-burn land*, arable gardens and paddy fields. Anybody who leaves the village must return all of their land to the community members granted rightful ownership.

Annual activities of the Xe Dang are spared for ten months for agricultural activities such as slash-and-burn and harvesting . The other two months are for ceremonies and festivities. The idea of a God creator does not exist among the Xe Dang. They believe in the existence of genies who perform each specific function.

b. He Le

He Le is a branch group of Xe Dang. Houses of the He Le are on stilts about 1 m above the ground. Each end of the top of the house is decorated with the horns of the house. The village of the He Le is an autonomous social unit, sometimes including up to 100 families. The village chief, elected by the villagers of certain age, is required to have necessary knowledge and considerable wealth. In all villages, there are fortune-tellers who take charge of the performance of rituals and ceremonies, a reconciliation judge responsible for the settlement of

disputes within the community and external relations.

The village controls fallow lands, forests, rivers, roads, sand dunes and water sources. Private property is a well-accepted concept. The purchase and sale of paddy fields and slash-and-burn land takes place among the inhabitants of the village.

c. Ba Na

In the past, the Ba Na used to occupy the coastal area of present Quang Ngai and Binh Dinh Provinces. They settled afterwards in the western mountain region. As one of the principal ethnic groups in the Central Highlands, the life of the Ba Na is governed by a traditional cycle. Their annual timetable is ten months for agriculture and two months for festivals, marriage, and various activities such as construction or repairing of houses and clothes making. In their animist universe, they plant banyan and mango trees in pagodas as a ritual. The Kapok tree is considered as a guardian and serves as a symbol of sacrifice. Rivers, water sources, mountains and forests have their own genies.

The Ba Na live in wooden houses on stilts with thatched or tiled roofs. In each village, there is a communal house called the "rong", its remarkable roof has two steeply rising surfaces. The communal house is the center of all acting, and young men's meetings, is used for defense and is a venue for festivals, ceremonies, games and entertainment.

The administrative unit of the village where the community lives still retains certain features of the ancient tribal commune. Each village is established on a defined territory, and the land is common property. The members of the village community are bound by social institutions, traditional rights, customs, rituals, and beliefs under supervision of the chief of the village "Tom play" and the council of elders "Kra play" acting in accordance with the principles of ancient military democracy.

Each family have their own home but may share with three or five other families in a traditional long house. Young people can take the initiative in marriage and couples do not adhere to either paternal or maternal family. The Ba Na make mounted graves with huts and hedges.

In agriculture, slash-and-burn cultivation is the main activity. Dry fields along streams or rivers are used for intensive farming for growing maize, sweet potato, millet of subsidiary cereal crops and several cash crops such as cotton, hemp, indigo and tobacco. Horticulture is also common. In backyard gardens they grow several crops in rotation. Animal husbandry is rather developed.

d. Mo Nam

Mo Nam settled long ago in the Central Highlands. Mo Nam are characterized by their desire for independence. Spiritually, the Mo Nam believe in and worship the elephant genie. Villages are generally established at the foot of mountains in order to easily procure natural water for daily use. Several Mo Nam people live together with the Xe Dang group in Kon Plong District.

Each village recognizes a certain area of land within its boundaries as their land of the village. The farming system is mainly slash-and-burn cultivation. The staple food is ordinary rice but they prefer sticky rice. Maize, sweet potato and cassava are subsidiary crops. Upland rice has rotation between maize, sweet potato, gourd and watermelon. The slope land for cultivation is less prepared. Each year, the chief of the village decides the land for cultivation and the head of the family chooses the land in peaceful consultation with the village chief. They are still not so familiar with total techniques on rice farming. The Mo Nam use manure from buffaloes for submerged soil treatment before transplanting rice but they do not use buffaloes as draft animals.

The Mo Nam society is matrilineal in many aspects. Children take the mother's family name. The nucleus of society is the family or the matrilineal family commune. Its members belong to two, or three but rarely more than three clans as community neighbors. The village chief is called "Rnut", and handles all the community affairs. The village has its own water source, cemetery, arable land and residential area.

(4) Food shortage

People in poverty duly depend on forest exploitation as a means of food supply. In mountainous villages, paddy fields are limited; therefore villagers desire to move to forest areas for slash-and-burn farming. In the study area, there are many villages with a high percentage of households suffering from food shortages. For the average household, 350 kg of rice, equivalent to annual food consumption sufficient for minimum human energy requirements, is the target to eliminate food shortages among villagers. Nevertheless, many communes have experienced food shortages for 4 to 5 months in spring or early summer when the previous year's crop has been consumed. According to the statistics of Kon Plong district, there are 1,524 households, 23.7 % of the total households in the district, faced with food shortages for a period of 1-3 months. For certain households, the food shortage duration may be as long as 4 to 5 months. Households with surplus food storage account for only 2%. For this, the district government gave food assistance to 371 households with 17.8 tons of food in all the communes from 1998 to 2000.

