

Table II-5. Soil Description on Working Spots and pH Profiles in Selected Priority Scheme - Tay Ua.

Spot #	General Information	Below	Depth	Color	Org. Matter	Tenure	Structure	Consist	Rock, etc.	Remarks***
B-1	Elevation 591mMSL Land use Paddy field Slope 0-1% Topography Plate Parent material Basalt Soil group Oxic ultisol	Ap A1 B1 B2	0-12 12-20 20-30 30-100+	25YR4/4 Dark red br. 25YR3/3 Dark red br. 25YR2/4 Very dark r/b 25YR3/6 Dark red br.	3-5% <0% Few Few	Clay loam Diat Diat Diat	Angular Diat Sub angular Diat	Fine Diat Diat Diat	0-5 tons, medium 2-4cm, medium 5-10cm, medium 3-5cm, medium	Sample No 11 Sample No 72
B-11	Elevation 554mMSL Land use Forest Slope 3-5% Topography Almost plate Parent material Basalt Soil group Udic ultisol	A B1 Hard pan	0-12 12-30 30+	5YR3/3 Very dark r/b 5YR3/5 Dark red br.	3-5% <0%	Silty clay loam Clay	Angular Diat	Medium Medium	Many Medium	
B-12	Elevation 590mMSL Land use Forest Slope 0-1% Topography Gently sloping Parent material Basalt Soil group Udic ultisol	Similar to B-11 Soil								
B-13	Elevation 595mMSL Land use Bush Slope 0-2% Topography Gentle undulating Parent material Basalt Soil group Dystric ultisol	A B1 B2	0-10 10-57 57+	25YR3/4 Dark red br. 25YR2/4 Very dark r/b 25YR3/3 Dark red br.	<1% <1% Few	Silty loam Silty clay loam Clay	Sub angular Diat Diat	Fine Fine Fine	None None None	
B-14	Elevation 590mMSL Land use Bush Slope <2% Topography Gently sloping Parent material Basalt Soil group Dystric ultisol	A Rock	0-17 17+	25YR3/4 Dark red br.	<1%	Silty loam	Sub angular	Fine	None	
B-15	Elevation 605mMSL Land use Bush Slope 3-5% Topography Gently undulating Parent material Basalt Soil group Dystric ultisol	A B Rock	0-16 16-23 23+	25YR3/3 Dark red br. 25YR3/4 Diat	3-5% Few	Silty clay loam Diat	Sub angular Diat	Fine Diat	None Many	
B-17	Elevation 580mMSL Land use Upland rice Slope 2-8% Topography Undulating Parent material Basalt Soil group Udic ultisol	A Rock	0-20 20+	5YR3/3 Dark red br.	2-3%	Silty loam	Granular	Medium	None 0.2-20cm, 90%	

\*E: Elevation; pH: B: Boring site.

\*\*Additional boring sites were B.

\*\*\*For pH-machine correct distribution.

Table II- 6 Physical Properties of Selected Soil Core Samples

Horizon and Depth(cm)	Name of Areas	Percent of Soil Moisture			Bulk Density	Percent of Particle Size Distribution			Soil Texture
		Field capacity pF2.5	Permanent wilting point pF4.2	Available water content pF2.5-pF4.2		Sand 2-0.075mm	Silt 0.02-0.002mm	Clay <0.002mm	
A ; 0-13	Upper Champi	40.81	33.18	7.63	1.05	13.0	43.5	43.5	Silty Clay Clay
B1 ;13-45		43.58	35.32	8.26	1.04	19.4	35.4	45.2	
A ; 0-10	Ditto	43.63	28.24	15.39	1.07	61.8	12.0	26.2	Sandy Clay Loam Silty Clay Loam
B1 ;10-25		42.32	27.92	14.40	1.07	18.8	44.9	36.3	
A ; 0- 9	Upper Tapoung	43.39	29.60	13.79	1.02	35.4	43.9	20.7	Loam Clay Loam
B ; 9-25		44.26	30.23	14.03	1.11	20.3	44.9	34.8	
A ; 0-13	Upper Kaphea	36.80	28.33	8.47	1.05	18.7	39.0	42.3	Clay Silty Clay
B1 ;13-47		39.43	29.17	10.26	1.06	14.4	42.2	43.4	
A ; 0- 5	Lower Xe Set	31.30	25.79	5.51	1.15	18.1	40.7	41.2	Silty Clay Silty Clay
B1 ; 5-28		33.77	27.87	5.90	1.13	14.8	40.0	45.2	
Ap ; 0-12	Upper Tay-un	41.53	30.35	11.18	1.02	26.0	42.6	31.4	Clay Loam Silty Clay Loam
A1 ;12-25		42.21	31.46	10.75	1.04	19.8	41.4	38.8	

Table II-7 Chemical Properties of Selected Soil Samples -Upper Champt-

Sample No.	Sampling Site	Soil code	Horizon and depth	pH		Nitrogen		Available	Exchangeable	
				H <sub>2</sub> O	KCl	Ammonia	Nitrate	Phosphorus	Potassium	Calcium
						NH <sub>4</sub> -Nmg 100g Soil	NO <sub>3</sub> -Nmg 100g Soil	P <sub>2</sub> O <sub>5</sub> mg 100g Soil	K <sub>2</sub> O mg 100g Soil	CaO mg 100g Soil
E-1	West part	6	A, 0-13	5.5	6.5	1	<1	10	100	1000
			B <sub>1</sub> , 13-45	6.5	6.5	1.5	1	5	100	1000
			B <sub>2</sub> , 45-100	7.1	6.2	<1	1	10-25	100	1000
B-1	East part	6	A, 0-10	5.5	6.7	1.5	1	5	150	1000
			B <sub>1</sub> , 10-25	6.8	6.7	1.5	1	5	150	1000
			B <sub>2</sub> , 25-50	6.8	6.6	1.5	1	5	150	1000
			B <sub>3</sub> , 50-65	6.6	6.5	1	1	5-10	150	1000
B-3	West-Centra part	6	A, 0-15	6.6	6.5	1.5	1	5-10	150	1000
			B <sub>1</sub> , 15-40	6.7	6.7	1.5	1	5-10	150	1000
			B <sub>2</sub> , 40-50	6.2	6.5	1.5	1	5-10	150	1000
			B <sub>3</sub> , 50-78	7.2	6.6	1	1	5-10	150	1000

Table II-8 Chemical Properties of Selected Soil Samples -Upper Tapoung-

Sample No.	Sampling Site	Soil code	Horizon and depth	pH		Nitrogen		Available	Exchangeable	
				H <sub>2</sub> O	KCl	Ammonia	Nitrate	Phosphorus	Potassium	Calcium
						NH <sub>4</sub> -Nmg 100g Soil	NO <sub>3</sub> -Nmg 100g Soil	P <sub>2</sub> O <sub>5</sub> mg 100g Soil	K <sub>2</sub> O mg 100g Soil	CaO mg 100g Soil
E-4	North east part	6	A, 0-9	6.8	6.7	1	1	5	100-150	1000
			B, 9-25	6.6	6.5	1.5	-	-	-	-
B-51	North east part	6	A, 0-10	6.5	6.5	1	1	75-100	70-100	1000
			B <sub>1</sub> , 10-32	6.3	6.6	1.5	1	5-10	70-100	1000
B-55	Central part	7	A, 0-11	5.5	6.7	1.5	1	5-10	70-100	1000
			B <sub>1</sub> , 11-51	6.3	6.6	1.5	1	5-10	70-100	1000

Table II-9 Chemical Properties of Selected Soil Samples -Upper Kapbeu-

Sample No.	Sampling Site	Soil code	Horizon and depth	pH		Nitrogen		Available	Exchangeable	
				H <sub>2</sub> O	KCl	Ammonia	Nitrate	Phosphorus	Potassium	Calcium
						NH <sub>4</sub> -Nmg 100g Soil	NO <sub>3</sub> -Nmg 100g Soil	P <sub>2</sub> O <sub>5</sub> mg 100g Soil	K <sub>2</sub> O mg 100g Soil	CaO mg 100g Soil
E-5	South east part	6	A, 0-13	5.0	6.8	1.5	1	5-10	150	1000
			B <sub>1</sub> , 13-47	5.3	6.6	1.5	1	5	150	1000
			B <sub>2</sub> , 47-100	5.3	6.6	1.5	1	5-10	150	1000
B-71	South east part without the scheme	6	A, 0-12	5.0	7.0	1.5	1	5	150	1000
			B <sub>1</sub> , 12-54	5.5	6.5	1.5	1	5	150	1000
B-72	Central-east	6	A, 0-11	6.3	6.8	1.5	1	5-10	70-100	1000
			B <sub>1</sub> , 11-38	6.5	6.6	1.5	1	5-10	100	1000
B-74	Central part	6	A, 0-12	5.7	6.5	1.5	1	5	70-100	1000
			B <sub>1</sub> , 12-52	5.6	6.4	1.5	1	5	70-100	1000
			B <sub>2</sub> , 52-100	6.5	6.4	1.5	1	5	70-100	1000
B-76	North west part	6	A, 0-12	5.6	5.8	1.5	1	5	100-150	1000
			B <sub>1</sub> , 12-56	6.3	5.7	1	1	5	100-150	1000
B-77	North centra part	6	A, 0-10	5.5	5.8	1	1	5-10	100	1000
			B <sub>1</sub> , 10-62	6.2	5.7	1	1	5-10	100	1000

Table II-10 Chemical Properties of Selected Soil Samples -Lower Xe Set-

Sample No.	Sampling Site	Items		pH		Nitrogen		Available	Exchangeable		
		Soil code	Horizon and depth	H <sub>2</sub> O	KCl	Ammonia	Nitrate	Phosphorus	Potassium	Calcium	
						NH <sub>4</sub> -Nmg 100g Soil	NO <sub>3</sub> -Nmg 100g Soil	P <sub>2</sub> O <sub>5</sub> mg 100g Soil	K <sub>2</sub> O mg 100g Soil	CaO mg 100g Soil	
E-3	Central part	6	A,	0-5	6.5	6.6	1	1	5	100-150	1000
			B <sub>1</sub> ,	5-28	7.5	6.7	1-5	1	75-100	100-150	1000
B-40	South east part	4	A,	0-12	5.5	6.7	1-5	1	10-25	150	1000
			B <sub>1</sub> ,	12-35	5.0	6.3	1-5	1	5-10	70-100	1000
			B <sub>2</sub> ,	35-75	5.2	5.7	1-5	1	5-10	100-150	1000
B-42	South east part	4	A,	0-13	5.7	5.8	1-5	1	5-10	70-100	1000
			B <sub>1</sub> ,	13-18	6.3	6.5	1-5	1	5	70-100	1000
Sandy	Without scheme	4	A,	0-15	6.3	5.5	1	1	5-10	70-100	1000

Table II-11 Chemical Properties of Selected Soil Samples -Upper Tay-Un-

Sample No.	Sampling Site	Items		pH		Nitrogen		Available	Exchangeable		
		Soil code	Horizon and depth	H <sub>2</sub> O	KCl	Ammonia	Nitrate	Phosphorus	Potassium	Calcium	
						NH <sub>4</sub> -Nmg 100g Soil	NO <sub>3</sub> -Nmg 100g Soil	P <sub>2</sub> O <sub>5</sub> mg 100g Soil	K <sub>2</sub> O mg 100g Soil	CaO mg 100g Soil	
E-2	Central east part	1	A <sub>p</sub> ,	0-12	6.5	6.7	<1	1	150	150	1000
			A <sub>1</sub> ,	12-25	6.5	6.7	<1	1	5	150	1000
			B <sub>1</sub> ,	25-50	7.0	6.5	1	1	5	150	1000
			B <sub>2</sub> ,	50-100	7.0	6.7	1	1	150	150	1000
B-11	East part	7	A <sub>1</sub> ,	0-12	7.0	6.7	1	1	5-10	150	1000
			B <sub>1</sub> ,	12-33	4.5	6.5	1-5	1	5	150	1000

Table II-12 Soil Units in Five Selected Schemes

Geological origin	Soil code	Soil unit	Distribution area* in Scheme: ha					Total
			Upper Champi	Upper Tapoung	Upper Kapheu	Lower Xe Set	Upper Tay-Un	
Alluvial	1	Orthic Acrisols (Dystric Cambisols and Fluvisols)	-	-	-	170	50	220
Sand stone + clay stone	4	Orthic Acrisols (Dystric Cambisols)	-	-	-	240	-	240
Basalt	6	Dystric Nitosols	855	55	1240	840	370	3360
	7	Dystric Nitosols (Lithic Nitosols)	10	45	-	-	-	55
	8	Nitosols (Lithosols)	5	-	-	-	-	5
Total			870	100	1240	1250	420	3580

\* Area in the Suitable land for cultivation. Swamp in Upper Tay-Un Scheme also is involved in the area.

Table II- 13 Present Land Use

District (Altitude: m)	Upper Champi (600-1000)	Upper Tapoung (1200)	Upper Kapheu (600-760)	Lower Xe Set (310-370)	Upper Tay-Un (550-590)
Land Use Category	ha	ha	ha	ha	ha
Lowland rice	0	0	0	100	20
Upland rice	0	0	190	140	30
Upland crops/Vegetables	0	0	0	90	0
Coffee	490	0	560		0
Tea	140	0	0		0
Fruits	0	0	0	20	0
Bush	40	90	450	420	280
Grass	80	0	0	100	10
Secondary forest	120	10	40	380	70
Swamp	0	0	0	0	10
Sub-sub-total	870	100	1240	1250	420
Pond	0	0	0	10	10
Village	10	0	30	10	0
National road	10	0	10	10	0
Sub-sub-total	20	0	40	30	10
Sub-total	890	100	1280	1280	430
Unsuitable land for cultivation	110	10	120	720	40
Total	1000	110	1400	2000	470

**Table II- 14 Land Suitability of Five Selected Schemes -Upper Champi-**

1. For Upland Unit: ha

Suitability Class		/I/	/II/	/III/	/IV/	Total
Soil code	6	50	380	420	115	965
	7	-	-	10	-	10
	8	-	5	-	-	5
Total		50	385	430	115	980

2. For Orchard Unit: ha

Suitability Class		/I	/II	/III	/IV	Total
Soil code	6	50	540	245	130	965
	7	-	10	-	-	10
	8	-	5	-	-	5
Total		50	555	245	130	980

**Table II- 15 Land Suitability of Five Selected Schemes -Upper Tapoung-**

1. For Upland Unit: ha

Suitability Class		/I/	/II/	/III/	/IV/	Total
Soil code	6	20	15	20	10	65
	7	-	35	10	-	45
Total		20	50	30	10	110

2. For Orchard Unit: ha

Suitability Class		/I	/II	/III	/IV	Total
Soil code	6	10	40	5	10	65
	7	20	25	-	-	45
Total		30	65	5	10	110

**Table II- 16 Land Suitability of Five Selected Schemes -Upper Kapheu-**

1. For Paddy Unit: ha

Suitability Class	I/	II/	III/	IV/	Total
Soil code 6	-	890	350	120	1360

2. For Upland Unit: ha

Suitability Class	/I/	/II/	/III/	/IV/	Total
Soil code 6	460	510	270	120	1360

3. For Orchard Unit:ha

Suitability Class	/I	/II	/III	/IV	Total
Soil code 6	240	660	280	180	1360

**Table II- 17 Land Suitability of Five Selected Schemes -Lower Xe Set-**

1. For Paddy Unit: ha

Suitability Class	I/	II/	III/	IV/	Total
Soil code 1	-	145	25	-	170
4	20	70	150	-	240
6	-	380	460	720	1560
Total	20	595	635	720	1970

2. For Upland Unit: ha

Suitability Class	/I/	/II/	/III/	/IV/	Total
Soil code 1	-	15	155	-	170
4	-	-	240	-	240
6	-	90	750	720	1560
Total	0	105	1145	720	1970



**Table II- 18 Land Suitability of Five Selected Schemes -Upper Tay-Un-**

Unit: ha

Suitability Class		I/	II/	III/	IV/	Total
Soil code	1	30	20	-	-	50
	6	75	70	215	40	400
Total		105	90	215	40	450

Unit: ha

Suitability Class		/I/	/II/	/III/	/IV/	Total
Soil code	1	-	-	50	-	50
	6	80	270	10	40	400
Total		80	270	60	40	450

Unit: ha

Suitability Class		/I	/II	/III	/IV	Total
Soil code	1	-	-	50	-	50
	6	50	235	75	40	400
Total		50	235	125	40	450

**Table II-19 Summary on Land Suitability of Five Selected Schemes**

Unit: ha

Scheme	Paddy			Upland			Orchard		
	I-III	IV	Total	I-III	IV	Total	I-III	IV	Total
Upper Champi	-	-	-	865 ( 88)	115 ( 12)	980(100)	870 ( 89)	110 ( 11)	980 (100)
Upper Tapoung	-	-	-	100 ( 91)	10 ( 9)	110 (100)	100 ( 91)	10 ( 9)	110 (100)
Upper Kapheu	1,240 ( 91)	120 ( 9)	1,360 (100)	1,240 ( 91)	120 ( 9)	1,360 (100)	1,180 ( 87)	180 ( 13)	1,360 (100)
Lower Xe Set	1,250 ( 63)	720 ( 37)	1,970 (100)	1,250 ( 63)	720 ( 37)	1,970 (100)	-	-	-
Upper Tay-Un	410 ( 91)	40 ( 9)	450 (100)	410 ( 91)	40 ( 9)	450 (100)	410 ( 91)	40 ( 9)	450 (100)

Table II- 20 Prospective Land Use

District	Upper Champi	Upper Tapoung	Upper Kapheu	Lower Xe Set	Upper Tay-Un
Land Use Category	ha	ha	ha	ha	ha
Lowland rice	0( 0)	0( 0)	140(+140)	1250(+1150)	420(+400)
Upland rice	0( 0)	0( 0)	0(-190)	0(-140)	0(-30)
Upland crops/Vegetables	140(+140)	100(+100)	0( 0)	0(-90)	0( 0)
Coffee	540(+100)	0( 0)	1100(+540)	0( 0)	0( 0)
Tea	140( 0)	0( 0)	0( 0)	0( 0)	0( 0)
Fruits	0( )	0( 0)	0( 0)	0(-20)	0( 0)
Bush	0(-40)	0(- 90)	0(-450)	0(-420)	0(-280)
Grass	0( 0)	0( 0)	0( 0)	0(-100)	0(-10)
Secondary forest	0(-80)	0(- 10)	0(-40)	0(-380)	0(-70)
Swamp	0( 0)	0( 0)	0( 0)	0( 0)	0(-10)
Total	870( 0)	100( 0)	1240( 0)	1250( 0)	420( 0)

\*Numerical values in parentheses are the differences in area from present use.

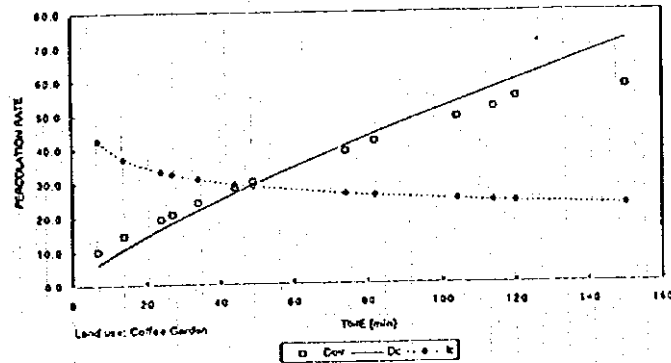
## *Figures*

Site	Champ-1	CS.No	15
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No.	T	Dov	DO	lnT	lnDov	(lnT)**2	lnT*lnDov
1	7	10.0	85.7	1.945	2.303	3.787	4.482
2	14	14.5	38.6	2.639	2.974	6.964	7.837
3	24	19.2	28.2	3.178	2.955	10.100	8.331
4	27	20.3	28.0	3.295	3.020	10.854	8.854
5	34	24.0	30.0	3.525	3.178	12.433	11.205
6	44	28.3	25.8	3.784	3.343	14.319	12.850
7	48	30.0	20.4	3.892	3.401	15.148	13.237
8	74	38.8	21.4	4.304	3.651	18.524	15.757
9	82	41.8	21.7	4.407	3.733	19.422	16.451
10	104	48.8	19.1	4.644	3.688	21.567	17.055
11	114	51.8	18.0	4.735	3.947	22.430	18.693
12	120	54.8	30.0	4.787	4.004	22.815	19.197
13	150	57.8	6.0	5.011	4.057	25.110	20.330
14	180	60.8	6.0	5.193	4.105	26.957	21.333
15	240	63.8	3.0	5.481	4.155	29.641	22.779
TOTAL				50.159	44.154	203.583	175.431

$D_c = 1.30$      $T_c = 0.80$  (mm)     $D_s = 23.55$  (mm/hr)  
 $I_c = 62.40$      $T_c = -0.20$  (mm/hr)     $T_b = 120.00$  (min)

Upper Champ-1



Site	Champ-2	CS.No	10
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No.	T	Dov	DO	lnT	lnDov	(lnT)**2	lnT*lnDov
1	5	10.50	222.0	1.609	2.813	2.589	4.533
2	10	27.50	108.0	2.303	3.314	5.304	7.632
3	20	41.50	84.0	2.995	3.728	8.975	11.153
4	50	55.50	28.0	3.912	4.015	15.304	15.711
5	80	63.00	15.0	4.382	4.143	19.202	18.155
6	85	78.00	64.0	4.551	4.359	20.739	19.855
7	120	83.00	9.6	4.787	4.413	22.815	21.194
8	150	85.00	4.0	5.011	4.443	25.110	22.254
9	180	88.00	8.0	5.193	4.483	26.957	23.311
10	240	92.00	3.0	5.481	4.522	29.641	24.735
TOTAL				40.228	40.358	177.147	159.755

$D_c = 10.51$      $T_c = 0.42$  (mm)     $D_s = 8.89$  (mm/hr)  
 $I_c = 254.85$      $T_c = -0.58$  (mm/hr)     $T_b = 348.00$  (min)

Upper Champ-2

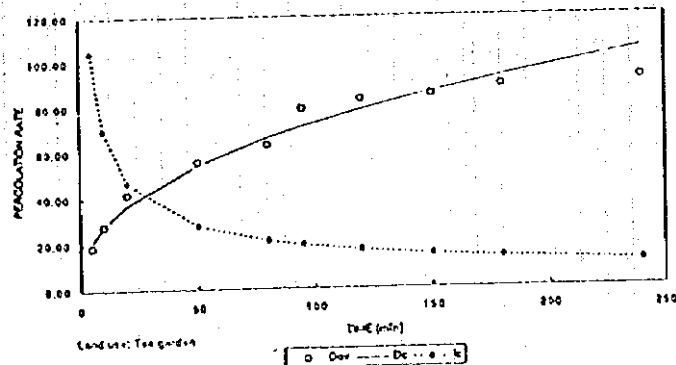
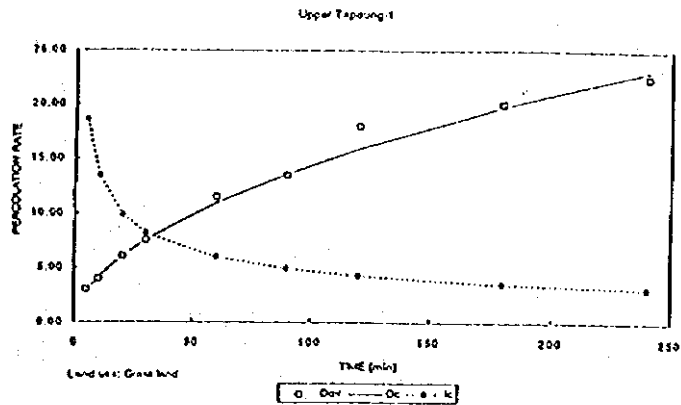