Table I-2.2.6 shows food supply condition in self-supply bases by commune, 2000. The households facing difficulty in getting food in self-supply total 41.4%, particularly the communes of Dak Tre, Hieu, Po E, Ngoc Tem and Dak Ring are in a severe condition. These communes are recognized as critical areas for deforestation.

Table I-2.2.6 Food shortage households (H/Hs) by commune

Communes	H/H classification			Total H/H	H/H under food shortage
	Surplus	Self supply	Shortage		
Kon Plong	25	752	146	923	15.8%
Tan Lap	20	464	93	577	16.1%
Dak Ruong	34	589	153	776	19.7%
Dak Tre	0	204	292	496	58.9%
Dak Koi	40	306	30	376	8.0%
Dak Pne	0	162	90	252	35.7%
Mang Canh	0	309	273	582	46.9%
Hieu	4	97	265	366	72.4%
Po E	0	105	182	287	63.4%
Mang But	0	294	458	752	60.9%
Ngoc Tem	0	192	312	504	61.9%
Dak Ring	0	164	362	526	68.8%
Total	123	3,638	2,656	6,417	41.4%

Source: Statistic data from Communal People's Committee , 2000

(5) Social services

To realize sufficient food supply and enhance living standards of isolated villages, infrastructure and social services such as roads, water, education and health connecting with basic human needs are indispensable. Nevertheless, the social welfare measures through the district government can not reach these villages although roads, education and health are recently undergoing overall improvement under the government initiatives to support ethnic communities. Table I-2.2.7 shows infrastructure and social services level of the Study Area compared with the national average. The table presents percentages of people having access to the services. It is obvious that electricity, health care, local markets, secondary schools and wells are at especially low level in Kon Plong District.

Table I-2.2.7 Condition of infrastructure

Region	Electricity	Public road	Climate	Market	Kindergarten	Elementary school	Secondary school	Well
National	53%	88%		54%	77%	100%	77%	65%
Central Highlands	20%	96%	84%	33%	76%	100%	50%	76%
Kon Tum Province	18%	89%	83%	13%	57%	100%	25%	50%
Kon Tum Town	39%	100%	100%	9%	100%	100%	64%	67%
Kon Plong District	8%	70%	60%	10%	30%	100%	20%	2%

Source: Statistic data 2000 in Kon Plong

Regarding education, there are 14 schools: 9 primary schools (level 1 only), 4 primary and secondary schools (level 1+2) and 1 high school in Kon Plong Town. The number of pupils is 8,026 of which primary school: 6,010, secondary school: 1,737 and high school: 279 (Table I-2.2.8), and the attendance rate is 74.8%, 21.6% and 3.6% respectively. Since the secondary schools had just been established in several communes, the actual number of pupils may have slightly increased. Nevertheless, the attendance rate of secondary school level is low especially in the remote areas. The government is now striving to improve this situation and to establish secondary schools in the communes.

Every commune has a health care facility and the one district hospital is located in Kon Plong Town. There is 74 medical staff working in those facilities (5 doctors, 16 physicians, 33 nurses and 20 health workers). Health care centers in Mang Canh, Ngoc Tem, Dak Ring and Dak Pne Communes are equipped with nurses, while the rest of the communes have no formal medical staff. Qualified medical staff and proper services are rare throughout the communes. According to the formal annual district report, the vaccination rate is 100%; the rate of consumption of vitamin A is 80% and the rate of the main six immunizations is 80% officially. Nevertheless, health workers reported that they could not carry out vaccination in remote regions due to difficulty of quality control, therefore, it might be that not all children (100%) had not yet received vaccination especially in isolated villages.

Table I-2.2.8 Number of pupils by commune

	Area	Primary school	Secondary school	High school
	Total	6,010	1,737	279
1	Kon Plong Town	820	620	160
2	Tan Lap	465	507	50
3	Dak Ruong	835	243	18
4	Dak Tre	501	164	38
5	Dak Koi	414	10	-
6	Dak Pne	250	25	-
7	Mang Canh	426	106	11
8	Hieu	398	34	-
9	Po E	346	28	2
10	Mang But	623	-	-
11	Ngoc Tem	435	-	-
12	Dak Ring	497	-	-

Source: Statistic Data from Communal People's Committee, 2000

Note: Primary schools have only grades 1-3. High schools own dormitories for ethnic minority students.

The most common diseases are malaria, tuberculosis, diarrhea, goiter and the other epidemic or endemic diseases. Particularly the malaria-infected rate is 5-10% of the total commune population.

Despite the campaign to eradicate malaria, the local health staff and cooperating agencies have had little success due to lack of information about hygiene, sanitation, malady contamination and clean primary water that is now being taken from rivers, streams, springs and primitive wells.

Infant mortality is high. Some households are faced with the situation of just one or two children of seven or eight births surviving. A major cause of death is colds that lead to pneumonia. 30% of children are under malnutrition and lack of protein, minerals and vitamins. An estimated infant malnutrition rate in the rural area is 40-50% according to the Red Cross in Kon Tum.

The family planning program has been difficult to implement because of local people's reluctance to change lifestyle. Even for the family planning extension workers traveling to each commune, the extension activities are limited due to the need to repeat visit every village, even those which are remote or isolated far from communes.

(6) Infrastructure

Apart from National Road 24, there are several branch roads connecting the communes. However, there are three communes, Mang But, Dak Ring and Ngoc Tem, inaccessible by vehicles. It takes about 2-3 days to walk from the main road to the center of the communes via footpaths. This causes severe difficulties for the people to transport their products to other areas.

Regarding public transportation in the district, there is a bus transport service between Kon Plong Town and Kon Tum Town operated by a private transportation company. Motorbike taxis are operated on the accessible roads in the district. National road 24 is now under construction for expansion and improvement, and it is creating much better transport conditions compared with the past years. In addition, access roads to remote areas are being improved: e.g. the road going to Dak Koi Commune has been upgraded and the one from Hieu Commune to Ngoc Tem Commune has been extended 6 km since 1999.

There are five communes, Dak Tre, Dak Ruong, Dak Phe, Tan Lap and Mang Canh, and one town enjoying a public electricity service. The Kon Plong Town and communes of Dak Ruong, Tan Lap and Dak Tre along National Road 24 have telephone booths, but the other eight communes have no access to telephones. The district postman delivers information in the form of printed matter every two days. In general, the communication in the three remote communes is very difficult.

The only extensive market is in Kon Plong Town. Grocery stores are usually located around the junctions of each access road to sell commodities for daily use. Small-scale merchants and dealers are travel from one village to another in the rural area to sell commodities. They are also involved in barter trading in the remote villages. Prices of commodities in such remote areas can be double or

triple those in the market of Kon Plong Town. It is, therefore, necessary for rural inhabitants to have more commercial chances to exchange goods.

2.2.2 Income and production

(1) Income level

According to income level classified by the district development plan 2000, the rich group is found mainly in Kon Plong Town, where the governmental institutions, schools and a district hospital are located, and the people have sustainable sources of income (beneficiaries of government salaries) with more stable living standards in comparison with those in the other communes. The 5 communes of Tan Lap, Dak Tre, Dak Koi, Dak Phe and Mang Canh are categorized in the second group. The inhabitants here are mixed with ethnic minorities and Kinh who have been developing the new economic zone and most of the dwellers enjoy a rather stable livelihood. The third group faced with difficulty or poverty comprises the 6 remote communes such as Dak Ruong, Hieu, Po E, Mang But, Ngoc Tem and Dak Ring. These communes are characterized by a sparse population density chiefly composed of ethnic minorities.

Table I-2.2.9 shows the average income level categorized into three groups within a commune (the data were collected through interview with commune chairpersons but interviewing were not conducted in the communes of Mang But, Ngoc Tem and Dak Ring).

Table I-2.2.9 Average income of households (1,000 VN Dong/year, 2000)

Area	Rich H/Hs	Medium H/Hs	Poor H/Hs
Kon Plong Town	3,574	732	445
Tan Lap	2,249	978	569
Dak Ruong	741	686	403
Dak Tre	1,945	884	290
Dak Koi	1,656	629	448
Dak Phe	1,181	716	382
Mang Canh	1,428	1,296	645
Hieu	845	400	306
Po E	790	740	356
Mang But	-	800*	-
Ngoc Tem	-	800*	-
Dak Ring	-	800*	-
Average	1,601	784	427

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

Note: In the development plan of Kon Plong district 2000, the district government categorized income level into the following four: 1) Starving households <13 kg of rice/capita/month, 2) Poor households <15 kg of rice/capita/month, 3) Average (or target) households 350 kg of rice/capita/annum, and 4) Rich households > 360 kg of rice/capita/annum.