Figure II-1 Intake Rate Data -Upper Champi-

No.	T	Dcv	CO	lnT	lnDcv	(lnT) <sup>2</sup>	lnT*lnDcv
1	5	3.00	36.0	1.609	1.059	2.589	1.748
2	10	4.00	12.0	2.303	1.385	5.304	3.182
3	20	6.00	12.0	2.995	1.792	8.976	5.369
4	30	7.50	9.0	3.401	2.015	11.557	6.853
5	60	11.50	8.0	4.094	2.442	16.751	9.998
6	90	15.50	4.0	4.500	2.603	20.250	11.714
7	120	18.00	9.0	4.787	2.890	22.915	13.834
8	180	20.00	2.0	5.193	2.995	26.957	15.558
9	240	22.50	2.5	5.481	3.114	30.041	17.068
TOTAL				34.354	20.337	145.370	85.354

Dc = 1.20 \*T\*\* 0.54 (mm) b = 2.93 (mm/hr)  
 k = 38.64 \*T\*\* -0.45 (mm/hr) Tb = 275.00 (min)



No.	T	Dcv	CO	lnT	lnDcv	(lnT) <sup>2</sup>	lnT*lnDcv
1	5	5.50	66.0	1.609	1.705	2.589	2.743
2	10	8.00	30.0	2.303	2.078	5.304	4.788
3	20	9.00	8.0	2.995	2.197	8.976	6.582
4	30	11.50	15.0	3.401	2.442	11.557	8.305
5	60	14.50	6.0	4.094	2.674	16.751	10.947
6	90	16.50	4.0	4.500	2.803	20.250	12.614
7	120	20.00	7.0	4.787	2.998	22.915	14.342
8	180	24.50	4.5	5.193	3.199	26.957	16.612
9	240	29.00	4.5	5.481	3.367	30.041	18.455
TOTAL				34.354	23.462	145.370	85.358

Dc = 2.83 \*T\*\* 0.41 (mm) b = 2.18 (mm/hr)  
 k = 89.62 \*T\*\* -0.59 (mm/hr) Tb = 354.00 (min)

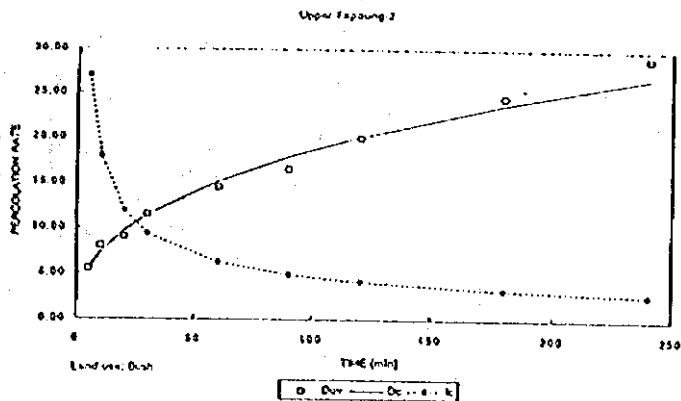
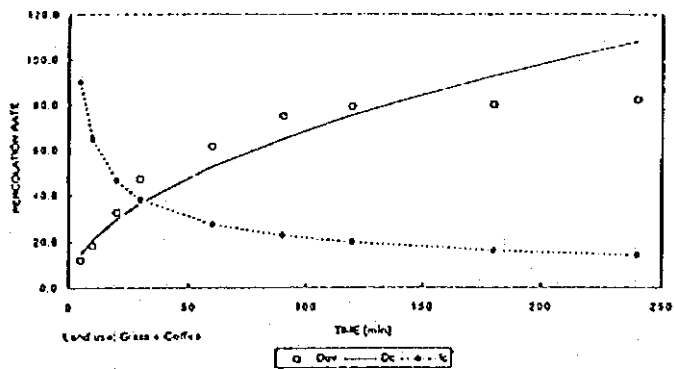


Figure II- 2 Intake Rate Data -Upper Tapoung-

No.	T	Dev	DO	lnT	lnDev	(lnT) <sup>2</sup>	lnT*lnDev
1	5	11.0	141.8	1.609	2.488	2.588	3.871
2	10	18.3	106.0	2.303	2.857	5.304	6.885
3	20	32.5	85.2	2.995	3.481	8.978	10.428
4	30	47.0	87.0	3.401	3.850	11.557	13.094
5	60	61.5	29.0	4.094	4.119	16.761	16.883
6	90	75.0	27.0	4.500	4.317	20.250	19.427
7	120	78.0	8.0	4.787	4.383	22.915	20.814
8	180	80.0	1.0	5.192	4.382	26.957	22.755
9	240	82.0	2.0	5.481	4.407	30.041	24.155
TOTAL				34.354	34.300	143.370	128.534

$D_c = 8.25$      $\cdot T^{**}$      $0.52$  (mm)     $b = 12.87$  (mm/hr)  
 $k = 183.00$      $\cdot T^{**}$      $-0.48$  (mm/hr)     $T_b = 288.00$  (min)

Upper Kapheu-1



No.	T	Dev	DO	lnT	lnDev	(lnT) <sup>2</sup>	lnT*lnDev
1	5	8.5	114.0	1.609	2.251	2.588	3.622
2	10	13.9	52.8	2.303	2.632	5.304	6.051
3	20	28.0	84.5	2.995	3.332	8.978	9.943
4	30	42.0	84.0	3.401	3.738	11.557	12.713
5	60	58.0	32.0	4.094	4.060	16.761	16.522
6	90	71.5	27.0	4.500	4.270	20.250	19.218
7	120	75.0	7.0	4.787	4.317	22.915	20.653
8	180	80.0	5.0	5.192	4.382	26.957	22.758
9	240	83.5	3.5	5.481	4.425	30.041	24.253
TOTAL				34.354	33.407	143.370	125.892

$D_c = 4.33$      $\cdot T^{**}$      $0.58$  (mm)     $b = 16.04$  (mm/hr)  
 $k = 153.23$      $\cdot T^{**}$      $-0.41$  (mm/hr)     $T_b = 248.00$  (min)

Upper Kapheu-2

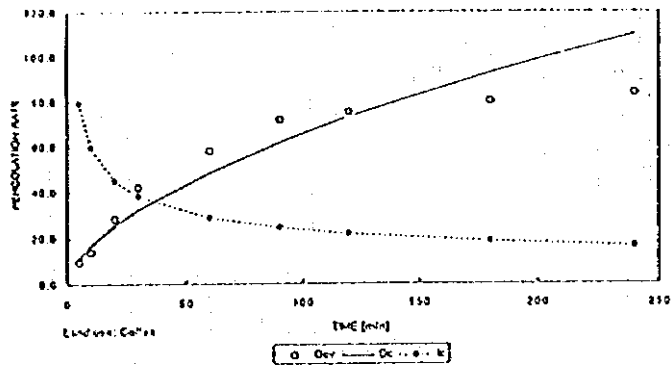


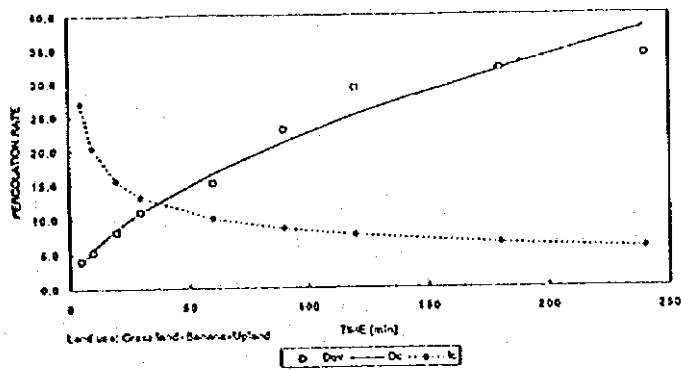
Figure II- 3 Intake Rate Data -Upper Kapheu-

Site	Xe Set-1	OS.No	9
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No.	T	Dev	CO	lnT	lnDev	(lnT) <sup>2</sup>	lnT*lnDev
1	5	4.0	48.0	1.609	1.386	2.589	2.230
2	10	5.3	15.6	2.303	1.658	5.304	3.841
3	20	8.1	16.8	2.995	2.092	8.975	6.259
4	30	10.9	16.8	3.401	2.359	11.567	8.125
5	60	15.1	9.4	4.094	2.715	16.761	11.115
6	90	22.9	15.6	4.500	3.131	20.250	14.090
7	120	29.1	12.4	4.787	3.371	22.915	16.137
8	180	32.0	2.9	5.193	3.485	26.957	17.993
9	240	34.0	2.0	5.481	3.525	30.041	19.325
TOTAL				34.354	23.744	145.370	99.131

$O_c = 1.42$   $T^{**}$   $0.59$  (mm)  $b = 5.71$  (mm/hr)  
 $k_c = 51.12$   $T^{**}$   $-0.49$  (mm/hr)  $T_b = 240.00$  (min)

Lower Xe Set-1



Site	Xe Set-2	OS.No	9
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No.	T	Dev	CO	lnT	lnDev	(lnT) <sup>2</sup>	lnT*lnDev
1	5	9.5	65.0	1.609	1.705	2.589	2.743
2	10	7.0	18.0	2.303	1.945	5.304	4.492
3	20	5.5	15.0	2.995	2.251	8.975	6.744
4	30	12.5	18.0	3.401	2.525	11.567	8.591
5	60	18.5	8.0	4.094	2.803	16.761	11.475
6	90	24.5	18.0	4.500	3.239	20.250	14.573
7	120	34.0	17.0	4.787	3.525	22.915	16.873
8	180	39.0	5.0	5.193	3.864	26.957	19.927
9	240	42.5	3.5	5.481	3.750	30.041	20.557
TOTAL				34.364	25.419	145.370	105.071

$O_c = 1.92$   $T^{**}$   $0.57$  (mm)  $b = 6.03$  (mm/hr)  
 $k_c = 65.66$   $T^{**}$   $-0.43$  (mm/hr)  $T_b = 258.00$  (min)

Lower Xe Set-2

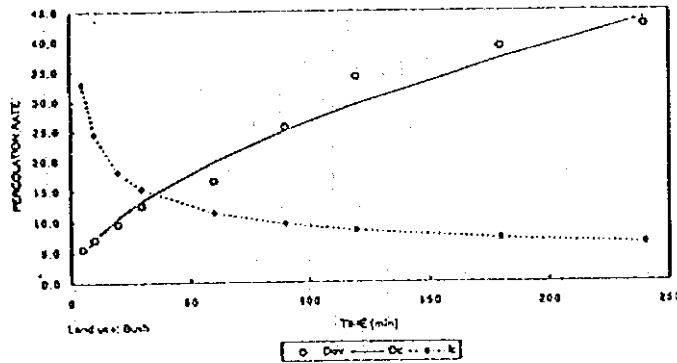


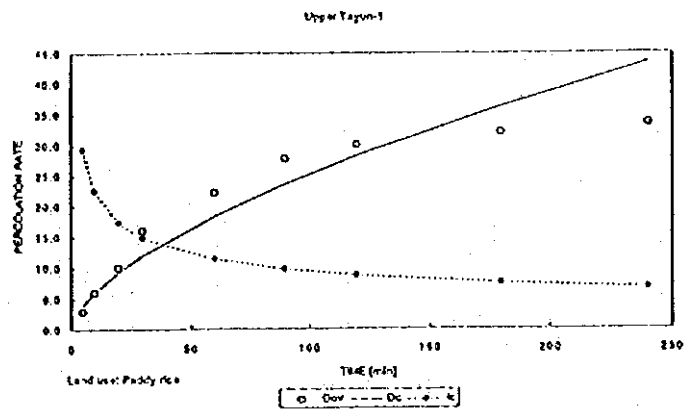
Figure II-4 Intake Rate Data -Lower Xe Set-



Site	Tayun-1	OS No	9
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No.	T	Dev	CO	lnT	lnDev	(lnT) <sup>2</sup>	lnT*lnDev
1	5	3.0	35.0	1.609	1.099	2.589	1.768
2	10	6.0	35.0	2.303	1.792	5.304	4.127
3	20	10.0	24.0	2.995	2.353	8.976	5.950
4	30	16.0	35.0	3.401	2.773	11.567	9.431
5	60	22.2	12.4	4.084	3.100	16.761	12.691
6	90	27.7	11.0	4.500	3.321	20.250	14.845
7	120	30.0	4.6	4.787	3.401	22.915	15.281
8	180	32.0	2.0	5.193	3.465	26.967	17.999
9	240	52.5	1.5	5.481	3.512	30.041	19.245
TOTAL				24.354	24.767	145.370	107.391

$D_c = 1.45$  \*T\*\*       $0.62$  (mm)       $b = 8.85$  (mm/hr)  
 $lc = 53.84$  \*T\*\*       $-0.38$  (mm/hr)       $T_b = 228.00$  (min)



Site	Tayun-2	OS No	9
------	---------	-------	---

No.	T	Dev	CO	lnT	lnDev	(lnT) <sup>2</sup>	lnT*lnDev
1	5	10.0	120.0	1.609	2.303	2.589	3.705
2	10	15.5	78.0	2.303	2.803	5.304	6.455
3	20	25.5	60.0	2.995	3.277	8.976	9.816
4	30	32.5	38.0	3.401	3.481	11.567	11.838
5	60	51.5	38.0	4.084	3.942	16.761	16.138
6	90	55.0	9.0	4.500	4.025	20.250	18.117
7	120	59.0	6.0	4.787	4.078	22.915	19.521
8	180	63.5	4.5	5.193	4.151	26.967	21.556
9	240	68.0	4.5	5.481	4.220	30.041	23.130
TOTAL				34.354	32.280	145.370	133.277

$D_c = 5.43$  \*T\*\*       $0.50$  (mm)       $b = 9.41$  (mm/hr)  
 $lc = 162.83$  \*T\*\*       $-0.50$  (mm/hr)       $T_b = 300.00$  (min)

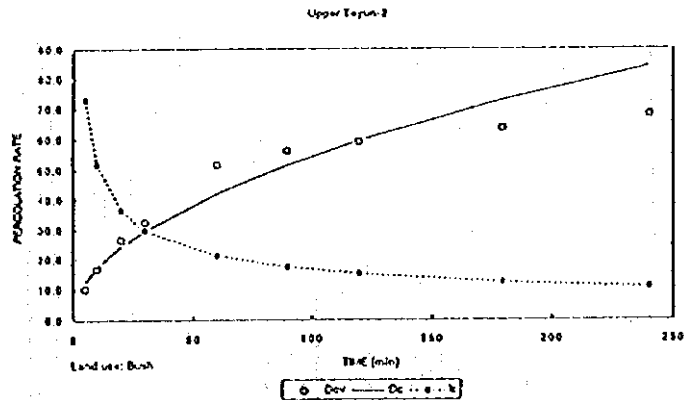
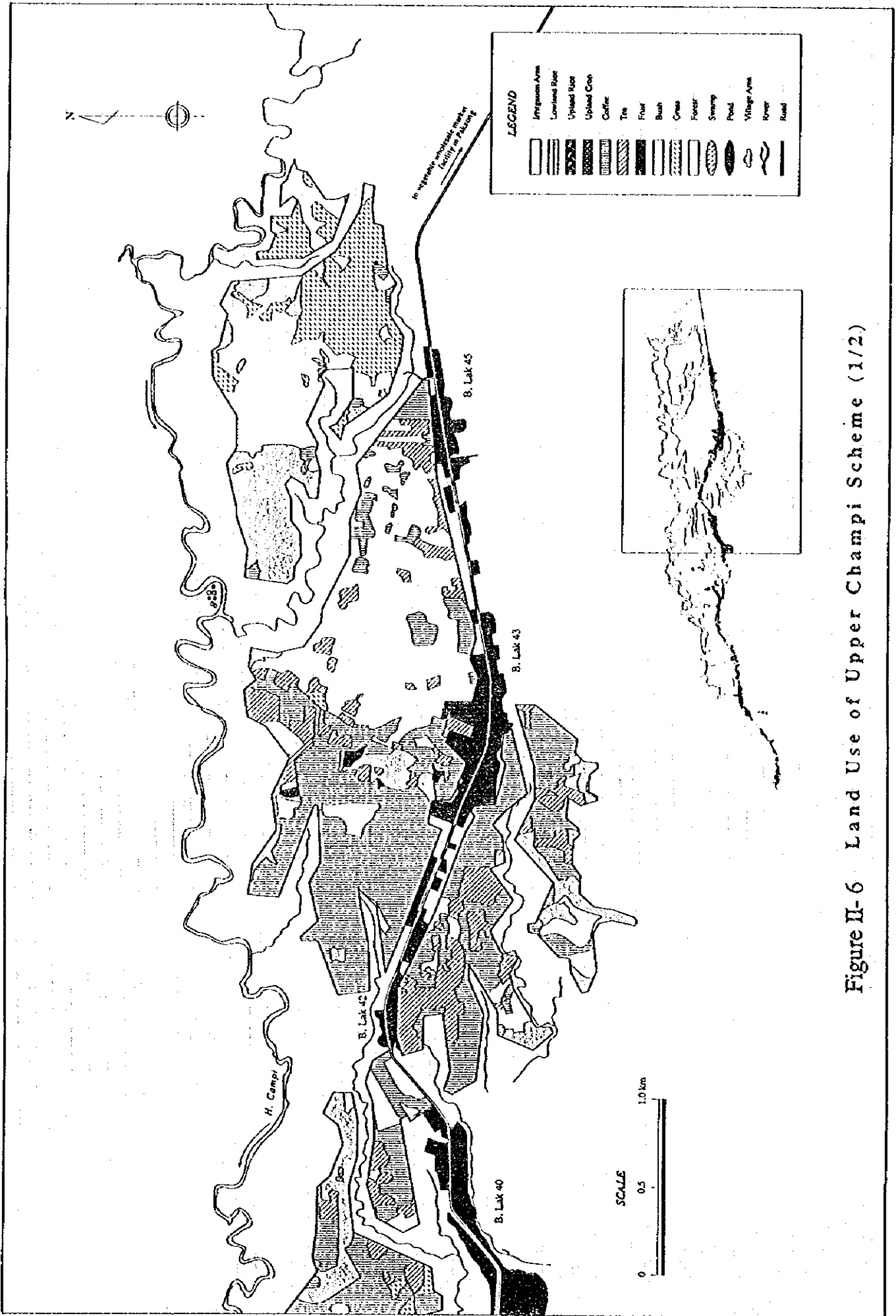
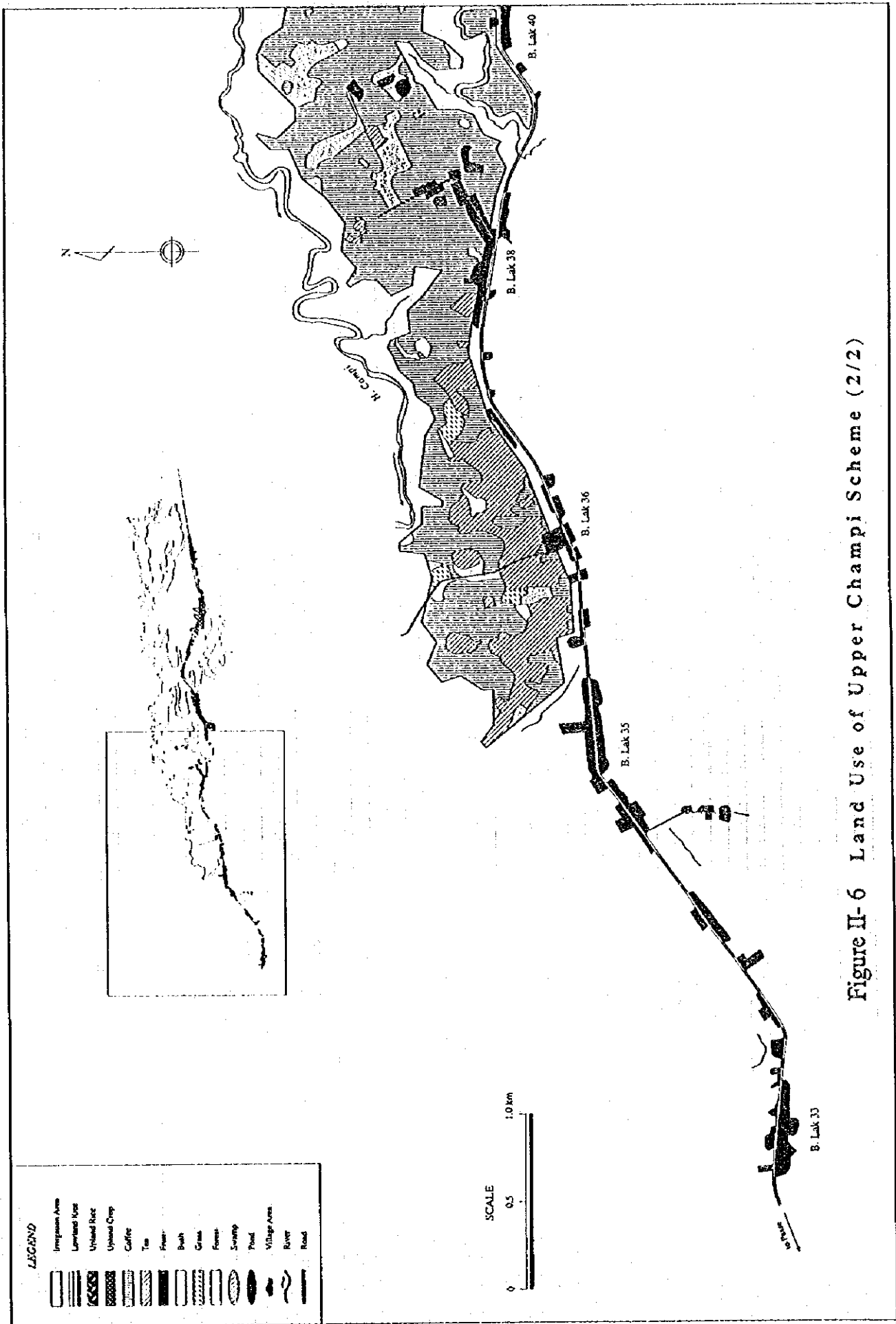


Figure II- 5 Intake Rate Data -Upper Tay-Un-





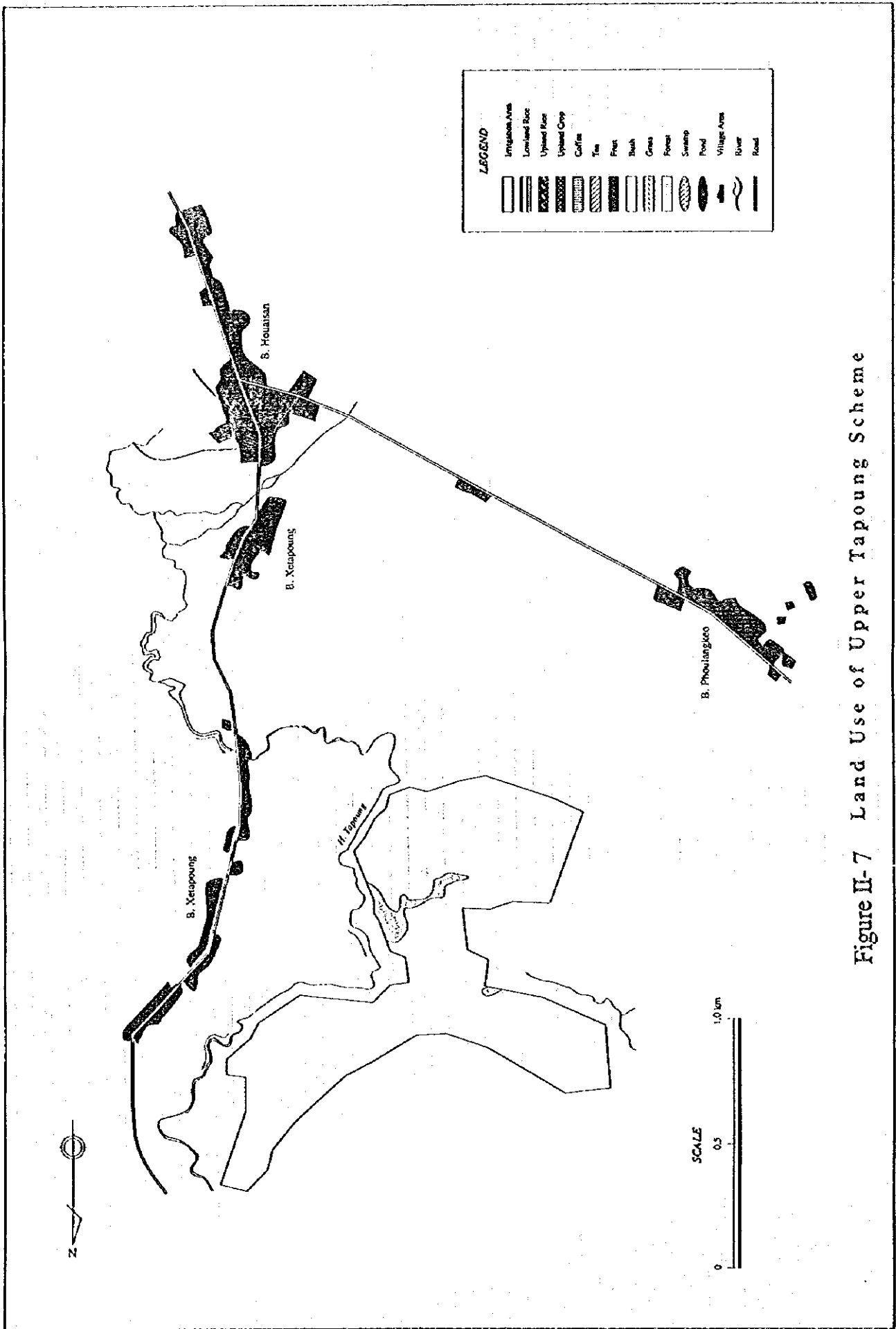


Figure II-7 Land Use of Upper Tapoung Scheme

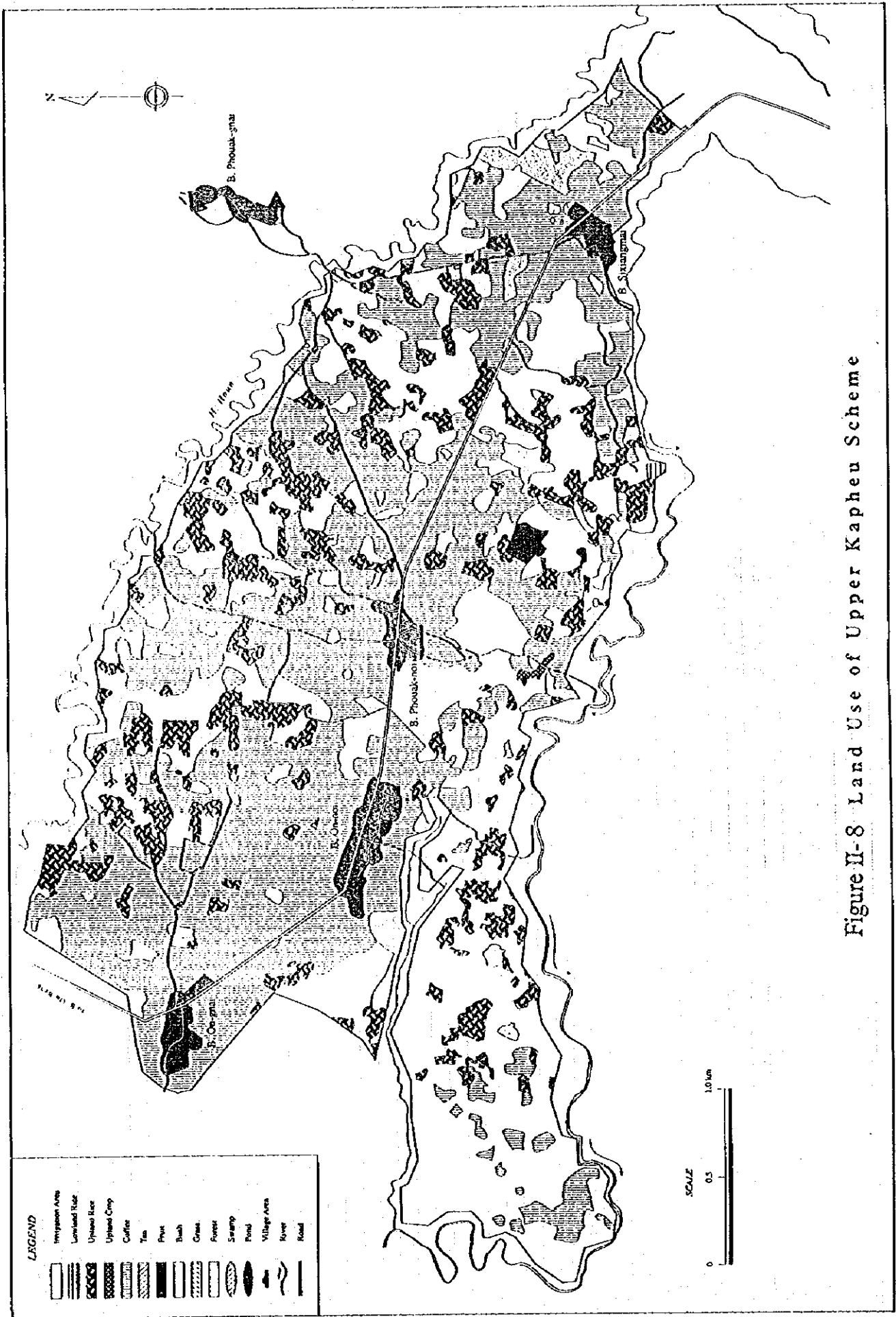
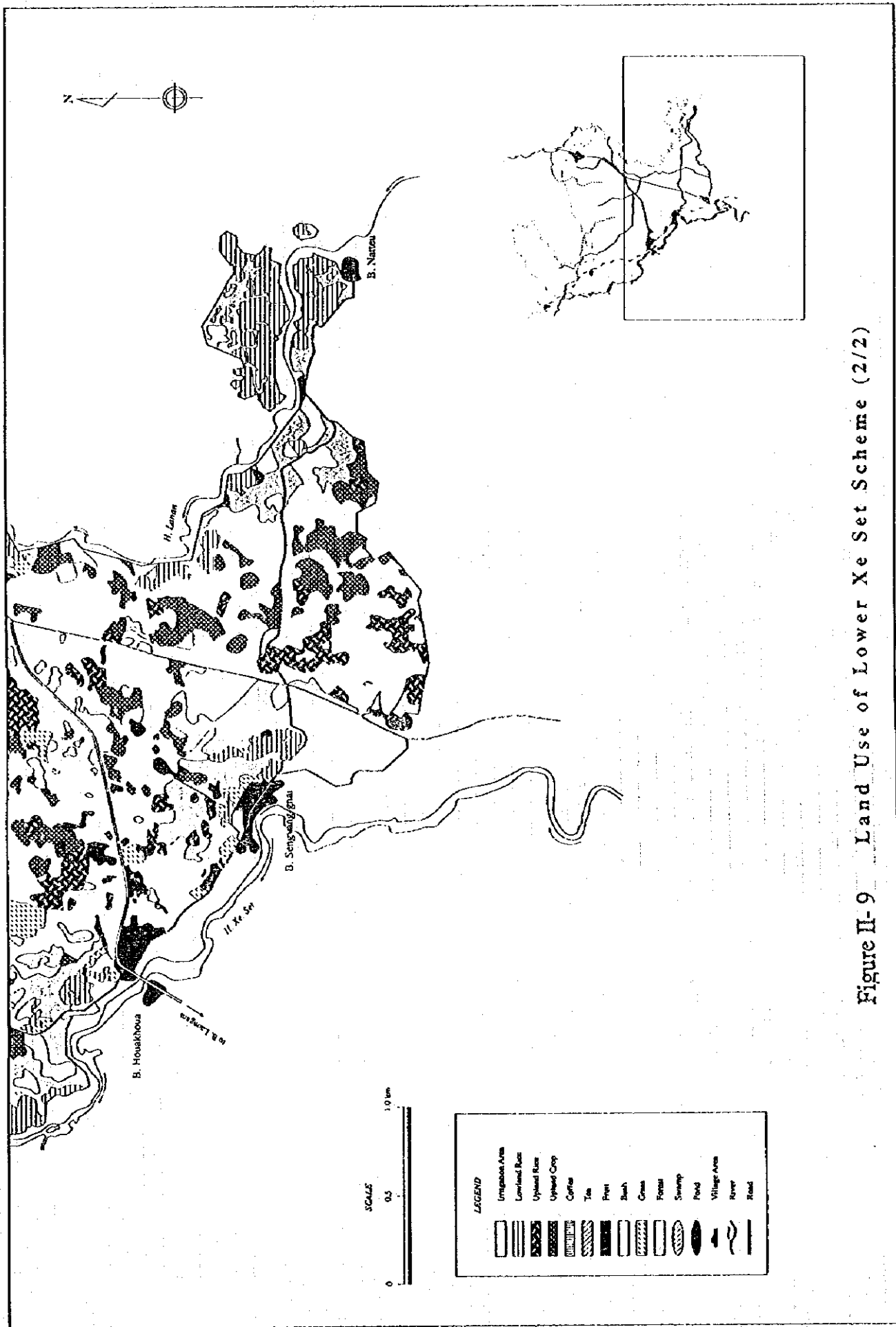


Figure II-8 Land Use of Upper Kapheu Scheme

Figure II-9 Land Use of Lower Xe Set Scheme (1/2)





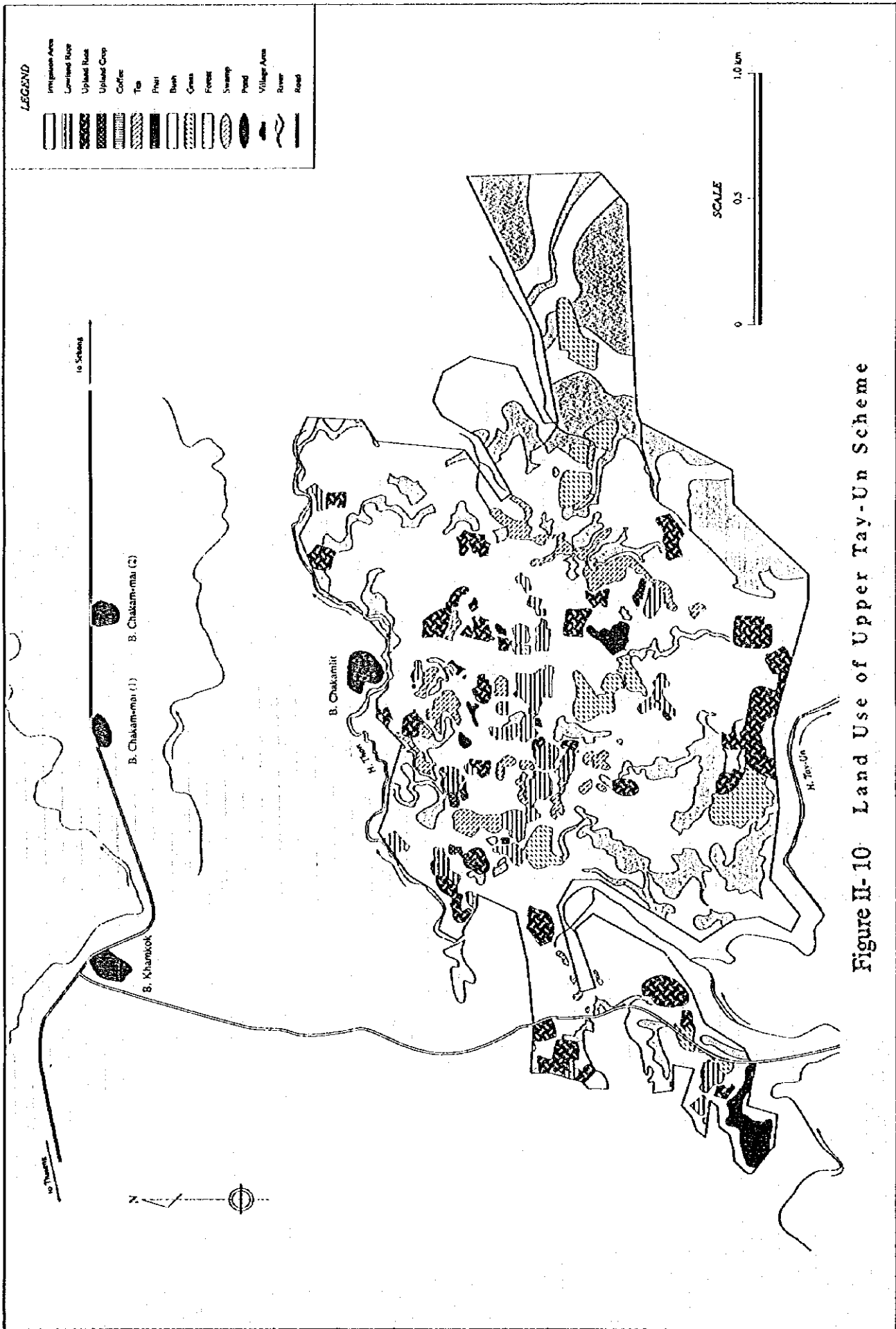
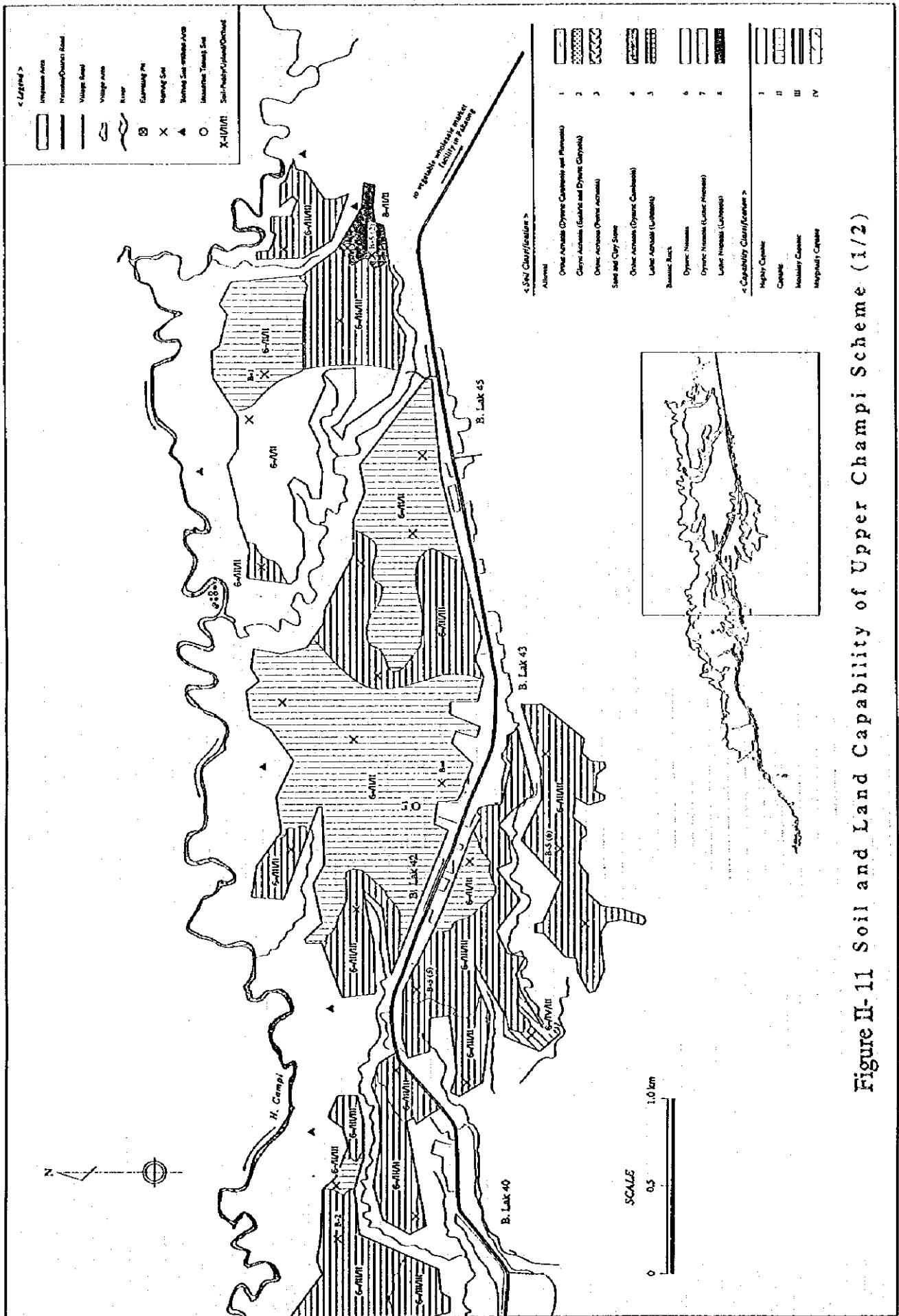


Figure II-10 Land Use of Upper Tay-Un Scheme





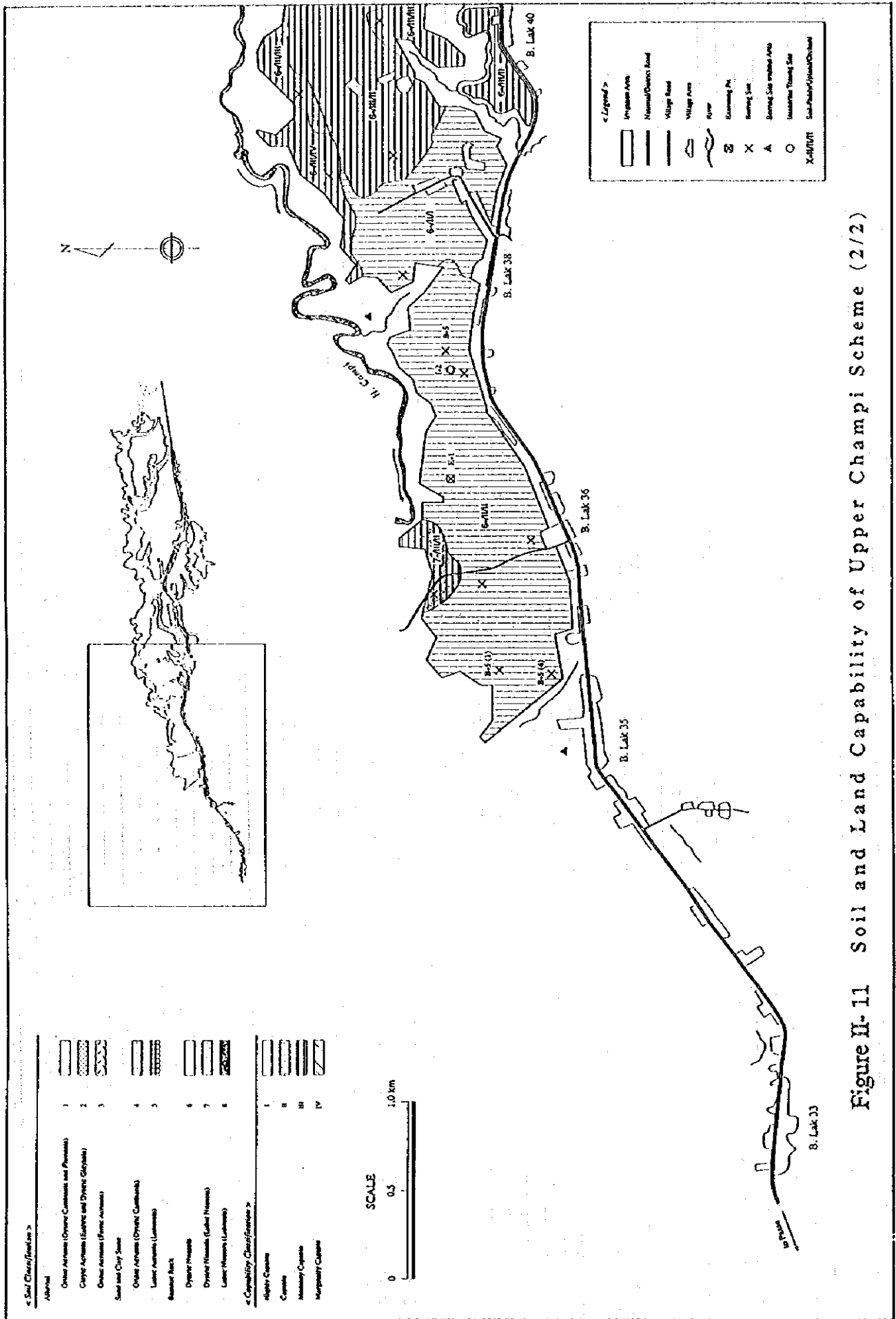


Figure II-11 Soil and Land Capability of Upper Champi Scheme (2/2)