(2) Income source

Agriculture is the major income source in Kon Plong District and also creates job opportunities for the local people (Table I-2.2.10). The staple food is rice and the supplementary foods are maize, tubercles or beans which are grown under shifting cultivation practice. Although animal husbandry shares a small portion of the total economical gain it represents an important income source of the people in rural areas. Other than agricultural activities, annuities such as subsidies for veterans share a rather high percentage.

Table I-2.2.10 Percentage of income source from different activities

Communes	Agriculture	Forestry	Livestock	Others	Annuity
Kon Plong Town	37.2	0.0	22.8	2.2	37.8
Tan Lap	36.9	14.7	26.4	0.0	22.0
Dak Ruong	59.6	0.0	14.7	1.9	23.8
Dak Trc	44.9	3.6	23.2	0.0	28.3
Dak Koi	38.2	1.4	23.1	0.7	36.6
Dak Pne	31.7	8.7	24.2	0.0	35.4
Mang Canh	38.7	9.9	21.6	0.5	29.3
Hicu	68.1	8.6	13.5	0.0	9.8
Po E	52.1	15.7	2.1	0.0	30.1
Mang But	64.2	8.7	15.0	0.0	12.1
Ngoc Tem	62.7	12.4	12.9	0.0	12.0
Dak Ring	68.3	9.8	11.6	0.0	10.3
Total	51.1	7.8	16.7	0.5	23.9

Source: Inventory Data by FIPI Working Group in 3,4,5/2000

2.2.3 Land use

(1) General features

The current land use situation based on the district statistics is shown in Table I-2.2.11. The same kinds of figures developed by satellite data (2001) shown in Table I-2.2.12 present a different situation. Nevertheless, the data on agricultural land are almost the same. Agricultural lands consisting of paddy and upland fields account for just 6,330 ha and forest area covers the largest area, 184,003 ha. State forest enterprises mainly manage forests and forest resources. Unutilized areas which are mostly bare hills cover a large portion.

Table I-2.2.11 Land use situation by District statistics 1999 (unit: ha)

Area	Land use types						Total
	Agriculture land	Forest area	Specialized in use	Residential area	Non-used area	Fish pond area	
Kon Plong	571.9	3,453.6	90.3	18.9	1,022.0	3.0	5,159.7
Tan Lap	624.4	6,095.8	59.3	21.6	579.0	0.2	7,380.2
Dak Ruong	1,130.0	12,957.8	62.1	36.5	4,933.0	0.7	19,120.1
Dak Tre	1,226.6	3,726.7	79.9	29.5	4,567.0	0.0	9,629.7
Dak Koi	389.4	28,653.0	26.9	21.0	2,419.0	0.0	31,509.2
Dak Pnc	215.8	15,449.0	16.1	8.3	180.0	0.0	15,869.1
Mang Canh	530.9	24,518.4	150.7	13.8	2,672.0	4.2	27,890.0
Hieu	279.5	16,950.9	98.0	14.5	2,937.0	0.0	20,279.9
Po E	194.5	9,764.0	64.6	10.7	1,356.0	0.0	11,389.7
Mang But	608.4	26,466.7	29.5	39.0	2,266.0	0.0	29,409.6
Ngoc Tem	236.3	18,896.0	13.4	20.9	5,304.0	0.0	24,470.6
Dak Ring	322.5	17,071.0	20.9	27.0	5,279.0	0.0	22,720.3
Total	6,330.2	18,4002.9	711.5	261.5	33,514.0	8.1	224,828.1

Source: Statistics Bureau of Kon Plong District-10/1999

Table I-2.2.12 Land use situation by LANDSAT TM 2001 (unit: ha)

	Forest	Bush	Grassland	Agriculture	Others	Total
Kon Plong	1,935	1,531	1,102	574	27	5,169
Tan Lap	3,171	2,652	1,945	739	71	8,578
Dak Ruong	4,519	9,441	4,261	959	77	19,257
Dak Tre	1,479	5,705	2,532	1,342	79	11,139
Dak Koi	19,825	8,313	3,872	481	47	32,538
Dak Pnc	7,862	5,549	1,261	215	10	14,896
Mang Canh	22,804	2,782	1,697	701	38	28,023
Hieu	18,230	426	1,032	189	7	19,884
Po E	10,124	849	617	96	8	11,694
Mang But	26,821	1,685	1,631	799	68	31,005
Ngoc Tem	20,215	2,584	945	186	20	23,949
Dak Ring	13,415	7,347	1,329	395	28	22,513
Total	150,399	48,864	22,224	6,678	479	228,645

(2) Land use rights

The agricultural land has been allocated to farmers in the district. At present, people in the four communes of Dak Ruong, Tan Lap, Dak Koi, and Kon Plong Town have been issued with the land use certificate. The forest land in the state forest enterprises has been allocated to farmers for protection through the contracts between the state forest enterprises and households. The farmers have not been granted with land for forestation.

In Kon Plong District, there are state owned forest enterprises including a service company recently converted from a forest enterprise . Thus the issues on land use rights are seen in the relations between those forest management bodies, between the forest enterprises and community, between the forest enterprises, between villages in the communes, and between farmers in the communes and hamlets.

The villages in the same commune and adjacent communes have few conflicts. In the past there used to be some conflicts between households due to ambiguous identification of boundaries , however, the cases were few , just one or two cases in each commune. These conflicts are usually reconciled by the communal People's Committee Office.

2.2.4 Industry

(1) Agriculture

There are some differences in agricultural practices among ethnic groups in the area. The Kinh who are the latest group immigrating to the area are good at farming and keeping animals. The Ba Na and Xe Dang are performing well on shifting cultivation, wet-land cultivation and animal husbandry. However, the local people do not participate much in the field of forestry, except for small piece-work such as planting or harvesting NTFPs.

Annual cultivated land is 4,738 ha of which rice and secondary crops occupies 1,484 ha, whereas shifting cultivation is 3,254 ha (Table I-2.2.13). The Xe Dang and Ba Na in Mang But, Mang Canh, Hieu, and Po E Communes intensively practice paddy rice production. Agricultural practice is generally paddy rice, and with other cereals such as cassava, maize and green pea.

Table I-2.2.13 Annual cultivation for crops (1999) (ha)

Commune	Rice and crops	Upland cultivation	Tree farm
Kon Plong T	16.00	385.50	104.50
Tan Lap	32.00	473.00	109.42
Dak Ruong	75.00	784.00	60.70
Dak Tre	38.00	463.30	579.00
Dak Koi	50.00	284.00	32.00
Dak Phe	10.00	196.50	7.00
Mang Canh	409.00	83.80	17.70
Hieu	174.00	59.00	30.50
Po E	114.65	52.00	22.50
Mang But	437.00	145.00	16.06
Ngoc Tem	35.00	167.50	11.20
Dak Ring	93.00	160.00	39.00
Total	1,483.65	3,253.60	1,029.58

Source: Statistics Bureau of Kon Plong District, 1999

Note: Tree farm means perennial plants such as coffee, rubber, tea, cashew, Boi Loi, etc.

The communes with upland rice production are Dak Ruong, Tan Lap, Dak Phe, Dak Koi, Dak Ring, Dak Tre, Ngoc Tem and Kon Plong Town. Upland rice cultivation has long been a traditional practice. As a number of farmers have no fields for paddy rice farming, they cultivate upland rice and other crops such as cassava and maize by slash-and-burn farming.

The area for paddy rice is mostly located in valleys and along rivers and streams. The cultivation area of rice that can be harvested twice is only 249.5 ha (9% of the total paddy field). The production relies on the rainy season while the dry season experiences shortages of water due to the absence of irrigation works. Single harvest fields form 1,234.15 ha (43% of the total rice cultivation land).

After upland rice is cultivated for 1 or 2 years, farmers leave the place to a new slash-and-burn field or come back to the fallow which they had abandoned 4 to 6 years ago. This cultivation cycle is, in principle, maintained by local people. The area of the upland rice cultivation now accounts for 3,253.6 ha (51.3% of the total agricultural land). The average yield is 1.2 to 1.5 tons/ha, if the weather conditions are moderate.

Most of the households use locally available seeds, particularly regarding to rice. 80% of the cultivation is planted with local low yield rice and the rest, 20% of the cultivation, is of new varieties of rice species such as 13/2, CN2, MTL32 and other hybrid Chinese species with a 3 to 4 tons/harvest.

Other crops such as cassava, pea, maize and vegetables are also cultivated on sloping lands on the terraced fields of old rice cultivation. Sugar cane was newly introduced in 1998 and mainly planted in Tan Lap Commune. The total area of maize is 900 ha of which 640 ha are planted with hybrid species of maize (DK888, LVN 10 and FASUNFIT 11). The total area of cassava is 848.9 ha of which 351 ha are planted with hybrid species of H34 and H54.