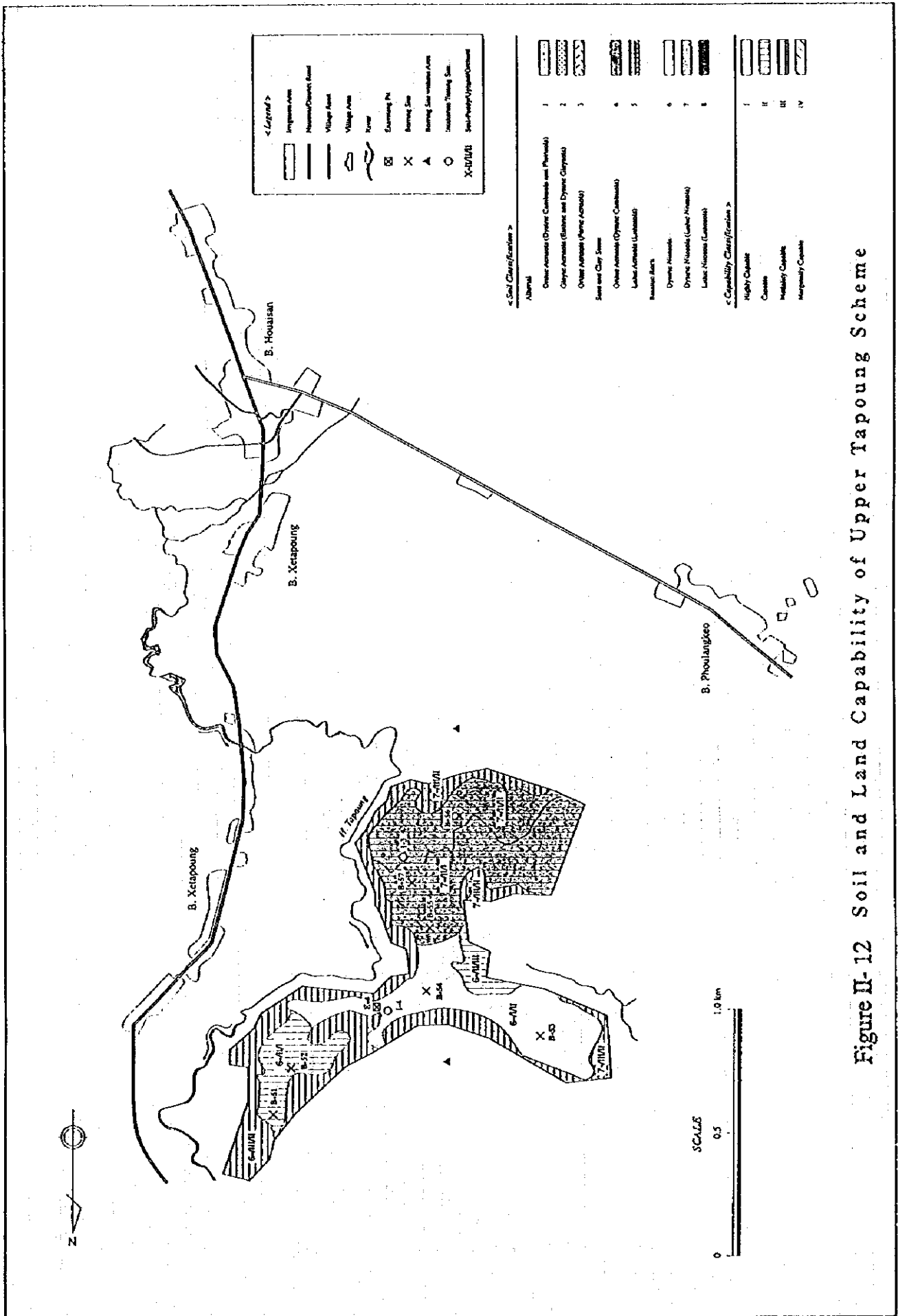
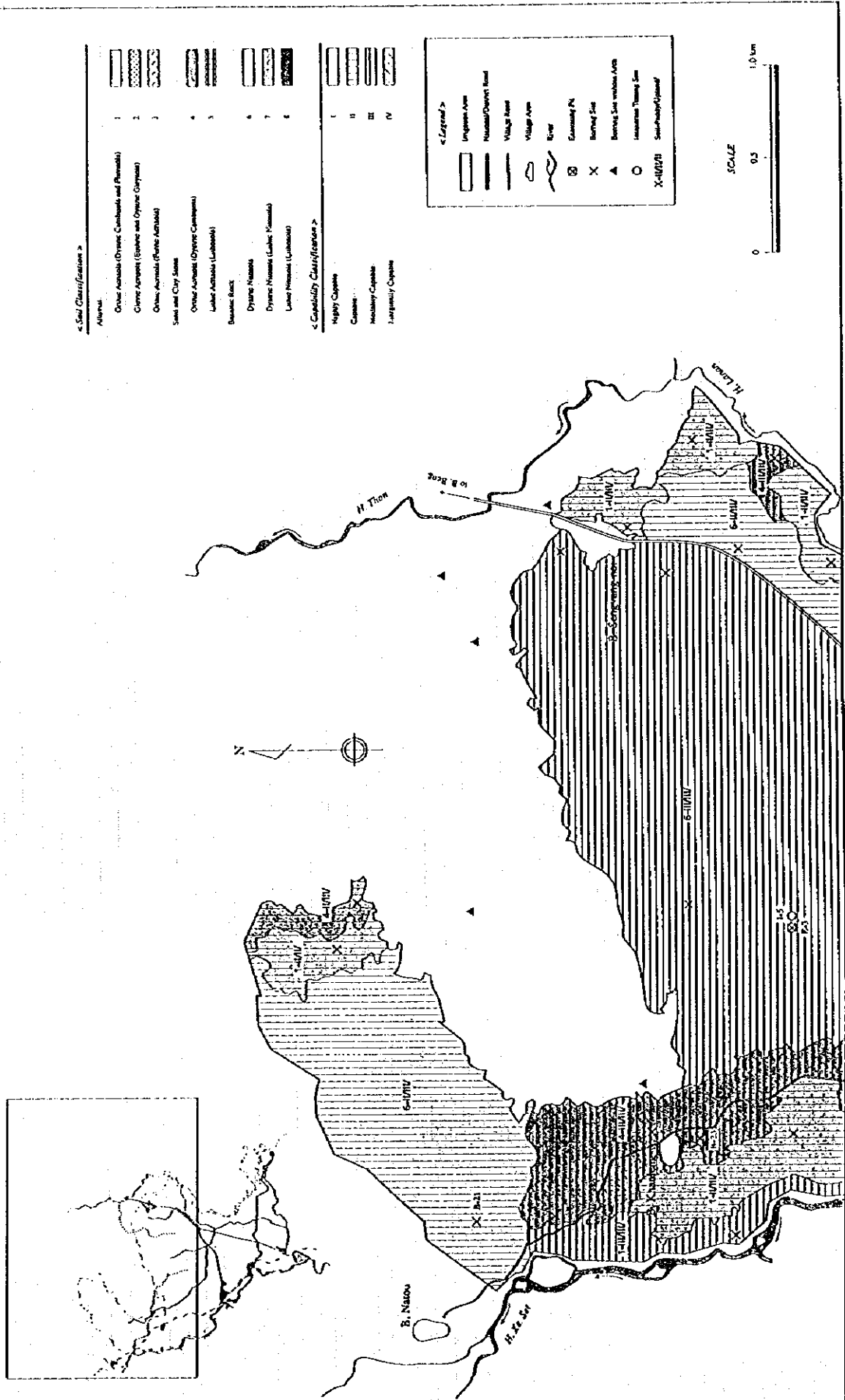


Figure II-12 Soil and Land Capability of Upper Tapoung Scheme



Figure II-14 Soil and Land Capability of Lower Xe Set Scheme (1/2)



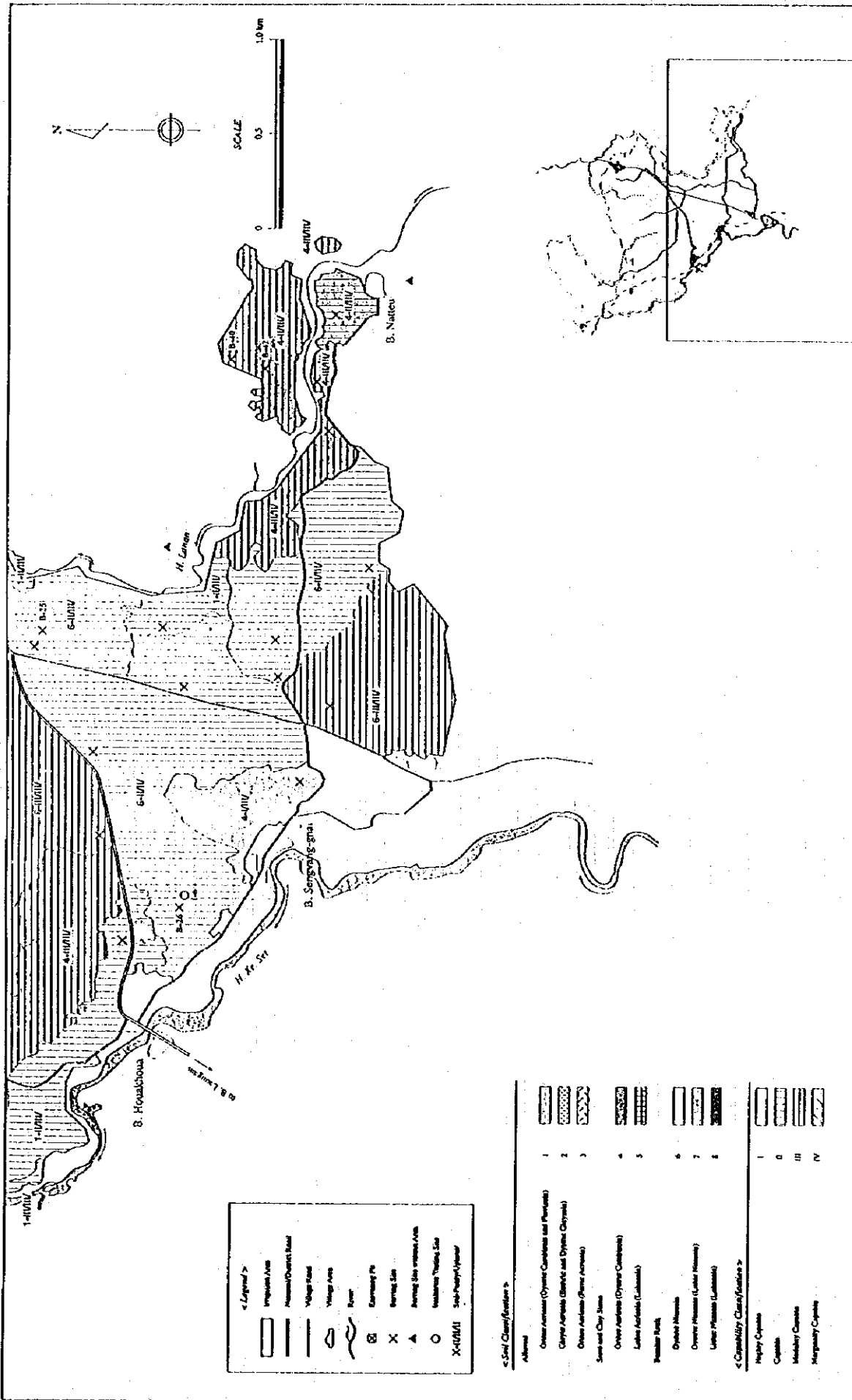


Figure II-14 Soil and Land Capability of Lower Xe Set Scheme (2/2)

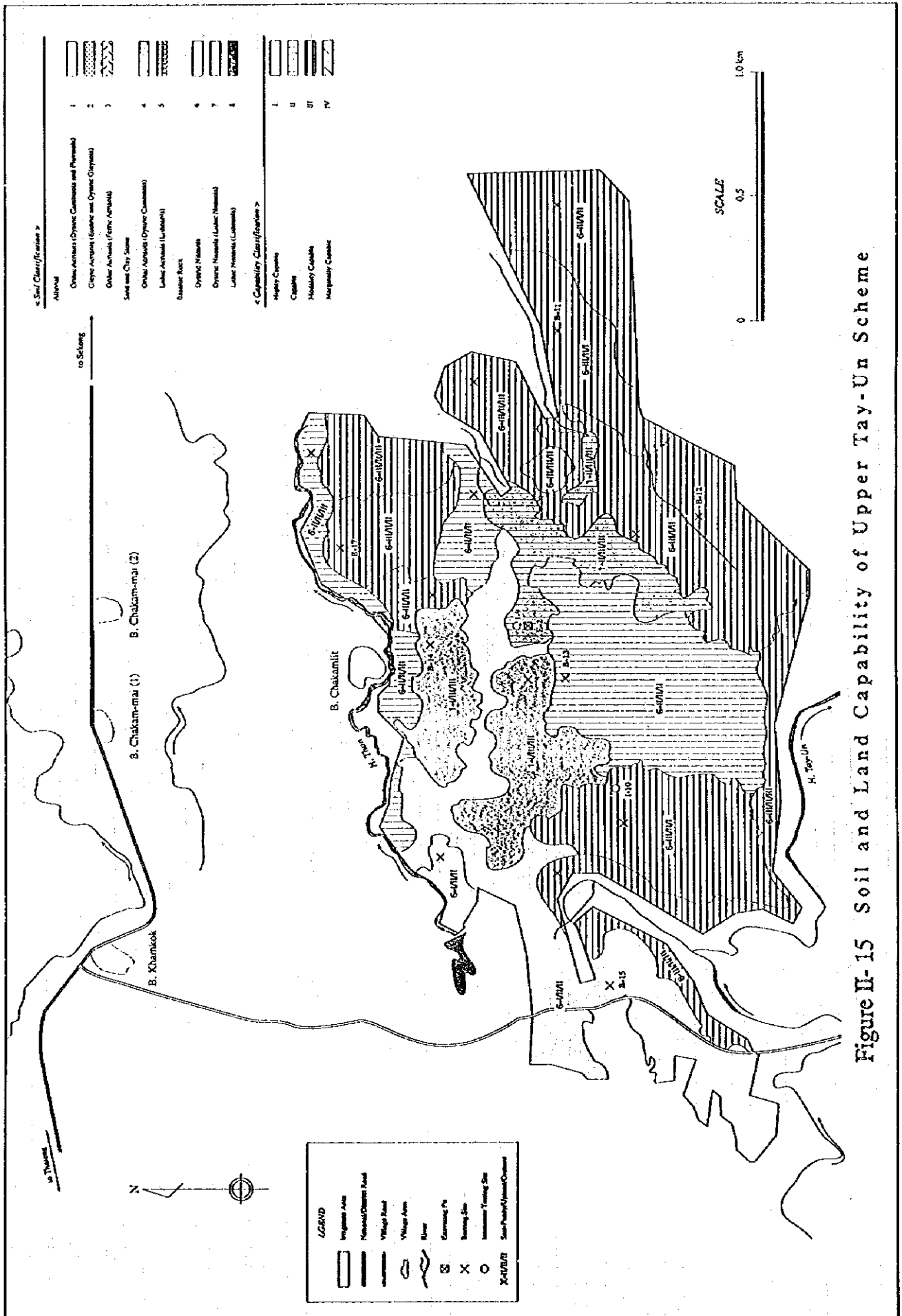


Figure II-15 Soil and Land Capability of Upper Tay-Un Scheme

**ANNEX III**  
**AGRICULTURE**



## ANNEX-III AGRICULTURE

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## **I AGRICULTURAL CONDITION IN THE SOUTHERN REGION**

### **1.1 Crop Production**

The study area is composed of some part of provinces of Champasak, Salavan and Sekong in the southern area of the country. The principal economic activity is farming in the provinces. Champasak and Salavan provinces produce surplus of rice for its' consumption while Sekong is of deficit province in rice. The total share of three provinces is about 23 % of rice production in the whole country on average of recent years. Among the crop production the provinces produce about 95 % of coffee and 90% of cardamom production in the whole country, and about 50% of tea(see Table III-1) mostly from the Boloven Plateau. Total production of rice in the provinces amounted to 364,000 tons(paddy) in 1994. About 90 % of the production is dependent on the rainfed lowland rice, 9 % is on the slash-and-burn cultivation, and the rest is by the irrigated dry season rice respectively. The ratio of the slash-and-burn cultivation in the provinces in 1994 is rather low compared to the national total of about 22 %.

#### Champasak province:

Most people in the province engage in lowland rice cultivation. They cultivate about 77,100 ha and produce 192,000 ton of rice on annual average for 1990 to 1994. There are also some 17,000 ha of coffee and other cash crops in the Boloven Plateau(see Table III-2). These farmers in the Boloven Plateau do not grow rice on a significant scale, and buy almost all the rice they need from other parts of the province. The farmers who live at subsistence level depend on the slash-and-burn cultivation, mainly in the Boloven Plateau and hilly areas in the southeast of the province and west of the Mekong. The annual average area under slash-and-burn cultivation is estimated at about 4,300 ha as shown in Table III-2.

#### Salavan province :

Salavan province is characterized by fertile flood plains of the Mekong and Xedone which produce substantial surplus of rice. The average annual production of rice is about 103,000 ton for 1991 to 1994. Some two thirds of the people are rice farmers who live in the plains. In Laongam district there about 7,000 ha of coffee, and other field crops like cardamom, groundnut and cotton are grown in Salavan and Laongam district which occupy a part of the Boloven Plateau. Recently banana cultivation is expanded in Laongam district(see Table III-3).

#### Sekong province:

Sekong province was created in 1984 in order to improve the public services to the population of the somewhat isolated and backward parts of Salavan province. The most of people live in the eastern mountains and on the northeastern slopes of the Boloven Plateau near Thateng. The economy of Sekong is entirely based on coffee, cardamom, and subsistence farming. The people who live near Thateng grow coffee and cardamom, and generate the substantial part of the provincial income(see Table III-4). The remainder of the population, except for a few rice farmers and the people who live in Sekong town, are slash-and-burn cultivators mostly live in the eastern mountains.

### **1.2 Livestock and Fisheries**

The farmers in the provinces raise buffalo, cattle for farm power and also for marketing. They keep pigs, poultry for marketing and rarely for home consumption. The livestock mostly plays important role as savings for their home economy. There are distinct activities to promote livestock production in the provinces; a few enterprise scale of cattle raising projects were attempted especially in the Boloven Plateau, but the Government has

scaled down the activities to the small holders level mainly from the view point of environmental aspect. The number of livestock in the provinces are given in Tables III-5 to III-7, and Table III-4 for Sekong province. During the period the number of cattle and poultry in the provinces increased significantly at a rate of 5.6 % and 6.6 % per annum, respectively. Pigs increased especially in Salavan province with growth rate of 15% per annum on average. Goat in Sekong province increased remarkably at a rate of 28% .

The fisheries activities in the area is also plays important role to supply protein for the rural population. The Mekong and it's tributaries are the main source of the fishery. Recently fish culture techniques by a fish pond has been introduced and operated by some farmers using fingerling of such kind of fishes as common carp and tilapia bred by the Fishery Research and Extension Station.

## II PRESENT AGRICULTURAL CONDITION IN THE STUDY AREA

### 2.1. Present Condition of Agriculture

#### 2.1.1 Major Crops in the Study Area

##### (1) General

The crops grown in the study area are largely varied dependent on the altitude and soil conditions of locations as well as accessibility to the market especially for vegetables. The cropped area and production of the major crops in the study area are in Tables III-8 to III-12, and summarized as follows:

District	(Unit: Area in ha, production in ton)												
	Coffee		Tea		Upland rice		Lowland rice		Vegetables		Cardamom		Total
	Area	Prod	Area	Prod	Area	Prod	Area	Prod	Area	Prod	Area	Prod	
Pakxong	16100	5700	380	100	710	590	240	50	400	5500	760	250	18590
Bachiang	560	130	-	-	2260	3740	540	1380	-	-	650	120	4010
Laongam	6700	1140	-	-	4700	7050	460	1150	-	-	1400	130	13260
Salavan	50	20	-	-	160	300	2390	7160	-	-	30	10	2630
Thateng	970	260	-	-	1110	1990	270	540	-	-	280	60	2630
Total	24380	7250	380	100	8940	13670	3900	10280	400	5500	3120	570	41120

Note: The data for Pakxong, Bachiang, Laongam, Thateng are of whole district, data for Salavan District include Zone 1,2,3 and 4.

The main crops found in the study area are, upland and lowland rice, coffee, tea, cardamom, fruit trees and vegetables. Other field crops such as soybeans and ground nut are also grown in limited area.

##### (2) Rice

The staple food is rice in the study area. The farmers grow rice both in the upland and lowland conditions. Upland rice (8940 ha) is mostly grown under the slash-and-burn cultivation method, while the lowland rice (3900 ha) is in the terraced rice field mostly under the rainfed condition. In Salavan district, the main crop is lowland rice. The production of upland and lowland rice in the study area is 13,670 ton, and 10,280 ton, respectively, and mostly for farmers their own consumption.

##### (3) Coffee

Coffee is dominated in Pakxong, Laongam and Thateng districts, and some elevated part in Bachiang district. Coffee is one of major crops in the study area, and the planted area of coffee trees totals about 24,400 ha in the study area and occupies more than 90 % of the total area of coffee (26,500 ha in 1993) in the country. According to the information obtained from LUADP, about 90 % of coffee plantation in the study area is planted with Robusta, and the remaining planted is Arabica and Liberica 5 %, respectively. The coffee is grown in the area of altitude above 400 m. The yield of coffee is still very low level as 300 kg/ha (husked dried beans) on average.

##### (4) Tea

Tea is only planted in Pakxong district along the Road No. 23, from around KM 35 to KM 43, in 380 ha of total area. The production is about 100 ton. Tea is mostly pruned in vertical shape. Harvesting from each tea tree is done twice a month during wet season and once a month in the dry season. The processed tea is sold in the domestic market. Due to high price of coffee in these years some tea farms abandon the production.

(5) Banana

Banana is mainly planted in Laongam area along Road No. 20. The yielding area of banana is about 600 ha out of about 1,000 ha of total area. The plantation of banana for marketing has been started in these few years and mainly exported to Thailand according to information obtained from the growers. The average yield of banana is as low as 6 ton/ha at present, and the total production is estimated at 3,500 ton in 1994.

(6) Fruits and Spices

Fruit trees such as durian, mango, lambutan etc. are planted around villages for marketing in local consumption. Recently, some private investors has started plantation of these kind of fruit trees for the marketing purposes. The Government also intends to extend fruit tree plantation. The Fruit Tree Research Station in KM 20 produces seedlings and supplies these to farmers. Pineapple is grown mostly in Bachiang district along the Road No. 23 in the limited area.

Spices such as cardamom, ginger, chilly, etc. are also supporting the farm income of farmers in the study area. Cardamom is commonly planted in rotation system with upland rice, the yield of cardamom in the study area is about 0.3 ton/ha in capsule.

(7) Vegetables

Vegetables such as cabbage, Chinese cabbage, potato, chayote, are mostly concentrated to the northern part of central area (Zone 1, 3 and 5) of Pakxong district. The total area cultivated is about 400 ha, and these vegetables are mainly produced for marketing for Pakxe and Thailand.

(8) Other crops

Upland crops such as soybeans, groundnut, maize, etc. are mostly cultivated in Laongam district. Fruit trees are also found in every places, especially along the Road No. 20 in Bachiang district. Almost all of farmers grow banana, mango, guava, cocos, etc. at their homestead. The area planted with these crops is rather small as compared to the total cultivated area. However fruit tree plays an important role in farm income through the local marketing.

### 2.1.2 Cropping Pattern and Farming Practices

(1) Rice

In the study area farmers grow lowland rice at the onset of the wet season using usually local varieties of around 150 days of growth duration, sowing around end of May to June depending on the arrival of rainfall, transplanting during June to July, and harvesting in November to December. The upland rice is grown mostly with slash-and-burn cultivation method. The cropping season is almost same as that of lowland rice. The slash-and-burn cultivation is mostly practiced as the shifting cultivation with rotation of three to five years in the lower part, and ten to fifteen years in the elevated part of the plateau. In Thongway village in Pakxong district, altitude is about 900 m, farmers prepare nursery in August, transplant in September and harvest in November to December without applying any chemical fertilizers and compost. The pests and disease are blast and brown spot, stem borers, gall midge and army worm according to information from farmers.



## (2) Coffee

Coffee flowers mainly in March to April and is harvested in December to February, but sometimes lasting until March to April. At the harvesting time, labors are employed from outside the study area especially from districts located in low altitude rice growing area after harvesting of rice. Usually no chemical fertilizers are applied, pruning is not appropriately done. They keep up to 7 to 8 stems per plant and as high as 5 to 7 meters for Robusta. Physiological die-back is observed almost in the whole area. Recently LUADP is extending guidance on coffee tree management techniques by regeneration of old trees aged more than 20 to 25 years, and pruning, harvesting and post-harvest techniques together with introduction of dwarf and rust resistant variety of Arabica. It is said that the quality of coffee at present in Boloven Plateau is rather low in spite of the very suitable land and climate for coffee production mainly due to ignorance of not only farmers but also traders of coffee. The main reasons of low quality are; too high moisture content over the 12 % of standard of EC market, one time harvesting of matured cherry mixed with immature one, slow drying on the ground directly and causing fermentation of beans, and low milling and sorting quality mixed with broken and immature beans. One of the private sector coffee trader is intending to introduce wet processing method for Arabica coffee to process high quality coffee in the study area.

## (3) Vegetables

The main season of cabbage and Chinese cabbage in Pakxong area is started seeding in December to January and harvested in May to June. Potato is seeded in March and harvested in June in Pakxong area. Vegetables are grown with irrigation by watering can or small irrigation pump during the dry season. Farmers also grow during the rainy season, harvest in September to October. Usually they use improved seed imported from abroad, using chemical fertilizers such as compound(16-20-0), and urea, and applying insecticide to control pests especially at the nursery stage.

## (4) Other crops

Other crops such as groundnut, soybeans, etc. are also seeded mostly in the mixing or rotation with the upland rice, or inter cropping with young coffee tree. This system is recently introduced mainly by the LUADP activities. Groundnut is seeded in May and harvested in September to October, while soybeans seeded in July and harvested in November to December. Cardamom is planted in the upland rice field with mix cropping system just one or two years before abandon the rice crop. Cardamom is planted using suckers and become for harvesting about five to eight years after. Light weeding is done and no fertilizers are applied.

The details of present cropping pattern and farming practices are given in Figures III-1 to III-5 and Table III-13, respectively.

### 2.1.3 Crop Yield and Production

The data on yield of crops in the study area was mainly collected from District Agriculture and Forestry Services of the related districts, and also through interviews to farmers.

The yield of rice is still at very low level, about 1.5 ton/ha of upland rice, 2.6 ton/ha of lowland rice on an average. The yield varies dependent on the cultivation method, condition of irrigation and soils. Lowland rice farmers always complain of the shortage of irrigation water and less availability of fertilizers due to lack of fund to purchase fertilizers.

Where irrigation water is available in the dry season, around 3 ton/ha with the improved varieties is practiced but the very limited areas.

Unit yield of coffee is very low, around 0.3 ton/ha on average of the whole area. There is no data and information available on the irrigated coffee cultivation but farmers interviewed always request irrigation for coffee to increase yield.

The yield of cabbage, Chinese cabbage and potato is 8 to 10 ton/ha, 6 ton/ha and 10 ton/ha, respectively. The yield of Chinese cabbage is very low, and cabbage and potato is still low. It seems mainly due to lack of proper cultivation techniques of farmers, and partly shortage of irrigation water.

#### 2.1.4 Livestock and Fisheries

Livestock raising is also very important activities in the area. Most of farmers keep cattle, buffalo, pig and poultry. The cattle and buffalo are mainly for meat and also draught power for field preparation and cart. Horse is also kept in the high altitude area for the purpose of transportation of materials where cart is not accessible. The number of livestock in the study area is given below and the details are in Tables III-8 to III-12.

District	Cattle	Buffalo	Horse	Pig	Poultry	Fishery	
						Pond	Prod.
Pakxong	17900	2220	530	5930	22000	170 ha	16 ton
Bachiang	5660	2110	-	5150	21000		
Laongam	10430	2450	-	9700	39200		
Salavan	4130	4630	-	3700	29700	78 ha	
Thateng	1750	1090	22	1130	5450	1 ha	
Total	39870	12500	552	25610	117350	249 ha	16 ton

In Pakxong area, large scale of cattle raising was once attempted but from the view point of protection of water resources and environment, the local government is going to reconsider the development of large scale cattle farm in the area. But the Government has intention to promote small scale holders (less than 400 to 500 heads per family) with semi-intensive raising method (improvement of grass land, pasturing and fattening) without concession of the land in the area. Cattle and buffalo raising is practiced by free ranging method (so called), the farmers keep them in freely moving mainly in the forest areas, with less care of animals. Raising method of animals are still primitive, and during the dry season, grass for cattle becomes short in common. The most problem matters for livestock raising is disease control, especially foot and mouth disease.

Inland fisheries is an important source of protein supply for the people of the rural area. Fisheries activity in the study area is mostly done as capturing fish with cast net, traps, or scoop net in the rivers, small streams, canals, ponds and lakes wherever they can access to catch naturally propagated fishes. The precise data concerning to the amount of fish caught in the study area are not available. Besides, recently fish cultivation using artificial fish pond is promoted by the government, but the area is not so large yet. The kind of fish cultivated is mainly common carp and tilapia, for which fingerlings are supplied from the Fishery Research and Extension Station located at KM 8. The number of fingerlings supplied to the farmers by the station was about 215,000 in 1994 increased from that of 55,000 in 1993. The accurate production data is not available yet due to little experience of harvest.

### **2.1.5 Agro-processing**

The most important agro-processing activity in the study area is milling of rice and husking of coffee. Most of villages are equipped with privately owned mills in their villages. Data on the number of mills in the study area is not available, but through interviews to villagers, no constraints are raised on the shortage of mills. At present almost all villagers use rice mill for milling rice, instead of pounding method. The milling charge is about 10 Kip/kg ( output ). There is found only one type of milling machine of steel huller one-pass type. The type of mill is used for milling of rice and coffee and the average capacity of mill is about 200 to 300 kg/hr of coffee ( output ), and 300 to 400 kg/hr of rice (output). The recovery rate of milling is about 60 - 62 % for rice, and about 50-60 % for coffee to dried cherry according to the millers respectively. The milling machine are usually operated with 16 to 18 horse power of diesel engine, but where electricity supply exists, electric motors are common. These engine and machine are imported mainly from China and Thailand, some are from Taiwan. Processing of tea is made in the very limited places around villages from KM 35 to KM 43, where farmers grow tea which seems to be Shan of Assam variety. Non fermented tea is processed by roasting method using hot iron plate by individual family of tea farmer.

### **2.1.6 Agricultural Machinery**

In these two years considerable number of hand tractor(two wheel) and milling machine were imported from Thailand, China and Taiwan. The most of hand tractor is used for transportation of materials with trailer but not for tilling of field. The accurate data on the number of machine in the study area are not available, but according to information by some trader who sold 50 units of hand tractor during March to May in 1995 in Pakxong district, more than 200 of hand tractors were believed to be distributed in Pakxong district. Some large farmers such as who operating cattle ranch have medium scale of tractors ( 30-45 HP) but the number is very limited. Some farmers ask these tractor owners to prepare the field, about 70,000 Kip/ha by one time of ploughing and harrowing.

## **2.2 Constraints for Agricultural Development**

Most of the constraints which are crucial to profitable and sustainable agricultural development in the study area, are due to insufficient agricultural services and infrastructures. Major constraints to further development of agriculture are summarized as follows:

### **a. Irrigation Water Deficit**

The farmers are suffering from shortage of irrigation water for cultivating rice in the wet season, particularly at the beginning of the wet season due to erratic distribution of rainfall. The rice farmers in the study area are eager to grow rice at least for self-sufficiency. The Government has strong intention to reduce slash-and-burn cultivation of upland rice. It is essential to develop stabilized agriculture with effective irrigation water supply to achieve the sustainable development of agriculture by replacing slash-and-burn cultivation with it.

### **b. Lack of Supporting Services and Improved Techniques**

Despite the fact that the existing agricultural area such as coffee plantations, rice and vegetable fields as well as livestock raising in the study area have a large potential of increasing productivity, no packages of farming techniques have been developed. Since there is no basis of researched techniques, credible extension services for increase in crop and livestock production for farmers could not be provided sufficiently by the offices concerned, mainly due to shortage of qualified manpower, facilities and equipment, and operational fund for research and extension work as well as lack of appropriate credit opportunities at reasonable cost/interest rates.

c. **Insufficient Marketing System of Agricultural Input and Output**

The shortage of agricultural inputs such as fertilizers and chemicals, as well as improved seed and seedlings, is a major constraint in the study area. Most of the farmers in the area are facing transportation problems both for inputs and outputs, and inadequate capital to purchase these inputs. The farmers also have less accessibility to market information, especially on export-oriented products, and have less power of negotiation with traders due to lack of a marketing organization of farmers.

### III AGRICULTURAL DEVELOPMENT PLAN

#### 3.1 Basic Agricultural Development Plan

##### 3.1.1 Agricultural Development Potential

The agricultural development policy of the Government is focused on (i) self-sufficiency in food (rice) and food security, (ii) promotion of production of agricultural commodities, and (iii) reduction of slash-and-burn cultivation by stabilized farming. Along with the policy, potential of agricultural development in the study area was focused on increasing agricultural production through (i) intensification, and improvement of the existing agricultural practices, and (ii) expansion of a new agricultural land.

##### (1) Crops

The existing agricultural activities in the study area are characterized as rather diversified farming system by cultivation of coffee, some extent of tea, cardamom and vegetables in the elevated area (above 400 m in altitude), and various upland crops such as upland rice, lowland rice, groundnuts, soybeans, fruit trees etc. in the relatively low area (below 400 m). The unit yield of the major crops cultivated in the study area is stagnated at rather low level in general, despite the natural conditions in the study area are quite suitable for wide range of crops, and there are much rooms to promote agricultural production by means of improving land productivity with appropriate agricultural techniques and infrastructure. The present crop yield and the potential yield of major crops grown in the study area are summarized as follows:

Crops	Existing Area (ha)	Present Yield (ton/ha)	Anticipated Yield (ton/ha)	Yield Increment (ton/ha)
Coffee	24,380	0.3	1 to 2	0.7 to 1.7
Tea	380	0.26	1 to 2	0.7 to 1.7
Upland rice	8940	1.5	3 to 4	1.4 to 2.4
Lowland rice	3900	2.6	4 to 5	1.6 to 2.6
Vegetables:				
Cabbage	180	8	20	12
Chinese cabbage	50	6	20 to 30	14 to 24
Potato	80	10	20	10

Notes: The anticipated yield of each crop is estimated based on the average production conditions under irrigation for the tropics, since there is no reliable data on the ultimate crop yield in and around the study area. The anticipated yield of coffee is assumed at rather conservative level referred to 5 ton/ha of potential yield under irrigated condition (Gordon Wrigley, 1988, and Netherlands MAF, 1989).

It is obvious that there is much rooms for increasing crop production by improving crop yield by intensification of farming practices.

The expansion potential of agricultural land in the study area was assessed with land capability classification based on the results of soil, land use and land capability survey, and crop suitability to the climatic condition which varies due to altitude of the land.

To assess the potential of crop production increase, the proposed typical cropping patterns were formulated taking into account the crop suitability by altitude and the present agricultural land use in the study area as follows:

Altitude	Cropping patterns	Wet season	Dry season
600<	A1	Lowland rice(135 days variety)	Lowland rice(120 days variety)
<600	A2	Lowland rice(150 days variety)	Lowland rice(135 days variety)
600<	B1	Lowland rice(135 days variety)	Cool season vegetables, general field crops
<600	B2	Lowland rice(135 days variety)	General field crops
600<	C	Upland crops, vegetables	Frost tolerant vegetables
400<1000	D	Coffee / tea	

The land of 135,600 ha suitable for agriculture in the study area was widely classified into four based on altitude, and the possible agricultural development potential was assessed applying the proposed typical cropping patterns as follows:

Altitude(m)	Proposed cropping pattern	Suitable area for agriculture (ha in net)	Irrigable area (ha in net)	Non irrigable area (ha in net)
above 1,000	C(change slash-and-burn to permanent cropping system) D(existing area)	22,900	2,450	20,450
600 ~ 1,000	A1(existing area) B1(existing and new area) C(change slash-and-burn to permanent cropping system) D(Robusta, existing area) D(Arabica,new area, change from slash-and-burn)	59,800	16,120	43,680
400 ~ 600	A2(existing and new area) B2(existing and new area) D(Robusta, existing area)	19,700	8,030	11,670
below 400	A2(existing and new area) B2(existing and new area) D(Robusta, existing area)	33,200	28,070	5,130
Total		135,600	54,670	80,930

The agricultural land area possible to be irrigated is estimated at about 54,800 ha in total in the study area and approximately 80,800 ha of non irrigation area was clarified as shown in the above table.

### 3.1.2 Basic Development Concepts for Agriculture

#### (1) General

The ultimate objectives of the Master Plan is to achieve a substantial and sustainable life improvement of the people in the study area. The basic agricultural development concept adopted within the framework of the Master Plan is to increase agricultural output to contribute to the life improvement by raising the family income. The envisaged agricultural development in the study area would be achieved through at first intensification of the existing diversified agriculture by improving husbandry technologies and development of infrastructure. And secondly by the expansion of agricultural area with establishing sustainable farming systems or by developing lowland rice field changing from the slash-and-burn cultivation which still remained in the study area.

#### (2) Coordination with Other Development Activities

The LUADP has been started from 1993 to promote agricultural activity in the Boloven Plateau especially for improvement of upland farming system including field crops, vegetables, fruits and other economic trees, and animal health, as well as rural infrastructures.

The research and extension work for coffee is mostly concentrated to improve planting materials, cultivation techniques, and improvement of coffee for entirely coffee area in the Plateau. Extension work for upland crops at present are mostly concentrated to the area of Thateng, Salavan and Loangam district except Pakxong district. The agricultural development plan in the frame work of the present Master Plan is formulated taking into consideration of well coordination with the activities of LUADP as well as other development projects.

(3) **Model Development Area**

The agricultural activities in the study area are varied mostly by the topographic and climatic conditions. The "model development area" method is proposed as the basic strategy to approach the overall agricultural development in the study area. The model area including model villages would be established in each category of agricultural land classified (especially by altitude), and it would be nuclear for extending agricultural development to the surrounding areas.

(4) **Stagewise Development Approach**

Taking into consideration the prevailing constraints for agricultural development, the agricultural development would necessarily be supported by various components such as strengthened research work and extension services, and improved marketing system and facilities as well as rural and agricultural infrastructures. Further more, considering the vast size of the envisaged objective area for agricultural development, the stagewise development strategy is required to be formulated based on the view point of short, medium and long term development periods.

### **3.1.3 Basic Agricultural Development Plan**

(1) **Long Term Target and Assumptions**

The basic development plan for the entire suitable area for crop cultivation was formulated with the following long term development targets and assumptions:

- to develop the whole land suitable for agriculture as population increase with 2.7 % per annum in the study area, basically by family farm of small scale holder system with 2.5 ha of holding area on average, it will require about 30 years to develop the whole area,
- to maximize irrigated agricultural area to stabilize and sustain yield and production,
- to establish the permanent cropping system suitable to the non-irrigable area through long term research and experiences,
- to reduce slash-and-burn cultivation into less than one tenth of present area in 30 years, and
- to replace slash-and-burn cultivation with permanent cropping systems by increasing diversified crops such as coffee, tea, vegetables particularly in the elevated area, and field crops such as groundnut, soybeans, maize etc. in the middle to lower area, double cropping of rice under irrigation in the lower area.

(2) **Proposed Cropping Pattern**

The proposed cropping pattern for the basic development plan was formulated based on the above assumptions and target with applying the proposed typical cropping patterns as shown in Table III-14 and summarized below:

(Unit: ha)

Crops	Existing	Proposed					
		Irrigated		Non-irrigated		Total	
		Wet	Dry	Wet	Dry	Wet	Dry
Coffee	24,400	11,005	11,005	48,370	48,370	59,375	59,375
Tea	380	380	380	1,000	1,000	1,380	1,380
Upland rice	8,940	0	0	700	0	700	0
Lowland rice	3,900	40,275	10,240	0	0	40,275	10,240
Vegetables	400	480	8,255	5,230	1,500	5,710	9,755
Cardamom	3,120	0	0	800	800	800	800
Field crops*		2,530	12,360	19,830	2,000	22,360	14,360
Fruit trees*		0	0	5,000	5,000	5,000	5,000
<b>Total</b>	<b>41,140</b>	<b>54,670</b>	<b>42,240</b>	<b>80,930</b>	<b>58,670</b>	<b>135,600</b>	<b>100,910</b>

\* The existing area is negligible small comparing to those of the others.

As seen in the above table, the total cultivated area will be expanded to about 135,600 ha of suitable land, say about 2.4 times of the 41,140 ha of the existing area, with about 54,700 ha of full irrigated area. About 9,000 ha of upland rice under slash-and-burn cultivation will be reduced to about 700 ha while existing 3,900 ha of the rainfed lowland rice field will be expanded and converted to about 40,000 ha of irrigated rice field in the wet season and 10,200 ha will be cultivated in the dry season respectively. Existing 24,400 ha of coffee field is expanded to about 59,400 ha out of which 11,000 ha will be irrigated. Area for vegetables irrigated will be about 500 ha in the wet season and 8,300 ha in the dry season while the non-irrigated vegetable area will be about 5,200 ha and 1,500 ha in wet season and dry season, respectively.

### (3) Anticipated Crop Yield and Production

The anticipated target yield of crops is as shown below:

Crops	Present (ton/ha)	Without irrigation (ton/ha)	With irrigation (ton/ha)
Coffee	0.3	1.0	1.5
Tea	0.26	0.5	1
Upland rice	1.5	2	3
Lowland rice			
Local variety	2.6	2.6	3
Improved variety	-	-	4
Field crops:			
Groundnut	1	1	2
Soybeans	1	1	2
Maize	1	1	3
Vegetables:			
Cabbage	8	10	20
Chinese cabbage	6	10	20
Potato	10	10	20

The target yield of each crop is assumed at the average production conditions under irrigation for the tropics, since there is no reliable data on the ultimate crop yield in and around the study area.

The increment of unit yield of crops without irrigated condition was estimated taking into account the agricultural extension activities in the future. The increment of crop production with project condition comparing to the present condition was estimated as shown below.



(Unit : ton)

Crops	Present		Proposed				Total	Increment
			Irrigated		Non-irrigated			
			Wet	Dry	Wet	Dry		
Coffee	7,250	0	16,508	0	48,370	64,878	57,628	
Tea	100	190	190	300	200	880	780	
Upland rice	13,670	0	0	1,400	0	1,400	-12,270	
Lowland rice	10,280	161,100	40,960	0	0	202,060	191,780	
Vegetables	5,500	9,600	165,100	52,300	15,000	242,000	236,500	
Cardamom	570	0	0	240	0	240	-330	
Filed crops*		5,060	24,720	19,830	2,000	51,610	51,610	
Fruit trees*				20,000		20,000	20,000	
Total	37,370	175,950	247,470	94,070	65,570	583,068	545,698	

The increment of coffee, rice, vegetables is about 57,600, 180,000 and 240,000 ton, respectively. Filed crops such as maize, groundnut and soybeans will be increased to about 51,000 ton, while Cardamom will be decreased along with reducing slash-and-burn cultivation.

#### (4) Livestock and fisheries:

Livestock raising, cattle, buffalo, pig and poultry, plays very important role in the farmers' economy traditionally in the study area. The high potential of cattle raising in the Boloven Plateau has been recognized, and some large scale of cattle farm development was attempted, but from the environment point of view, the attempt has been changed to reforestation activities to keep water resources especially at the higher portion of the plateau. The proposed livestock development is based on the introduction of package of simple technologies as follows:

- fencing for animals to prevent free roaming system by growing shrub and tree legumes and live fencing around house compound, and as hedgerows on crop boundaries,
- legume grasses sown in grazing land without modifying traditional grazing management drastically, and techniques for ensilage making especially for dry season feed,
- introduce semi-intensive raising method including grazing land improvement and some cereal crops such as maize for fattening, and
- improvement of veterinary services by the concerned offices

The middle to lower part of the plateau, especially natural grass land or bush land after slash-and-burn cultivation (about 43,000 ha) has a large potential for development of the improved grass land or feed production for livestock raising. The possible number of livestock which is represented by cattle is estimated as follows:

District	Grass land/feed crops (ha)	Number of cattle (No.)
Pakxong	29,000	58,000
Bachiang	8,000	16,000
Laongam	3,000	6,000
Salavan	1,000	2,000
Thateng	1,000	2,000
Total	42,000	84,000

The possible number of cattle grazed per ha after improvement is assumed at 2 heads.

The most constraints for small holder livestock development is lack of package of technology for feed production and animal health control. As for feed production, it is required to establish the sustainable upland farming systems for fodder production by

displacing the slash-and-burn cultivation systems. The technologies for small holder farmers which is most appropriate to the study area would be introduced from the neighboring Southeast Asian countries. The Department of Livestock and Veterinary Services has plan to strengthen the Livestock Research Station at KM 49 to extend semi-intensive livestock raising method including forage technologies and veterinary service. The veterinary service is inevitable to promote livestock production to meet international health standards, especially for export to foreign country. Livestock development in the study area would be much promoted by establishing the required technologies in the long run of research work.

There is potential for fish culture using natural ponds and streams as well as artificial ponds in the plateau. Unused number of natural ponds above 1,200 m in the Pakxong area can be utilized for fish culture by establishing a legal lease system by the government to private investors or village communities. There is also fish culture potential using the natural streams in the plateau, such kind of cool water fish as trout, and even in the lowland rice field for carps and tilapia, etc. It would be necessary to establish technologies package through long term research and experiences. The existing area of ponds in the study area is estimated at about 250 ha including natural ponds in Pakxong district. The potential of fish production is estimated at about 250 ton/year, applying rate of 1 ton/ha (common carp or tilapia). About 500 ha of regulation pond for irrigation purpose would be constructed in the Lower Xeset project and the 500 ton of fish culture potential would be newly created.