There are 10 irrigation works invested in by the government to irrigate an area of 376 ha (Table I-2.2.14). Apart from that, there are about 100 irrigation works constructed by farmers to irrigate 446.4 ha of winter-spring crops.

(2) Animal husbandry

Most of the inhabitants in the rural area raise cattle and poultry. This activity brings in 16.7% of their total income. Although this is not a large amount of money it is substantial to them. The pattern of domestic animal husbandry is different between the eastern and western communes. In Mang But, Po E and Hieu Communes, buffalo are more popular than cattle, and in Dak Tre, Dak Koi, Tan Lap and Dak Phe Communes, cattle are the major animals (Table I-2.2.15 and I-2.2.16). Both buffalo and cattle are raised in Dak Ring, Ngoc Tem and Mang Canh Communes. This difference may be connected with villagers' main farming type, e.g. paddy or upland rice. Cattle are raised in the area where rice

cultivation is rather limited. Almost all the households raise pigs and poultry.

Table I-2.2.14 Irrigation works in Kon Plong District

Commune	Year of construction	Irrigation (ha)
Tan Lap	1978	80.0
Dak Ruong	1975	40.0
Dak Ruong	1976	26.0
Dak Ruong	1982	25.0
Kon Plong Town	1992	40.0
Dak Koi	1994	10.0
Dak Pne	1990	50.0
Dak Koi	1992	20.0
Kon Plong Town	1994	25.0
Dak Koi	1993	60.0
Government		376.0
Villagers made		446.4
Total		822.4

Source: Master Plan of Social-Economic Development of Kon Plong District (1999-2000)

Table I-2.2.15 Number of domestic animals by commune

Area	Number of heads				
	Buffalo	Cattle	Pig	Goat	Poultry
Kon Plong Town	148	798	1,970	30	9,600
Tan Lap	26	335	680	50	5,000
Dak Ruong	107	933	1,800	380	380
Dak Tre	3	916	66	0	983
Dak Koi	40	354	323	0	1,687
Dak Pne	134	113	184	244	1,500
Mang Canh	354	246	962	263	3,501
Hieu	668	52	470	0	1,050
Po E	374	22	225	0	755
Mang But	1,224	25	2,064	0	5,242
Ngoc Tem	446	541	963	0	3,521
Dak Ring	432	610	1,719	0	3,969
Total	3,956	4,945	11,426	967	37,188

Source: Statistic Data from Communal People's Committee in 2000

Animal husbandry is an important income generation activity for ethnic villagers, particularly the Xe Dang and Mo Nam. Some constraints are pointed out by ethnic minority people for domestic animal farming: a) local species give low productivity, b) Epidemic diseases often happen especially during the cool season in November and December.

Table I-2.2.16 Domestic animal farming per household (2000)

Area	Buffalo	Cattle	Pig	Goat
Kon Plong Town	0.16	0.86	2.13	0.03
Tan Lap	0.05	0.58	1.18	0.09
Dak Ruong	0.14	1.20	2.32	0.49
Dak Tre	0.01	1.85	0.13	0.00
Dak Koi	0.11	0.94	0.86	0.00
Dak Pne	0.53	0.45	0.73	0.97
Mang Canh	0.61	0.42	1.65	0.45
Hieu	1.83	0.14	1.28	0.00
Po E	1.30	0.08	0.78	0.00
Mang But	1.63	0.03	2.74	0.00
Ngoc Tem	0.88	1.07	1.91	0.00
Dak Ring	0.82	1.16	3.27	0.00

Note: The total number of households is 6,417 (2000)

(3) Perennial crops and other cash crops

According to information gained from the DARD, the tree oriented perennial products, such as coffee, rubber and Boi Loi, are not very common in the Study Area. Coffee was introduced in this area very recently. Rubber is planted by forest enterprises. Both products are planted mainly in the south-eastern communes. Agroforestry is not ordinarily practiced either.

Table I-2.2.17 Areas for production of perennial crops and other cash crops by commune

	Tea	Coffee	Cashew nut	Rubber	Pepper	Boi Loi	Cinnamon	Fruit
Total area(ha)	11.00	220.60	33.60	508.00	2.00	211.30	24.90	121.00
Dak Ring							x	x
Ngoc Tem	x						x	x
Mang But	x							x
Po E	x							x
Hieu	x							x
Mang Canh	x							x
Dak Koi						X		x
Dak Pne			X					x
Tan Lap			X		x	X		x
Kon Plong Town		X			x	X		x
Dak Ruong		X	X					x
Dak Tre			X	x				x

Source: DARD, 1999

Prices of coffee and rubber link with the world market and the plantation has rapidly expanded in the Central Highlands. Boi Loi (used for incense) is mainly domestic, and the production of cashew nuts, paper and several other cash crops is still limited to experimental level.

The variety of coffee grown in Vietnam is Robusta which is mainly used as a raw material for worldwide brand instant coffee. According to coffee experimentation and extension in the Central Highlands by the regional office in the MARD, there are three varieties of coffee: Che, Voi and Catemo available for cultivation.

(4) Upland farming

Effective use of open land for agroforestry should be the base of a sustainable forest management model. This activity to plant perennial trees is needed to meet soil and climate conditions, and needs and experiences of the local people.

Annual farming patterns and yield of upland crops are closely related to rainfall. The crops are planted in the wet season (April) and harvested after three months (July) before the second and marginal yield crop (August to November). The preferred food crops are upland rice, maize and beans (mung beans, soy beans and black beans).

People prefer white sticky rice but also like brown rice. Average yield of upland rice with shifting cultivation is 500 kg/ha. Rice is usually cultivated for 7 years. Summer maize is fed to pigs but it is also a temporary substitute staple food during shortages of rice. Average yield of maize is 1.8 tons. Maize is cultivated for around 7 years until the yield declines to 1.3 tons/ha.

Mung bean is an easily commercialized crop throughout the national market and it is also effective for soil fertilization. It is suitable for dry farming. The average yield is 0.6 tons/ha and terminate the farming is terminated when the yield declines to 0.44 tons/ha. Sesame production is 500 kg per ha on average. Net profit of sesame is less than rice due to high labor intensity.

Steep sloping land is generally used for cassava cultivation under a rotation of varied duration with shifting cultivation. As land pressure shortens the rotation period, the yield decreases. Actual production is estimated at 2 tons/ha of dried cassava. It is not only an important staple food but also a raw material for alcohol production among local people.

Slash-and-burn cultivation is common among upland communities. Shifting cultivation was practised during the war when people had to move towards deep forests. At present, slash-and-burn farming is practised in the secondary forests near villages.

(5) Hunting

The common wish of villagers is to protect forests and wildlife as common property for future generations. After a successful hunt, the game is shared by all villagers. Tiger and Asian wild dog are reportedly never hunted by the Mo Nam or purposely trapped due to their traditional status as protective gods.

The most common hunting tool is a simple trap designed to catch birds or pests such as rats and other small mammals. Bows, arrows and crossbows are used for deer and wild boar. Large-scale traps are commonly used by skilled hunters to catch large mammals such as Sambar (deer family, a.k.a. wild goat), buffalo and wild boar. Dap traps can be used to catch medium-sized wild cat such as Marbled Cat (*Prionodon pardicolor*), Leopard Cat (*Felis bengalensis*), Yellow-Bellied Weasel (*Mustela kathiah*), and other kinds of small mammals. The thong trap is used for catching both medium-sized and small Wild Pig, Large Indian Civet (*Viverra zibetha*), Binturong (*Arctictis binturong*), and Serow.

Bows and arrows are used for hunting medium-sized mammals such as Long-Tailed Macaque (*Macaca fascicularis*, crab-eating monkey family), Red-shanked Douc Langur (*Pygathrix nemaeus*), White-shanked Douc Langur, Bear Macaque, Pig-Tailed Macaque and Crested Gibbon, and bird species such as Greater Hornbill (*Buceros bucornis*) and Silver Pheasant (*Lophura nycthera annamensis*). Birds are primarily hunted for consumption as a source of protein. Some species of birds, such as Pigeons (*Ducula badia* or *D. aenea*) and Doves (*Streptopelia* sp.), are trapped during the harvest season. Some species, like the Crested Argus (*Rheinardia ocellata*), which belongs to the pheasant family, are trapped from February to March.

Local people say that they do not allow outsiders to hunt in their forests, but many poachers come from other communes to hunt illegally. When hunting large mammals, hunters stay for a few months in the forests and make traditional medicines by drying and smoking their catches, before carrying them to Kon Tum Town where they are sold to traders. The best hunting season in the area is from August to October, by the lunar calendar.

(6) Other industries

Commercial services in the district are concentrated in Kon Plong Town. In remote areas, traditional handicraft is practised but there are no special manufacturing activities recognized in a commercial sense. In general, the commercial services are in a small-scale, mainly to meet with local demands. The equipment used for the services is old and backward. The processing techniques are not sophisticated, making it difficult for goods exchange with external markets. Processing for food products and other small-sized industries are almost all located in Kon Plong Town.