### **3.2 Proposed Agricultural Development Plan for Model Areas**

#### **3.2.1 General**

The agricultural development plan for the selected 16 model development project areas was formulated along with the basic development concepts and taking into consideration the following specific objectives:

- to replace slash-and-burn cultivation (upland rice) with lowland rice or upland field crops other than upland rice,
- to promote vegetable and upland field crops especially in the elevated land
- to promote double cropping of rice in the lowest land where most of lowland rice is cultivated under rainfed at present,
- to expand coffee plantation, Arabica as well as Robusta, to the middle to elevated land, and
- to promote semi-intensive livestock raising especially for cattle by improving pasture lands and veterinary services.

#### **3.2.2 Present Condition of the Selected Project Areas**

The present agricultural condition in and around the selected project areas are estimated mainly based on data of the concerned villages obtained from each district agricultural services and given in Table III-15. The selected areas are located from 100 m at the lowest to above 1,200 m at the highest project area respectively. These areas include almost all types of agricultural activities observed in the study area. Coffee plantation area concentrated to the higher land while the lowland rice field is mostly in the low altitude of 100 to 200 m, but including the lowland rice field found at altitude of 850 to 900 m. Livestock raising, especially cattle and pigs is found almost all areas, but much buffaloes are found in the lowland rice areas. The total number of household is about 5,800 with 31,600 population, and the total cropped area is about 9,400 ha, 1.6 ha per household on average. The total number of cattle, buffalo, pig and poultry is about 9,100, 3,800, 6,500 and 37,000 respectively.

### 3.2.3 Proposed Cropping Pattern

The typical cropping patterns for the selected project areas are formulated as shown in Figure III-5 and the proposed cropping patterns are as given in Table III-16 and summarized as follow:

Crops	(Unit : ha)						
	Present		With Project		Increment		Total
	Wet season	Dry season	Wet season	Dry season	Wet season	Dry season	
Coffee	2,980	2,980	3,730	3,730	750	750	750
Tea	90	90	90	90	0	0	0
Field crops	240	0	220	4,470	-20	4,470	4,450
Upland rice	1,380	0	0	0	-1,380	0	-1,380
Cardamom	290	290	10	10	-280	-280	-280
Lowland rice	1,730	0	17,070	5,560	15,340	5,560	20,900
Vegetables	0	0	290	850	290	850	1,140
<b>Total</b>	<b>6,710</b>	<b>3,360</b>	<b>21,410</b>	<b>14,710</b>	<b>14,700</b>	<b>11,350</b>	<b>25,590</b>

Note: These figures are of rounded off.

Planted area of coffee is increased by 760 ha, about 25 % of the present area while the area of tea remains as it is. Field crops such as groundnut, soybeans etc. are increased by about 4,500 ha for dry season in the lower altitude area. Most of Cardamom area combined with upland rice is decreased, but Cardamom cultivated in the elevated area as upland crop would remain as it is. Lowland rice is increased especially in the lower area. Vegetables is increased in the elevated land. The increment of the lowland rice cropping area is about 20,900 ha, that of vegetables is about 1,100 ha.

### 3.2.4 Proposed Farming Practices

Proper farming practices are essential for realizing the full exploitation of agricultural potential in the project area. It is necessary to introduce new high-yielding and high quality varieties of crops with appropriate techniques of fertilizers and agro-chemicals usage along with the supply of irrigation water and institutional support services. The present small holding farming practices prevailing in the project area are applied basically, such as animal power for land preparation and transportation, manual operation for transplanting and harvesting, etc. Although farm mechanization is now gradually introduced in the area, but the rapid farm mechanization is not recommended in the proposed farming practices in due consideration of the large amount of investment needed at once for the individual small holding farmers.

Regarding plant protection, proper application of chemicals will become necessary for safe and effective control of insects and diseases taking into account the selection of attractive and non-harmful agro-chemicals. The minimum use of pesticides is recommended to avoid disastrous damages by pests if necessary with introduction of the environmentally sound practices by using selected chemicals and under a proper guidance of the agricultural services. The inputs and labor requirement for the proposed farming practices for each crop are summarized in Table III-17.

The farming practices to be paid attention are management and improving of soil fertility in the area. Mulching practices with leguminous crops or cut and dried grass has been proved over many years to be beneficial for the purpose of protecting the soil and increasing crop yield in many countries.

Proper management of livestock is essential to promote livestock production as well as keep clean living environment in the study area. The most of farmers are feeding animal with residues and byproducts of crops, and the animals are mostly freely roaming in and around the living areas and cattle and buffalo are pasturing even in the forest area. It is recommended to produce managed grazing lands by improving fodder instead of depending

only on the natural grasses which could be done with minor modification of the traditional grazing management. Beside grazing improvement, it is also essential to promote disease control by extension of veterinary services.

### 3.2.5 Anticipated Crop Yield and Production

The present yield of crops in the project area is rather low level mainly due to lack of irrigation water, shortage of farm inputs, and low level of supporting services to provide farming techniques and materials. After implementation of the project, the yield of crops would be substantially increased and stabilized through getting accustomed to irrigation farming practices accompanied with agricultural support services. The increase of yield without the project is considered to be insignificant. There are little research or actual results regarding the ultimate crop yield in the study area. The anticipated crop yield is assumed based on the information for crop yield generally achieved in the tropics. The proposed target yield is as shown below:

Crops	Present (ton/ha)	With project (ton/ha)
Coffee	0.3	1.5
Tea	0.26	1
Upland rice	1.5	3
Lowland rice		
Local variety	2.6	3
Improved variety		4
Vegetables:		
Cabbage	8	20
Chinese cabbage	6	20
Potato	10	20

The target yield of each crop is assumed at the average production conditions, under irrigation for the tropics, since there is no reliable data on the ultimate crop yield in and around the study area.

Most of farmers in the study area are not familiar yet with new varieties of crops and farming practices to be introduced such as proper fertilization, plant protection, and water management. In order to attain the projected target yield as earlier stage as possible by applying the proposed farming practices, it is essential to improve and strengthen the present agricultural supporting services in keeping pace with the implementation of the infrastructure development. It would take rather long time to enable the farmers to sufficiently manage the operation of the irrigation facilities and to attain the projected target yield in success, because the supporting systems and research institute are still not well organized and the qualified manpower is in short. It will take some long time to train the extension officers possible to work effectively. It is necessary to start research and training work prior to the start of the construction works. The build-up period is assumed at five years after completion of the project works and starting the proper support services.

The anticipated crop production by the project at full target stage is given in Table III-18 and summarized as follows:

Crops	(Unit : ton)		
	Without Project	With Project	Increment
Coffee*	890	5,600	4,710
Tea	23	90	67
Field crops**	240	9,400	9,160
Upland rice	2,070	0	-2,070
Cardamom	87	3	-84
Lowland rice	4500	90,500	86,000
Vegetables***	0	22,800	22,800

\* Production is in hulled dried beans.

\*\* Counted as groundnut.

\*\*\* Counted as cabbage or potato.

The anticipated production of coffee, tea, field crops is about 5,600, 90, 9,400 ton per annum respectively. Lowland rice and vegetables will achieve more than 90,000 and 22,000 ton of production respectively. The expected increment of production of coffee is about 4,700 ton (hulled dried beans), about 70 ton of tea, about 9,000 ton of field crops such as groundnut and maize. The remarkable one is 86,000 ton of lowland rice which count nearly one fourth of total rice production in 1994 in the concerned three provinces. Vegetables, the expected increment is about 22,800 ton which will become valuable crops for both of domestic and foreign markets.

### 3.2.6 Livestock and Fisheries

There are about 9,100 head of cattle and 3,800 head of buffalo in the project area. The anticipated production of livestock is assumed based on the number of livestock in the project area which is mostly grazed on the natural lands with livestock unit of about one head/ha at present. By improving the grazing lands with introduction of forage and caring with veterinary services, the livestock unit would be increased to double of the present level. Also by increasing lowland rice cultivation, it will become necessary to increase buffalo for soil preparation with forage and by products of rice.

There is about 40 ha of fish ponds in the project area and the expected fish production will be increased to about 40 ton per year. Beside the existing pond, about 500 ha of regulation pond for irrigation will be constructed in the Lower Xeset project area, which may have potential to produce 500 ton of fish in a year. It is necessary to conduct long term research and experiences to establish technologies package for effective extension of fish culture.

### 3.3 Expected Agricultural Impact

The major direct agricultural impacts expected to be brought at the full target stage of the model area development project are summarized as follows:

- Self Sufficiency in Food (rice) will be much improved through substantial increase of lowland rice which account about 86,000 ton per year,
- Reduction of slash-and-burn cultivation and promotion of crop diversification will be achieved through introduction of stabilized sustainable cropping system under irrigation by increasing coffee plantation, field crops and vegetables, as well as increasing lowland rice field,
- Live stock raising activities will be improved and promoted through grazing land improvement and semi-intensive raising method together with appropriate veterinary services,
- Inland fish culture will be promoted by improving culture method through effective extension work based on the researched technologies.

## IV AGRICULTURAL CONDITION IN AND AROUND SCHEME AREAS

To grasp the agricultural conditions in the priority scheme areas, the basic data and information on the major agricultural activities and the main kind of crops, production and cultivated area as well as number of livestock and area of fish pond in and around the scheme areas were collected through field reconnaissance, interview to farmers and village offices concerned and summarized as shown in Tables III-19 and 20.

### 4.1 Major Crops in and around the Scheme Areas

The main kind of crops cultivated vary by scheme areas as summarized below.

Main crops	(Unit : area in ha, production in ton)									
	Upper Champi		Upper Tapoung		Upper Kapheu		Lower Xe Set		Upper Tay-Un	
	Area	Prod	Area	Prod	Area	Prod	Area	Prod	Area	Prod
Coffee	1,630	410	430	170	450	140	-	-	100	23
Tea	250	82	-	-	-	-	-	-	-	-
Upland rice	10	5	20	13	260	390	120	250	50	70
Lowland rice	-	-	-	-	2	6	90	230	70	120
Cabbage	-	-	130	1,400	-	-	-	-	-	-
Groundnut	-	-	-	-	-	-	150	230	-	-
Chilly	-	-	-	-	-	-	70	6	-	-
Cotton	-	-	-	-	-	-	30	15	-	-
Cardamom	8	0.1	-	-	-	-	-	-	5	0.2

#### (1) Upper Champi Area

The main agricultural activities in this area are based on cultivation of coffee and tea. About 96 % of farmers have 1,630 ha of coffee farms, and about a half of them holds 250 ha of tea farm also. Average holding size of coffee and tea farms in the concerned 8 villages is 2.4 and 0.4 ha respectively. Upland rice cultivated under slash-and-burn system is about 20 ha (upland rice and cardamom areas). Annual production of coffee, tea and rice is about 490 (green bean), 80 (processed) and 5 (in paddy) tons respectively. Tea cultivation in the Boloven Plateau is mostly concentrated to this area. Durian is planted in villages of KM 33 to KM 35 along Road No. 23.

#### (2) Upper Tapoung Area

About 430 ha of coffee is the main crop of three villages in and around this area followed by about 130 ha of vegetables such as cabbage, Chinese cabbage under slash-and-burn cultivation system. About 96 % of farmers cultivate coffee, and more than 60 % of farmers grow cabbages in addition to coffee. About 20 ha of upland rice under slash-and-burn cultivation system mostly are continued by farmers in Phoulangeo village, on the other hand cultivation of cabbage is mostly carried out by farmers in Houaisan and Xetapoung villages. The farmers hold coffee, cabbage and upland rice field of 1.8, 0.9 and 0.7 ha respectively on average. The annual production of coffee, cabbage and upland rice is estimated at about 170, 1,400 and 13 tons, respectively.

#### (3) Upper Kapheu Area

About 95 % of farmers cultivate 260 ha of upland rice and more than 90 % of farmers grow 480 ha of coffee. The average holding size of upland rice and coffee is 0.6 and 1.2 ha, and annual production is estimated at about 390 and 140 ton, respectively. Lowland rice area is limited only to 2 ha and 6 tons of production by three farmers, the most of farmers still depend on upland rice cultivation under slash-and-burn system.

(4) Lower Xe Set Area

Main crops in this area are upland crops such as 140 ha of groundnut, 60 ha of chilly, 30 ha of cotton and 110 ha of upland rice under slash-and-burn system. Total lowland rice area is only 80 ha and concentrated on only 30 % of farmers in the area and at 4 villages out of 6 in the area, say Natteu, Sengvang-gnai, Sengvang-noi and Natou. More than 80 % of farmers cultivate groundnut in addition to lowland rice or upland rice, and 60 % are based on upland rice plus other upland crops. Annual production of crops is estimated at 210 ton of groundnut(in shell), about 5 ton of chilly(dried), 230 ton of upland rice, 210 ton of lowland rice and about 15 ton of cotton(seed cotton). The average holding size of crop field is 0.5 ha of groundnut, 0.3 ha of chilly, 0.5 ha of upland rice, 0.7 ha of lowland rice and 0.3 ha of cotton.

(5) Upper Tay-Un Area

Main crops in and around the area are 100 ha of coffee, 70 ha of lowland rice and 50 ha of upland rice. Their typical farming type is lowland rice with coffee, or upland rice with coffee. About 55 % of farmers have lowland rice field, and about 47 % of farmers cultivate upland rice under slash-and-burn system. More than 80 % of farmers grow coffee in addition to rice cultivation. Average holding size of coffee, lowland and upland rice field is 1.0, 1.2 and 0.9 ha per farmer. Annual total production of each crop is estimated at about 23, 120 and 70 ton respectively.

#### 4.2 Cropping Pattern and Farming Practices

Cropping pattern in and around the areas is characterized by kind of crops cultivated, and there is no clear difference in cropping season through the areas as shown in Figure III-6. The farming practices prevailing in the areas are almost in the same level of techniques.

(1) Coffee

Main coffee flowering season is end of February to March and harvested mainly in January to March in Upper Champi and Upper Tapoung areas, December to February in Upper Kapheu and Upper Tay-Un areas. Usually no chemical fertilizers are applied, pruning is not appropriately done. Coffee tree management techniques as well as harvesting and post-harvesting techniques is at present expanding under the guidance of LUADP covering whole Boloven coffee area. According to information from the farmers in Upper Kapheu area, the yield of coffee in 1995/96 resulted in as low as about 1/3 of the former year mainly due to water deficit during flowering to swelling season of fruit.

(2) Cabbage

Cabbage is the main vegetable produced in Upper Tapoung area, any other priority scheme area grows vegetables for market. The main season is started as seeding in December to January and harvested in May to June. They also grow during the rainy season, harvesting in September to October. Usually they use seed from abroad, use chemical fertilizers such as compound(16-20-0), and applying insecticides to control insects. Main insect is Diamondback moth(*Plutella xylostella*) of which larvae damage on leaf. Seedling of cabbage is prepared in a nursery located along streams with watering by can or small pump. Transplanting to the main field is done waiting rainfall, but at present some farmers have small irrigation pumps to uplift water from the streams. Most of cabbage production is done under slash-and-burn system and some of the field are planted with coffee trees after cabbage.

(3) Rice

The upland rice is grown under slash-and-burn system in some scheme areas,

especially in Upper Kapheu, Lower Xe Set and Upper Tay-Un areas. The rice is sown directly to the field at the onset of the wet season using usually local varieties of around 6 to 7 month of growth duration, and harvested in November to December in Upper Tay-Un and Upper Kapheu areas, and October to November in other areas. Most of lowland rice cultivation is found in Lower Xe Set and Upper Tay-Un areas with irrigation water diverted from rivers near the field. Ordinary transplanting method is applied using nursery. Seeding time is around May to June and transplanted 1 month after seeding, and harvested in November to December in Lower Xe Set area, and December to January in Upper Tay-Un area. Most of rice is glutinous varieties. Harvesting is done threshing on panicles standing in the field for some varieties of high shattering characteristics. Other varieties are harvested cutting on the middle part of stem using sickle. Threshing is done usually by manual in the field and carried by cart to granary in the village. Neither chemical fertilizers nor pesticides are applied for rice cultivation in the scheme areas. Considerable damages on rice are caused by wild bore, rodents and crabs according to information from the farmers.

#### (4) Upland Crops

Other upland crops such as groundnut, chilly and cotton are cultivated in Lower Xe Set area in addition to rice cultivation. Cotton and chilly is sometimes grown in mix each other. Chilly is transplanted at the beginning of the rainy season and harvested in September to October. Cotton is seeded in June and harvested in November to December. Groundnut is seeded in May to June and harvested in August to September. Variety of groundnut grown in the area is mostly local bunch type. Usually no chemical fertilizers and pesticides are applied.

#### (5) Tea

Tea is found only in Upper Champi area. Harvesting of tea is done twice a month during wet season and once a month in the dry season. The processing method of tea is roasting on the wide iron pan using fire. The tea is sold in the domestic market, but some tea farms are out of production due to low market price.

### 4.3 Yield of Crops

The average yield of crops are generally in low level in all scheme areas. The average yield of the main crops in each area is as shown below:

Crops	(Unit : yield in ton/ha)				
	Upper Champi	Upper Tapoung	Upper Kapheu	Lower Xe Set	Upper Tay-Un
Coffee	0.3	0.4	0.3	-	0.23
Tea	0.34	-	-	-	-
Upland rice	0.5	0.6	1.5	2.1	1.4
Lowland rice	-	-	3.0	2.6	1.7
Cabbage	-	10	-	-	-
Groundnut	-	-	-	1.5	-
Chilly	-	-	-	0.08	-
Cotton	-	-	-	0.5	-
Cardamom	0.04	-	-	-	0.04

(Coffee in green beans, rice in paddy, groundnut in shell and chilly in dried conditions)

The average unit yield of coffee is still very low, around 0.2 to 0.4 ton/ha and no distinct differences are found among the areas. According to information obtained from farmers in the Upper Kapheu area, most of coffee farms were affected by water deficit in 1995/96 and the yield was decreased to about 1/3 of the former year. In Upper Tapoung area, some coffee farms could produce no production in the last year due to unidentified reasons. It may be due to die-back from overbearing in the former year and poor soil management.



Lowland rice cultivation is done with very less care management, no weeding, no fencing, etc. All farmers use local varieties and generally apply neither chemical fertilizers nor organic manure. The average yield of lowland rice ranges from 1.7 ton/ha in Upper Tay-Un area to 3 ton/ha in Upper Kapheu area.

Main vegetable around Upper Tapoung area is cabbage, and the unit yield is estimated at about 10 ton/ha on average. The present low yield is due mainly to lack of proper cultivation techniques of farmers such as application method of fertilizers and effective control of insects, and some are due to shortage of irrigation water in the dry season.

#### 4.4 Livestock and Fish Culture

##### (1) Livestock

Main livestock in and around each scheme area is shown in the table below:

Main crops	(Unit : head)									
	Upper Champi		Upper Tapoung		Upper Kapheu		Lower Xe Set		Upper Tay-Un	
	Total	/Farmer	Total	/Farmer	Total	/Farmer	Total	/Farmer	Total	/Farmer
Buffalo	2	-	-	-	-	-	260	0.7	380	3.6
Cattle	1,700	2.5	690	2.9	430	1.0	530	1.5	100	0.9
Horse	80	0.1	170	0.7	-	-	-	-	-	-
Pig	840	1.2	150	0.6	860	1.9	590	1.7	140	1.3
Poultry	4,670	6.8	1,550	6.5	4,420	10.0	2,770	7.8	710	6.7

##### (a) Upper Champi Area

Cattle and pig is the main livestock in the area. Cattle raising is mostly carried out in the elevated part of the area by less than 30 % of farmers in the area. About 35 % of farmers hold pig.

##### (b) Upper Tapoung Area

The main livestock in this area is cattle, horse and pig. Horse is mainly kept for transportation of farm inputs and outputs where cart is not accessible.

##### (c) Upper Kapheu Area

Cattle, pig and poultry is the main livestock in the area. Less than 20 % of farmers keep cattle, and the holding number of cattle is relatively lower among the development project areas.

##### (d) Lower Xe Set Area

Buffalo, cattle, pig and poultry is the main livestock in the area. But the holding number of buffalo per farmer is less than 1 head while that of cattle is about 1.5.

##### (e) Upper Tay-Un Area

More than 40 % of farmers have buffalo, and it is used for farm power say plowing, harrowing and transportation. Holding number of cattle is relatively lower among the development areas.

##### (2) Fish Culture

The number of farmers holding fish pond and the total area of the pond in and around each scheme area is as shown in table below. Fish culture using pond is not the main agricultural activities in the project areas, and the number of fish pond is very limited in the

areas. Exceptionally in Chakamlit village of Upper Tay-Un area where more than 40 % of farmers have pond, but the area is as small as less than 0.0 1 ha each.

Upper Champi		Upper Tapoung		Upper Kapheu		Lower Xe Set		Upper Tay-Un	
Total (ha)	Farmer (no.)	Total (ha)	Farmer (no.)	Total (ha)	Farmer (no.)	Total (ha)	Farmer (no.)	Total (ha)	Farmer (no.)
4.2	27	6	14	0.4	2	2	6	0.9	16

The kind of fish raised in the pond is mostly Tilapia and common carp propagated at Fishery Research and Extension Station of Champasak Province located at KM 8.

#### 4.5 Processing of Product

Most important agro-processing activity in and around each scheme area is rice milling and coffee husking. Most of villages have privately owned rice/coffee mills in their villages. The number of rice/coffee mills in each area is obtained from each village office concerned as follows:

Machine	(Capacity : ton/day in output)									
	Upper Champi		Upper Tapoung		Upper Kapheu		Lower Xe Set		Upper Tay-Un	
	No.	Capa.	No.	Capa.	No.	Capa.	No.	Capa.	No.	Capa.
Rice mill	-	-	-	-	9	26	7	4.2	-	-
Coffee mill	27	58	2	5	36	50	4	6	6	5
Total	27	-	2	-	45	-	11	-	6	-

There is no complains by farmers about milling quality, capacity and recovery rate, etc., but it was observed that the steel huller type mill is used for milling of rice and coffee, and the recovery rate is about 60-62 % for rice, 50 to 60 % for coffee on average according to millers. Some of villagers mill rice for daily meal by using pounding method.

#### 4.6 Agricultural Machinery

Number of agricultural machinery and equipment in and around each project area were obtained through village offices concerned and shown in table below:

Equipment	Upper Champi	Upper Tapoung	Upper Kapheu	Lower Xe Set	Upper Tay-Un
2Wheel tractor*	14	2	54	1	0
2Wheel tractor	5	1	49	1	1
Tractor	1	1	0	0	0
Oxcart	57	156	82	37	32
Handcart	73	8	67	99	8
Water pump	1	NA	0	0	0
Truck	17	6	2	0	0
Pickup	20	0	0	0	0

\* with a wheel handle only for purpose of transportation.

Soil preparation of lowland rice field such as plowing and harrowing is mostly done by oxen or buffalo. Some cabbage farmers employ tractor for first plowing of the newly opened field. Two-wheel tractors(2WT) have been introduced especially for the purpose of transportation, it is taking place of oxcart especially in Upper Kapheu area where one set of 2WT per 4.3 farm household on average.

## V AGRICULTURAL CONDITION IN PRIORITY SCHEME AREAS

The present cropping patterns in each priority area estimated based on the field survey and the results of land use study are as illustrated in Figure III-6. The main crops, production and number of livestock in each area are described as follows.