In the district there are 78 utilities for production:

- Domestic carpentry: 10 utilities
- Metal workshops: 3
- Timber processing: 1
- Construction material production (brick and roofing tile): 6
- Garment production: 19
- Mechanical repairs, food and food product processing, cereal milling, brewing: 15
- Others: 24

2.3 Wild animal distribution

Although the fauna in the Study Area is as diverse as the flora, in general, it is pointed out that a sufficient survey has not yet been conducted in the whole area. Groups of bat, rodent, reptile and amphibian in particular have not been covered by those surveys. In this section, the existence of wild animal species and their significance are described .

2.3.1 Faunal diversity

There are 31 orders, 98 families and 351 species of vertebrates identified according to the collected secondary information and field survey carried out in the Study (Table I-2.3.1 and Volume III 3). A list of all the species identified is indicated in Volume III 3.

Table I-2.3.1 Vertebrate species in Kon Plong District

Class	Order	Family	Species
Mammals	11	27	67
Birds	17	52	226
Reptiles	2	14	36
Amphibians	1	5	22
Total	31	98	351

In comparison with other adjacent protected areas, it is obvious that the Study Area enjoys rich diversity and the numbers of mammal and bird species in particular are the highest among all the locations (Table I-2.3.2).

Table I-2.3.2 Comparison of faunal species in different locations

Location	Mammal	Bird	Reptile and amphibian	Butterfly
Kon Plong District	67	226	58	126
Kon Ka Kinh Nature Reserve	42	160	51	209
Ngoc Linh Nature Reserve (Kon Tum Province)	52	190	63	236
Ngoc Linh Nature Reserve (Quang Nam Province)	51	171	40	N/A

Source: adapted from WWF, 2001

2.3.2 Endangered animal species

Rarity of faunal species can be another indicator for evaluating the biodiversity of areas. There are two categories used for understanding the rarity, i.e., the Vietnam Red Data Book and Decision 18 HDBT, 1992, and 52 and 27 species are covered by the categories respectively (Table I-2.3.3 and Volume III 5). In contrast with the total number of identified species in Table I-2.3.1, it is significant that approximately 40% of mammals belong to precious species in the Vietnam Red Data Book and 34% in the Decision 18. With reptiles, the figure is 36% for the Vietnam Red Data Book.

Table I-2.3.3 Rarity of faunal species

Class	Vietnam Red Data Book						Decision 18 HDBT, 1992			
	E	V	R	T	Total	Ratio (%)	IB	IIB	Total	Ratio (%)
Mammals	6	5	5	1	27	40.3	16	7	23	34.3
Birds			2	10	12	5.3	4		4	1.8
Reptiles	1	7	1	4	13	36.1				
Amphibians										
Total	17	12	8	15	52	14.8	20	7	27	7.7

Status : E = Endangered; V = Vulnerable; R = Rare; T = Threatened
 IB = The first priority list of wildlife prohibited hunting
 IIB = The second priority list of wildlife prohibited hunting

2.3.3 Status of wild animal resources

With regard to resources of wild animals, it is possible to assess the status by referring to the amount of animals caught in communes. According to an interview with local people, it is clear that Wild Boar and Muntjac are the most common hunting animals for local people (Table I-2.3.4).

Table I-2.3.4 Annual average amount of large mammal hunting in communes

Name of species	Dak Koi	Dak Puc	Mang Canh	Hieu	Po E	Ngoc Tem
Wild Boar	20	15	5	20	10	15
Sambar Deer	1	1	2	2		5
Muntjac	10		3	3	10	20
Old World Monkey		30	?	?	?	?
Bear	0.25	0.5		0.1		0.5

Although information available from interviews is not always correct, the results indicate a trend that hunting by local people is not too intensive in the Study Area. However, the majority of local hunters feel that animal resources in the area are remarkably reducing for these 5 to 6 years, for example, Elephants were probably extinct by 1999 and Bears became rare from 1995.

The differences in patterns of hunting between the two parties can be summarized in equipment, method, purpose, object and attribute (Table I-2.3.5). In conclusion, hunting by outside hunters may be more harmful than that by local hunters and have more impact on the decrease of animals in the area.

Table I-2.3.5 Differences in patterns of hunting between local and outside hunters

	Local hunters	Outside hunters
Equipment	Traditional	Modern
Method	Random	Deliberate
Purpose	Self-consumption	Trading
Object	Meat	Capture, medicine, trophy
Attribute	Extensive	Intensive