### 5.1 Upper Champi Area

#### (1) Crops and Cropping Pattern

The main crops in the Upper Champi scheme area is coffee and tea. The present cropping pattern is estimated based on the results of present land use study as follow:

Crops	(Unit: ha)	
	Wet season	Dry season
Coffee	460	460
Tea	130	130
Total	590	590

The area of coffee is estimated at 460 ha and that of tea is 130 ha, respectively.

#### (2) Crop Yield and Production

The average yield of coffee and tea is estimated at 0.3 and 0.3 ton/ha, respectively, and the annual production of coffee and tea is estimated at about 140 ton and 40 ton, respectively.

#### (3) Number of Farmers

The number of farmers concerned to the area is estimated based on the average holding size of coffee and tea farms as follow:

Farm type	Number of farm household
Coffee and tea	186
Coffee only	12
Total	198

Most of farmers(94%) in the area cultivate coffee and tea, and the rest grow coffee only. The total number of farm household concerned to the area is estimated at 198.

#### (4) Livestock and Fish Culture

The number of livestock in the area is estimated based on the number of farmer concerned to the area and the average holding number as follow:

Livestock	(Unit: head)	
	Average/farmer	Total number
Cattle	2.5	490
Horse	0.1	20
Pig	1.2	240
Poultry	6.8	1350

Most of farmers in the area hold cattle, pig and poultry, and the number of these animal is estimated at 490, 240 and 1350, respectively.

No fish pond is found in the area according to the result of land use study.

## 5.2 Upper Tapoung Area

Most of the area is covered with elephant grass, and in some area is under bush and secondary forest. Actually the area is not utilized for agricultural purpose at present except grazing of cattle some times. The farmers in the concerned 3 villages cultivate coffee, vegetables and upland crops outside the area.

## 5.3 Upper Kapheu Area

### (1) Crops and Cropping Pattern

The main crops in the Upper Kapheu priority area is coffee and upland rice. The present cropping pattern is estimated based on the results of present land use study as follow:

Crops	(Unit: ha)	
	Wet season	Dry season
Coffee	540	540
Upland rice	180	0
Total	720	540

The area of coffee is estimated at 540 ha and that of upland rice is 180 ha, respectively.

### (2) Crop Yield and Production

The average yield of coffee and upland rice in the area is estimated at 0.3 and 1.5 ton/ha, respectively, and the annual production of coffee and paddy is estimated at about 160 ton and 270 ton, respectively.

### (3) Number of Farmers

The number of farmers concerned to the area is estimated based on the average holding size of coffee and upland rice farms as follow:

Farm type	Number of farm household
Coffee and upland rice	300
Coffee only	131
Total	431

Most of farmers(around 70%) in the area cultivate coffee plus upland rice, and the rest grow coffee only. The total number of farm household concerned to the area is estimated at 431.

### (4) Livestock and Fish Culture

The number of livestock in the area is estimated based on the number of farmer concerned to the area and average holding number as follow:

Livestock	(Unit : head)	
	Average/farmer	Total number
Cattle	1.0	430
Pig	1.9	820
Poultry	10.0	4300

Most of farmers in the area raise cattle, pig and poultry, and the number of these animals is estimated at 430, 820 and 4300, respectively.

No fish pond is found in the area according to the result of land use study.

## 5.4 Lower Xe Set Area

### (1) Crops and Cropping Pattern

The main crops in the Lower Xe Set scheme area are lowland rice and upland rice. The present cropping pattern is estimated based on the results of present land use study as follow:

Crops	(Unit : ha)	
	Wet season	Dry season
Lowland rice	100	0
Upland rice	130	0
Upland crops	90	0
Fruits	20	20
Total	340	540

The area of lowland rice, upland rice, upland crops such as groundnut, chilly and cotton, fruits such as banana is estimated at 100, 130, 90, and 20 ha, respectively. These crops are cultivated only in the wet season and no crops in the dry season except banana which is found in the small extent of area.

### (2) Crop Yield and Production

The average yield of lowland rice, upland rice, upland crops(groundnut) is estimated at 2.6, 2.1, and 1.5 ton/ha, respectively, and the annual production of these crops is estimated at about 270, 260, 140 ton, respectively. The annual production of banana is estimated at about 240 tons.

### (3) Number of Farmers

The number of farmers concerned to the area is estimated based on the average holding size of coffee and upland rice farms as follow:

Farm type	Number of farm household
Lowland rice and upland crops	129
Upland rice and upland crops	156
Total	285

Most of farmers in the area cultivate upland crops, plus upland rice or lowland rice. The total number of farm household concerned to the area is estimated at 285 at present.

### (4) Livestock and Fish Culture

The number of livestock in the area is estimated based on the number of farmer concerned to the area and the average holding number of livestock as follow:

Livestock	(Unit : head)	
	Average/farmer	Total number
Buffalo	0.7	200
Cattle	1.5	430
Pig	1.7	490
Poultry	7.8	2200

Most of farmers in the area raise cattle, pig and poultry, and buffalo is raised by the most of lowland rice farmers. The total number of these animals is estimated at 430, 490, 2200 and 200, respectively.

About 5 ha of fish pond is found in the area according to the result of land use study, but the yield of fish is quite low mostly due to lack of raising techniques and shortage of water especially during the dry season.

## 5.5 Upper Tay-Un Area

### (1) Crops and Cropping Pattern

The main crops in the Upper Tay-Un priority area is lowland rice and upland rice. Beside these crops the farmers grow coffee outside the area. The present cropping pattern is estimated based on the results of present land use study as follow:

Crops	(Unit : ha)	
	Wet season	Dry season
Lowland rice	20	0
Upland rice	20	0
Total	40	0

The area of lowland rice, upland rice is estimated at 20, and 20 ha, respectively. These crops are cultivated only in the wet season and no crops in the dry season.

### (2) Crop Yield and Production

The average yield of lowland rice, upland rice is estimated at 1.7, 1.4 ton/ha, respectively, and the annual production of paddy in the area is estimated at about 30, 40 ton, respectively.

### (3) Number of Farmers

The number of farmers concerned to the area is estimated based on the average holding size of coffee and upland rice farms as follow:

Farm type	Number of farm household
Lowland rice and coffee	17
Upland rice and coffee	33
Total	50

Most of farmers in the area cultivate coffee, plus upland rice or lowland rice. The total number of farm household concerned to the area is estimated at 50 at present.

### (4) Livestock and Fish Culture

The number of livestock raised by the farmers in the area is estimated based on the number of farmer concerned to the area and average holding number as follow:

Livestock	(Unit : head)	
	Average/farmer	Total number
Buffalo	3.6	180
Cattle	0.9	50
Pig	1.3	70
Poultry	6.7	340

Most of farmers in the area raise buffalo, cattle, pig and poultry. The total number of these animals is estimated at 180, 50, 70 and 340, respectively.

About 6 ha of fish pond including natural swamp is found in the area according to the result of land use study, these pond was made recently and the yield of fish is quite low mostly due to lack of techniques and shortage of water especially during the dry season.

## 5.6 Agricultural Development Constraints

Most of the constraints crucial to profitable and sustainable agricultural development

in the scheme areas, are due to insufficient agricultural services and infrastructure. Major constraints to further development of agriculture in each area are summarized as follows:

(1) Upper Champi Area

- Water deficit for coffee some times especially for season of flowering to swelling of fruits,
- Quality of tea processed at present is not highly acceptable for domestic and international markets,
- Some elevated part of the area is not suitable to grow coffee due to frost, and
- Management of trees and soil fertility, harvesting and post-harvest practices for coffee and tea are not properly operated, and cause low yield and low quality of product.

(2) Upper Tapoung Area

- Management of trees and soil fertility, harvesting and post-harvest practices for coffee are not properly operated, and cause low yield and low quality of product,
- Water deficit especially for vegetables during the dry season, and
- Inappropriate cultivation techniques such as pests control, raising of seedlings, etc. cause low yield and much loss of seed, and so on.

(3) Upper Kapheu Area

- Unstable rainfall causes water deficit for coffee especially for season of flowering to swelling of fruits, once every 3 to 4 years, and
- Management of trees and soil fertility, harvesting and post-harvest practices for coffee are not properly operated, and cause low yield and low quality of product.

(4) Lower Xe Set Area

- Unstable rainfall especially beginning of the wet season causes water deficit for upland crops such as groundnut and chilly, etc.,
- Primitive cultivation techniques and unimproved varieties, poor soil fertility management, primitive harvesting and post-harvest practices cause low yield and low quality of product of lowland rice as well as upland crops,
- Unstable river flow after construction of Xe Set Hydropower Station causes difficulty for intake of irrigation water for rice field, and
- Crabs and wild pig, rodents cause considerable loss of rice.

(5) Upper Tay-Un Area

- Unstable rainfall especially beginning of the wet season causes water deficit for upland crops as well as lowland rice,
- Crabs, wild pig and rodents cause considerable loss of rice, and
- Management of trees and soil fertility, harvesting and post-harvest practices of coffee are not properly operated, and cause low yield and low quality of product.

## **VI AGRICULTURAL DEVELOPMENT PLAN**

### **6.1 Basic Agricultural Development Concept**

The ultimate objectives of the agricultural development in the Boloven Plateau defined in the Master Plan is to achieve a substantial and sustainable life improvement of the people in the area by increasing agricultural output to contribute raising the family income. The proposed agricultural development in the Boloven Plateau would be achieved through at first intensification of the existing diversified agriculture by improving husbandry technology and development of infrastructure, and secondly the expansion of agricultural area with establishment of sustainable farming systems together with developing lowland rice field changing from the slash-and-burn cultivation where applicable.

### **6.2 Development Concept for the Priority Schemes**

The proposed agricultural development concept for each priority development scheme area is formulated along with the above principle concept, by assessing the development potential of agriculture as well as taking into account the existing agricultural conditions in the specific area. The basic development concepts for each area are as follows:

#### **(1) Upper Champi Scheme**

- Improvement of existing coffee and tea farming by development of irrigation infrastructure,
- Conversion of 240 ha of slash-and-burn area into the permanent cropping field by 80 ha for coffee, and by introducing about 110 ha of vegetables and upland crops, where is above around 1,200 m and coffee is not suitable due to frost.
- Establishment of fish culture using a water reservoir which will be constructed for irrigation and be managed by the water users' organization.

#### **(2) Upper Tapoung Scheme**

- The existing vegetable cultivation techniques mostly done under slash-and-burn system at present will be improved by opening 80 ha of new field. The vegetables will be grown under the permanent farming system by introducing advanced vegetable cultivation techniques such as management and improvement of soil fertility, and with irrigation development.
- The anticipated beneficiary farmers will be about the whole 270 households(year 2000) increased from the existing 240 households in the 3 villages, with 0.3 ha of the new vegetable farm.
- Establishment of fish culture using a water reservoir which will be constructed for irrigation and be managed by the water users' organization.

#### **(3) Upper Kapheu Scheme**

- Improvement of coffee plantation with irrigation development,
- Conversion of slash-and-burn system into 420 ha of coffee expansion, and establishment of permanent cropping system with rotation of lowland rice and upland crops(100 ha).
- The beneficiary farmer will be whole of villagers, about 550 household(year 2000) increased from the present 440 household with increasing rate of 3.6 % per annum. The farmland for each household, 1.6 ha of coffee and 0.2 ha of lowland rice field.
- Establishment of fish culture using a water reservoir which will be constructed for irrigation and be managed by the water users' organization.



(4) Lower Xe Set Scheme

- Improvement and development of lowland rice field by introducing double cropping of paddy(200 ha) with appropriate irrigation system development,
- Conversion of slash-and-burn system and establishment of lowland rice and upland crop cultivation(800 ha) under the permanent cropping system with appropriate irrigation system development.
- About 400 households of the whole villagers in the concerned 6 villages will be beneficiary farmers in year 2000 with 2.7 % increase rate per annum from the present 360 households, and 2.5 ha of lowland rice field per household.
- Establishment of a model post-harvest facility for rice, including drying, storing and milling equipment. Drying yard, paddy and rice storage, milling machine, etc. will be implemented. This facility will belong to the village "rice bank" and be operated and managed by the villagers concerned.

(5) Upper Tay-Un Scheme

- Improvement and development of lowland rice production by introducing double cropping of rice(70 ha) with appropriate irrigation system development,
- Total area of lowland rice field will be 330 ha including the existing(20 ha) and the converted from slash-and-burn system into the permanent cropping system with rotation of lowland rice and upland crops(310 ha) by appropriate irrigation system development.
- Number of beneficial farmers cultivating inside the scheme area at present is estimated at 50 household. Farmers having no lowland rice field in the concerned 3 villages are 15 households. For increased number in the villages are 10 households, and it will be able to offer 227 ha to immigrant households from out side the villages, as seen below.

Items	Present condition		With project condition	
	No of household	Area (ha)	No of household	Lowland rice area (ha)
Rice field in area	17	20	17	20
Upland rice field in area	33	30	33	40
Farmers having no lowland rice field *	15	0	15	18
Future increase **			10	25
To be offered to immigrants ***			90	227
Total	55	50	165	330

\* These farmers are within the concerned 3 villages.

\*\* According to population increase by year 2000(2.7%/annum).

\*\*\* 2.5 ha/household who will have only the rice field but any other agricultural land.

- Establishment of fish culture using a pond which will be constructed as a water reservoir for irrigation, and managed by the water users' organization.
- Establishment of a model post-harvest facility for rice, including drying, storing and milling equipment. Drying yard, paddy and rice storage, milling machine, etc. will be implemented. This facility will belong to the village "rice bank" and be operated and managed by the villages concerned.

### 6.3 Proposed Cropping Pattern

The proposed cropping patterns for the project areas were formulated taking into account the present condition of agricultural land use, and the basic consideration on the crop suitability such as by altitude and the familiarity to the farmers, and present agro/socio-economic conditions, availability of irrigation water as well as expected future development in and around the areas which are in line with the above development concept. The crops

selected and cropping pattern formulated for the each area are as follows. The proposed cropping pattern is illustrated in Figure III-7.

(1) Upper Champi Scheme(920~1,220m)

(a) Selection of crops

Coffee	500 ha	Existing area, plus some expansion of Arabica varieties is expected.
Tea	120 ha	Existing area.
Vegetables, upland crops	110 ha	Highland vegetables (cabbage, peas, strawberry, asparagus, etc.) and some upland crops(maize, sweet corn, soybeans, potato, etc.)

(b) Cropping pattern

The proposed cropping pattern is summarized as follow:

Crops	(Unit : ha)	
	Wet season	Dry season
Coffee	500	500
Tea	120	120
Upland crops	110	0
Vegetables	0	110
Total	730	730

Upland crops and vegetables are proposed to be grown in rotation to maintain soil fertility, to prevent soil born disease and pests.

(2) Upper Tapoung Scheme(1,200~1,220m)

(a) Selection of crops

Vegetables, upland crops	80 ha	Highland vegetables (cabbage, potato, carrot, cauliflower, etc.) and some upland crops(maize, sweet corn, soybeans, etc.)
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(b) Cropping pattern

The proposed cropping pattern is summarized as follow:

Crops	(Unit : ha)	
	Wet season	Dry season
Upland crops	40	40
Vegetables	40	40
Total	80	80

Upland crops and vegetables are proposed to be grown in rotation to improve soil fertility, to prevent soil born disease and pests, etc.

(3) Upper Kaphou Scheme(570~790m)

(a) Selection of crops

Coffee	900 ha	About a half is the existing area, and the rest half area is expected for expansion of Arabica varieties.
Lowland rice	100 ha	Lowland rice of 135 days of growth duration

Upland crops                      100 ha                      in the wet season,  
 Upland crops (maize, groundnut, soybeans,  
 etc.).

(b) Cropping pattern

The proposed cropping pattern is summarized as follow:

Crops	(Unit : ha)	
	Wet season	Dry season
Coffee	900	900
Lowland rice	100	0
Upland crops	0	100
Total	1000	1000

The upland crops are grown in the dry season after lowland rice in the wet season.

(4) Lower Xe Set Scheme (300~400m)

(a) Selection of crops

Lowland rice                      1,000 ha                      Lowland rice (150 days in wet season, 135  
 days in dry season),  
 Upland crops                      800 ha                      Upland crops (groundnut, chilly, cotton,  
 maize, soybeans, etc.) Some cool dry  
 season vegetables (cabbage, peas, etc.), and  
 water melon etc. as hot dry season crops.

(b) Cropping pattern

The proposed cropping pattern is summarized as follow:

Crops	(Unit : ha)	
	Wet season	Dry season
Lowland rice	200	200
Lowland rice	800	0
Upland crops	0	800
Total	1000	1000

Lowland rice is grown in the wet season in 1,000 ha, while it is limited to 200 ha in the dry season due to shortage of irrigation water. Upland crops is grown in the rest of 800 ha in the dry season under irrigated condition.

(5) Upper Tay-Un Scheme (500~600m):

(a) Selection of crops

Lowland rice                      330 ha                      Lowland rice (135 days in wet season, 120  
 days in dry season),  
 Upland crops                      80 ha                      Upland crops (maize, soybeans, groundnut,  
 etc.), cool season vegetables (cabbage, peas,  
 sweet corn), etc.

Crops	(Unit : ha)	
	Wet season	Dry season
Lowland rice	70	70
Lowland rice	80	0
Lowland rice	180	0
Upland crops	0	80
Total	330	150

Lowland rice is grown in 330 ha in the wet season, and 70 ha in the dry season. Upland crops is grown in 80 ha under irrigated condition, and the rest of 180 ha is fallow without crops in the dry season.

#### 6.4 Proposed Farming Practices

As mentioned in the Master Plan, no precise data was available which describes on the research results of the farming practices of crops and animal husbandry in the areas. The farming practices proposed for the priority scheme areas are formulated mostly based on the general experiences in the tropics and the results of the investigation through the present field study. It is strongly recommended to carry out a variety of on-farm trial and research to establish appropriate farming practices, to verify the possibility of agricultural development and to promote agricultural production in the areas.

The farmers have much experiences with cabbages, Chinese cabbages, etc. but only a little reliable experiences with new kinds of highland vegetables. And the farmers are very familiar with growing local variety rice but not accustomed to grow improved varieties and double cropping of rice. It is inevitable to introduce new varieties of lowland rice, upland crops as well as new kind of vegetables to improve quality and yield as well as to meet market requirement of products, and to establish a trial and demonstration station in order to show the effective cultivation techniques of these crops, and to train extension officers and farmers in the area.

The present small holding farming practices prevailing in and around the scheme areas will be applied basically, such as animal power for land preparation and transportation, manual operation for transplanting and harvesting, etc. Although farm mechanization is now gradually introduced in the areas, the rapid farm mechanization is not recommended in the proposed farming practices in due consideration of the large amount of investment needed at once for the individual farmer.

Regarding plant protection, the proper application of chemicals will become necessary for the safe and effective control of insects and disease taking into account selection of attractive and non-harmful agro-chemicals. The minimum use of pesticides is recommended to avoid disastrous damage by pests if necessary together with the introduction of environmentally sound practices that use selected chemicals such as Fenitrothion, Buprofezin, Dithiocarbamate, Benomyl, and under a proper guidance of the agricultural services. To minimize pesticide application and to ensure the effective control of pests and disease as well as to protect the environment, it is recommended to introduce biological method of control such as sex pheromone traps, utilization of predators and natural enemies, etc. which will be promoted under IPM program by MAF.

The farming practices to be paid attention are management and improvement of soil fertility in the area. The soils need intensive management to maintain fertility to continue proper level of production in the field converted from the slash-and-burn system to the permanent cropping system. A cropping rotation system will be essential for vegetables including upland crops not only for maintain the soil fertility but also to avoid soil born pests

and diseases. Mulching practices with leguminous crops or covering with cut and dried grass as well as application of organic materials as compost etc. are strongly recommended.

The proper management of livestock is essential in promoting livestock production as well as preventing damage on the crops, and keeping clean living environment in the scheme areas. It is recommended to develop the managed grazing lands by improving fodder which could be done with minor modification of the traditional grazing system, not only to depend on the natural grass. It is also essential to promote disease control of the animals by an extension of the veterinary services and the breeding of healthy animals.

Fish culture is now sporadically practiced in the scheme areas by few farmers. It is recommended to introduce modernized culture techniques for effective use of reservoirs to be constructed for irrigation water, but it is needed to clarify the possibility of fish culture using these reservoirs especially from view points of quality and temperature, diseases and parasites, etc. in the reserved water. As initial stage, common carp, catfish, murrel and climbing perch etc. are recommended because of adaptability to the wide range of water condition. Tilapia is also recommended to the area of low altitude. Intensive fish culture system will not be applicable by utilizing reservoirs for irrigation, mainly due to large seasonal fluctuation of water flow and level, but extensive system will be adopted.

The inputs and labor requirement for the proposed farming practices for main crops are presented in Table III-17.

## 6.5 Anticipated Crop Yield and Production

### 6.5.1 Target Yield of Crops

The present yield of crops in the project area is rather low due mainly to the lack of irrigation water, a shortage of farm inputs, and the low level of supporting services to supply farming techniques and materials. By implementation of the project the yield of crops would be substantially increased and stabilized after accustoming the irrigation farming practices supported by the agricultural services. The increase of yield without the project is considered to be insignificant. The target yield of crops at the full development stage is assumed below:

Crops	Present (ton/ha)	With project (ton/ha)
Coffee	0.3	1.5
Tea	0.26	1.0
Upland rice	1.5	3.0
Lowland rice		
Local variety	2.6	3.0
Improved variety		4.0
Vegetables:		
Cabbage	8.0	20
Chinese cabbage	6.0	20
Potato	10.0	20
Upland crops		
Groundnut	1.5	2.0
Soybeans	1.0	2.0
Maize	1.0	3.0

The target yield of each crop is assumed at the average production conditions, under irrigation for the tropics, since there is no reliable data on the ultimate crop yield in and around the scheme areas. The present yield is the average of the scheme areas.

Most of farmers in the study area are not familiar yet with new varieties of crops and farming practices to be introduced such as proper fertilization, plant protection, and water

management. In order to attain the projected target yield as early as possible by applying the proposed farming practices, it is essential to improve and strengthen the present agricultural supporting services to keep pace with the implementation of the infrastructure development. It would take rather long time to enable the farmers to sufficiently manage operation of the irrigation facilities and to attain the projected target yield in success, because the supporting systems and research institute are still not well organized and the qualified manpower is in short. It will take some long time to train the extension officers possible to work effectively. It is necessary to start research and training work prior to the start of the construction works. The build-up period is assumed at 5 years after the completion of the project works and the starting of proper support services.

### 6.5.2 Anticipated Crop Production

The anticipated crop production by the project in each area at the full target stage is given in Table III-21 and summarized as follows:

#### (1) Upper Champi Scheme

Crops	With project			Present	Increment
	(Unit: ton)				
	Wet season	Dry season	Prod.total		
Coffee*	0	750	750	138	612
Tea	60	60	120	39	81
Upland crops**	330	0	330	0	330
Vegetables***	0	2200	2200	0	2200
Total	390	810	3400	177	3223

\* The production of coffee is of hulled dried beans.

\*\* Upland crops is represented by maize and may include soybean(green), sweet corn, etc.

\*\*\* Vegetables is represented by cabbages.

The expected production of coffee with project condition is estimated at about 750 tons, from 140 tons of present production with 600 tons of increment. Tea production will be increased to about 120 tons per annum, 3 times of present production. More than 2000 tons of highland vegetables, and some 300 tons of upland crops such as maize will be promoted besides increase of the existing main crops of coffee and tea.

#### (2) Upper Tapoung Scheme

Crops	With project			Present	Increment
	(Unit: ton)				
	Wet season	Dry season	Prod.total		
Upland crops*	120	120	240	0	240
Vegetables**	800	800	1600	0	1600
Total	920	920	1840	0	1840

\* Upland crops is represented by maize.

\*\* Vegetables is represented by cabbages.

About 200 tons of upland crops and 1600 tons of vegetables will be expected from the scheme annually.

(3) Upper Kapheu Scheme

Crops	With project			Present	Increment
	Wet season	Dry season	Prod.total		
Coffee*	0	1350	1350	162	1188
Lowland rice	400	0	400	0	400
Upland rice	0	0	0	270	-270
Upland crops**	0	200	200	0	200
Total	400	1550	1950	432	1518

\* Fruits are represented by banana.

\*\* Upland crops are represented by groundnut.

Drastic increase of annual coffee production will be achieved in this scheme, from 160 tons of present to about 1200 tons in future. In the field converted from the slash-and-burn system, lowland rice and upland crops will be grown, and the incremental paddy production is about 130 tons, and about 200 tons of upland crops is expected under irrigated condition.

(4) Lower Xe Set Scheme

Crops	With project			Present	Increment
	Wet season	Dry season	Prod.total		
Lowland rice	4000	800	4800	260	4540
Upland rice	0	0	0	273	-273
Upland crops*	0	1600	1600	135	1465
Fruits**	0	0	0	240	-240
Total	4000	2400	6400	908	5492

\* Fruits are represented by banana.

\*\* Upland crops are represented by groundnut.

Lowland rice under irrigation will be the main crop in this scheme, and about 4800 tons of paddy production will be expected annually. Upland crops will be grown under irrigation in the dry season, and the expected production is about 1600 tons.

(5) Upper Tay-Un Scheme

Crops	With project			Present	Increment
	Wet season	Dry season	Prod.total		
Lowland rice	1320	280	1600	34	1566
Upland rice	0	0	0	42	-42
Upland crops**	0	160	160	0	160
Total	1320	440	1760	76	1684

\*\* Upland crops are represented by groundnut.

Lowland rice will be the main crop in this area, and the expected annual production is about 1600 tons of paddy, and 160 tons of upland crops.

## 6.6 Livestock and Fish Culture

### 6.6.1 Livestock Raising

Natural grass land, bush and secondary forest in the most of the scheme areas will be converted to the permanent cropping area where some times cattle and buffaloes are grazing in at present. Along with the conversion of the land use, raising system of cattle would be also improved. It is recommended to construct proper houses for animals not only to manage

feeding effectively and for better health condition of animals, but also utilize by-products of crops such as straw, chaffs of rice and beans, and to make compost effectively. It is also recommended to establish communal grazing lands with pen and improved kind of grasses and fodder trees, and these lands would be utilized in rotation to keep pace with growth of the fodder.

In Lower Xe Set scheme area, about 200 of buffalo at present is quite short for cultivation of 1000 ha of lowland rice field. It will be necessary to introduce more than 300 head of buffaloes from outside the scheme area to manage the total rice field. In the Upper Kapheu area introduction of 50 head of buffaloes will be necessary to manage 100 ha of newly created lowland rice field. For propagation and better health care of the buffaloes, veterinary services such as artificial insemination and vaccination would be inevitable.

### 6.6.2 Fish Culture

The anticipated production of fish culture using ponds constructed for irrigation is estimated based on the effective area for fish culture of each pond as follows:

Schemes	Effective area(ha)	Production(kg)
Upper Champi	0.3	200
Upper Tapoung	16	8000
Upper Kapheu	2	1000
Lower Xe Set	0	0
Upper Tay-Un	2	1000

Note : Yield of fish applied is 500 kg/ha by extensive techniques.

- Upper Champi Scheme --About 0.3 ha of effective area of reservoir will be used for fish culture and the expected fish production is estimated at about 200 kg annually.
- Upper Tapoung Scheme --About 33 ha of reservoir for irrigation will be constructed with 16 ha of the effective area for fish culture. The expected production is estimated at about 8 tons annually.
- Upper Kapheu Scheme --About 22 ha of irrigation reservoirs will be constructed with 2 ha of the effective area for fish culture and the expected annual production of fish is estimated at about 1 ton.
- Upper Tay-Un Scheme About 5 ha of irrigation reservoir will be newly constructed with 2 ha of the effective area for fish culture. The expected annual fish production is estimated at 1 ton.



## *Tables*

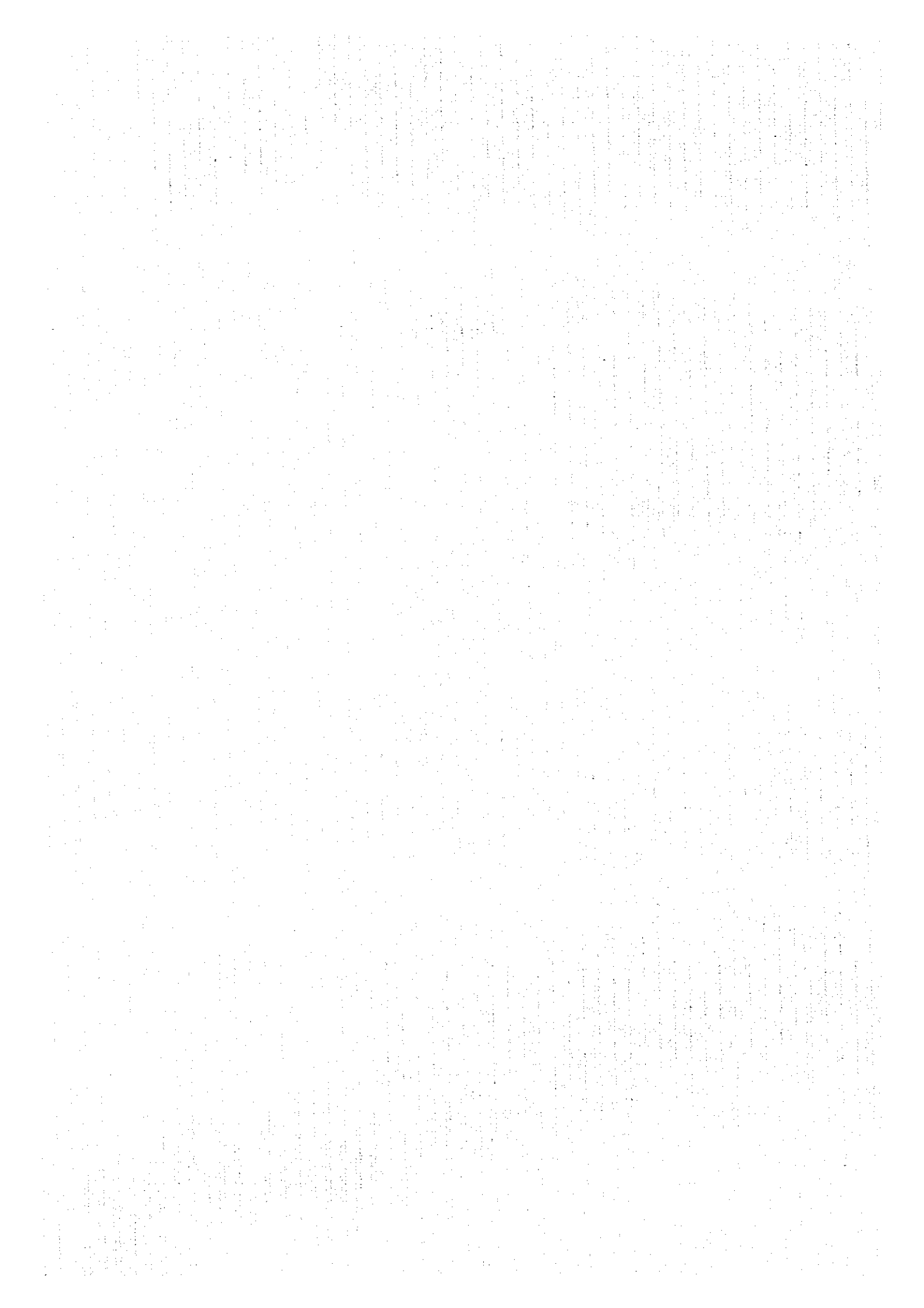


Table III-1 Production of Major Crops in Laos and Related Southern Provinces

(Unit: production is in 1,000 ton)

Year	Item	Total	Lowland	Irrigated	Upland	Maize	Sweet	Mung	Soy	Ground	Tobacco	Cotton	Sugar	Veget.	Sesame	Coffee	Tea	Carda-
		rice	rice	rice	rice	potato	beans	beans	nut	nut		cane	cane					mom
1990	Laos total:	1491.50	1081.13	40.99	369.38	66.57	218.26	2.61	4.21	6.38	56.43	4.93	96.36	53.51			5.20	2.00
	Saravan	114.90	103.39	1.33	10.17	1.82	15.30	0.07	0.67	0.82	3.43	0.11	1.62	5.76			0.93	
	Sekong	10.22	2.66	0.00	7.56	1.08	93.03	0.01	0.00	0.01	1.13	0.02	1.20	1.29			0.43	
	Champasak	183.87	171.25	1.56	11.05	1.60	0.93	0.77	0.18	0.56	9.31	0.02	5.70	8.70			3.69	
	South-Total	308.99	277.30	2.89	28.78	4.50	109.26	0.85	0.85	1.39	13.87	0.15	8.52	15.75	0.00		5.05	0.00
	%/national	20.7	25.6	7.1	7.8	6.8	50.1	32.6	20.2	21.8	24.6	3.0	8.8	29.4			97.1	0.0
1991	Laos total:	1223.37	842.14	43.72	337.53	68.57	132.08	2.11	5.51	5.63	45.33	4.75	80.49	51.23			8.02	1.71
	Saravan	111.61	97.85	0.38	13.37	1.83	15.91	0.07	1.60	0.40	3.50	0.12	1.65	5.88			1.42	0.06
	Sekong	6.81	2.02	0.60	4.79	0.25	16.55	0.01	0.00	0.01	1.15	0.01	1.22	1.32			0.69	0.00
	Champasak	159.74	151.13	0.00	8.01	0.00	0.47	0.19	0.31	0.19	0.24	0.11	0.34	8.88			5.74	0.97
	South-Total	278.16	251.00	0.98	26.17	2.08	32.93	0.27	1.91	0.60	4.89	0.24	3.21	16.08	0.00		7.85	1.03
	%/national	22.7	29.8	2.2	7.8	3.0	24.9	12.8	34.7	10.7	10.8	5.1	4.0	31.4			97.9	60.2
1992	Laos total:	1502.36	1153.43	55.30	293.63	58.70	104.80	2.74	5.15	6.76	48.26	5.30	94.42	18.36	4.85		6.58	1.02
	Saravan	118.86	105.76	0.46	12.64	1.84	16.55	0.08	0.52	0.36	3.60	0.25	1.81				0.82	0.09
	Sekong	10.33	4.29	0.02	6.02	1.66	14.56	0.00	0.02	0.03	0.04	0.01	3.98				0.72	0.00
	Champasak	225.34	212.91	2.08	10.34	0.25	0.47	0.21	0.31	0.22	0.24	0.07	0.67				4.55	0.09
	South-Total	354.53	322.96	2.56	29.00	3.75	31.58	0.29	0.85	0.61	3.88	0.33	6.46	0.00	0.00		6.09	0.18
	%/national	23.6	28.0	4.6	9.9	6.4	30.1	10.6	16.5	9.0	8.0	6.2	6.8	0.0	0.0		92.6	17.6
1993	Laos total:	1250.63	921.40	45.58	283.65	47.62	112.87	2.20	4.52	5.28	29.22	5.95	89.56	125.13	4.03		7.62	1.48
	Saravan	73.80	59.67	0.03	14.11	0.02	17.21	0.09	0.52	0.36	3.67	0.66	1.97	17.21			0.82	0.50
	Sekong	11.83	3.55	0.00	8.28	1.36	19.29	0.01	0.00	0.00	1.25	0.10	1.40	19.29			0.72	0.00
	Champasak	204.03	194.60	1.50	7.93	0.40	0.60	0.21	0.31	0.22	0.25	0.09	0.72	0.90			5.90	0.09
	South-Total	289.66	257.82	1.53	30.32	1.78	37.10	0.31	0.83	0.58	5.17	0.85	4.09	37.40	0.00		7.44	0.59
	%/national	23.2	28.0	3.4	10.7	3.7	32.9	14.1	18.4	11.0	17.7	14.3	4.6	29.9	0.0		97.6	39.9
1994	Laos total:	1577.02	1197.70	37.77	341.56	55.79	159.50	1.68	5.99	5.00	31.78	5.91	65.14	141.39			9.04	1.94
	Saravan	124.58	107.24	0.26	17.08	0.86	4.00	0.10	0.79	0.76	3.75	0.06	2.29	18.28			1.25	0.91
	Sekong	13.10	4.80	0.00	8.30	1.36	19.27	0.00	0.00	0.00	1.33	0.66	1.78	30.80			0.72	0.00
	Champasak	226.70	218.79	0.87	7.04	1.11	0.89	0.14	0.48	0.35	0.03	0.04	0.92	1.83			6.28	0.09
	South-Total	364.38	330.83	1.13	32.42	3.33	24.16	0.24	1.27	1.11	5.11	0.76	4.99	50.91	0.00		8.25	1.00
	%/national	23.1	27.6	3.0	9.5	6.0	15.1	14.3	21.2	22.2	16.1	12.9	7.7	36.0			91.3	51.5

Data source: Data source for 1990 to 1993 is Agricultural Statistics Yearbook 1993, MAFF, and data for 1994 is Basic Statistics 1994, CPC.

Table III-2 Area and Production on Major Crops in Champasak Province(1/5)

Crop/Year	Paksé	Sanasoumboun	Phonethong	Bachiang	Pakxong	Pathoumphone	Champasak	Soukouna	Moumlapamok	Khong	Total
<b>Lowland Rice:</b>											
1990	2,050	10,130	18,270	750	40	5,780	10,760	7,740	5,540	11,060	72,120
Prod(ton)	6,450	27,340	54,800	2,540	45	16,240	31,210	16,250	15,740	30,970	201,585
1991	1,940	10,050	18,380	710	46	5,850	10,360	7,780	5,850	11,230	72,196
Prod(ton)	4,450	19,800	46,340	2,100	34	10,150	21,290	8,790	11,500	26,670	151,124
1992	1,940	10,050	18,380	710	46	5,830	10,370	7,780	5,940	11,480	72,526
Prod(ton)	5,700	26,140	51,450	2,140	55	15,730	26,630	14,000	15,450	32,130	189,425
1993	1,870	9,940	17,820	680	68	5,540	10,370	8,010	5,980	11,490	71,768
Prod(ton)	5,423	24,850	48,114	1,768	54	13,850	25,925	14,418	14,950	29,874	179,226.4
1994	1,940	9,820	19,290	800	89	5,920	10,370	9,630	6,220	11,530	75,609
Prod(ton)	5,790	28,280	49,780	2,410	89	17,530	30,420	23,210	16,200	26,230	199,939
Average	1,948	9,998	18,428	730	58	5,784	10,446	8,188	5,906	11,358	72,844
%	3	14	25	1	0	8	14	11	8	16	100
Prod(ton)	5,563	25,282	50,097	2,192	55	14,700	27,095	15,334	14,768	29,175	184,260
%	3	14	27	1	0	8	15	8	8	16	100
<b>Upland rice:</b>											
1990	75	160	0	3,120	1,330	163	0	0	16	0	4,864
Prod(ton)	90	290	0	7,350	1,200	310	0	0	20	0	9,260
1991	59	160	0	2,650	630	130	0	0	16	0	3,645
Prod(ton)	70	260	0	5,400	630	250	0	0	20	0	6,630
1992	22	150	0	3,400	820	130	0	0	16	0	4,538
Prod(ton)	24	250	0	6,810	820	250	0	0	29	0	8,183
1993	21	130	0	3,180	750	230	0	0	0	0	4,311
Prod(ton)	21	230	0	4,040	1,390	450	0	0	0	0	6,131
1994	0	140	0	2,870	820	140	0	0	0	0	3,970
Prod(ton)	0	260	0	5,160	1,390	224	0	0	0	0	7,034
Average	35	148	0	3,044	870	159	0	0	10	0	4,266
%	1	3	0	71	20	4	0	0	0	0	100
Prod(ton)	41	258	0	5,752	1,086	297	0	0	14	0	7,448
%	1	3	0	77	15	4	0	0	0	0	100

Data source: Agriculture and Forestry Services of Champasak Province.

Table III-2 Area and Production on Major Crops in Champasak Province(2/5)

Crop/Year	Pakse	Sanasomboun	Phomethong	Bachiang	Pakxong	Pathoumphone	Champasak	Soukouna	Moulapamok	Khong	Total
<b>Total Rice:</b>											
1990	2,125	10,290	18,270	3,870	1,370	5,943	10,760	7,740	5,556	11,060	76,984
Area(ha)											
Prod(ton)	6,540	27,630	54,800	9,890	1,245	16,550	31,210	16,250	15,760	30,970	210,845
1991	1,999	10,210	18,380	3,360	676	5,980	10,360	7,780	5,866	11,230	75,841
Area(ha)											
Prod(ton)	4,520	20,060	46,340	7,500	664	10,400	21,290	8,790	11,520	26,670	157,754
1992	1,962	10,200	18,380	4,110	866	5,960	10,370	7,780	5,956	11,480	77,064
Area(ha)											
Prod(ton)	5,724	26,390	51,450	8,950	875	15,980	26,630	14,000	15,479	32,130	197,608
1993	1,891	10,070	17,820	3,860	818	5,770	10,370	8,010	5,980	11,490	76,079
Area(ha)											
Prod(ton)	5,444	25,080	48,114	5,808	1,444	14,300	25,925	14,418	14,950	29,874	185,357
1994	1,940	9,960	19,290	3,670	909	6,060	10,370	9,630	6,220	11,530	79,579
Area(ha)											
Prod(ton)	5,790	28,540	49,780	7,570	1,479	17,754	30,420	23,210	16,200	26,230	206,973
Average	1,983	10,146	18,428	3,774	928	5,943	10,446	8,188	5,916	11,358	77,109
Area(ha)											
%	3	13	24	5	1	8	14	11	8	15	100
Prod(ton)	5,604	25,540	50,097	7,944	1,141	14,997	27,095	15,334	14,782	29,175	191,707
%	3	13	26	4	1	8	14	8	8	15	100
<b>Coffee:</b>											
1990	0	0	0	550	16630	220	0	0	0	0	17400
Area(ha)											
Prod(ton)	0	0	0	76	3710	37	0	0	0	0	3823
1991	0	0	0	548	16,630	220	0	0	0	0	17398
Area(ha)											
Prod(ton)	0	0	0	86	4,434	25	0	0	0	0	4545
1992	0	0	0	548	16,630	220	0	0	0	0	17398
Area(ha)											
Prod(ton)	0	0	0	102	5,760	39	0	0	0	0	5901
1993	0	0	0	403	16,643	192	0	0	0	0	17238
Area(ha)											
Prod(ton)	0	0	0	94	5,873	38	0	0	0	0	6005
1994	0	0	0	403	16,660	192	0	0	0	0	17255
Area(ha)											
Prod(ton)	0	0	0	129	6,029	48	0	0	0	0	6206
Average	0	0	0	490	16,639	209	0	0	0	0	17,338
Area(ha)											
%	0	0	0	3	96	1	0	0	0	0	100
Prod(ton)	0	0	0	97	5,161	37	0	0	0	0	5,296
%	0	0	0	2	97	1	0	0	0	0	100

Data source: Agriculture and Forestry Services of Champasak Province.

Table III-2 Area and Production on Major Crops in Champasak Province(3/5)

Crop/Year	Pakse	Sarasoumboun	Phonethong	Bachiang	Pakxong	Pathoumphone	Champasak	Soukhouma	Moulapanok	Khong	Total
<b>Cardamom:</b>											
1990	0	159	0	916	848	65	0	0	0	0	1988
	0	5.5	0	0	35.1	2.5	0	0	0	0	43.1
1991	0	159	0	916	848	65	0	0	0	0	1988
	0	6	0	37	41	2	0	0	0	0	86
1992	0	159	0	916	848	65	0	0	0	0	1988
	0	6	0	37	41	2	0	0	0	0	85.9
1993	0	159	0	557	720	60	0	0	0	0	1496
	0	5	0	20	41	4	0	0	0	0	70
1994	0	139	0	545	856	60	0	0	0	0	1600
	0	8	0	21	41	4	0	0	0	0	74
Average	0	155	0	770	824	63	0	0	0	0	1,812
	0	9	0	42	45	3	0	0	0	0	100
	0	6	0	23	40	3	0	0	0	0	72
	0	8	0	32	55	4	0	0	0	0	100
<b>Soybeans:</b>											
1990	0	86	0	96	0	0	4	0	0	0	120
	0	56	0	113	0	0	4	0	0	0	86
1991	0	87	0	156	4	0	7	0	0	0	48
	0	70	0	188	4	0	6	0	0	0	39
1992	0	87	0	132	4	0	9	0	0	0	56
	0	70	0	168	4	0	7	0	0	0	45
1993	0	87	0	151	0	2	11	0	0	0	58
	0	62	0	116	0	1	9	0	0	0	29
1994	0	87	0	278	0	2	11	0	0	0	58
	0	61	0	306	0	1	9	0	0	0	25
Average	0	87	0	163	2	1	8	0	0	0	68
	0	26	0	48	0	0	2	0	0	0	20
	0	64	0	178	2	0	7	0	0	0	45
	0	21	0	59	1	0	2	0	0	0	15

Data source: Agriculture and Forestry Services of Champasak Province.

Table III-2 Area and Production on Major Crops in Champasak Province(4/5)

Crop/Year	Pakse	Sanasoumboun	Phonethong	Bachiang	Pakxong	Pathoumphone	Champasak	Soukouna	Mounlapamok	Khong	Total
<b>Groundnut:</b>											
1990	0	0	0	11	0	21	4	30	35	69	159
Prod(ton)	0	0	0	10	0	13	3	15	21	21	73
1991	0	50	0	126	0	7	5	25	38	65	140
Prod(ton)	0	25	0	88	0	3	4	13	23	29	72
1992	0	40	0	126	0	7	6	25	38	74	150
Prod(ton)	0	20	0	113	0	4	4	15	23	37	83
1993	0	40	0	245	0	12	9	30	39	75	165
Prod(ton)	0	20	0	221	0	10	7	15	24	38	94
1994	0	40	0	261	0	12		30	39	75	156
Prod(ton)	0	20	0	235	0	10		18	23	38	89
Average	0	34	0	154	0	12	5	28	38	72	154
Area(ha)	0	22	0	100	0	8	3	18	25	46	100
%	0	17	0	133	0	8	4	15	23	33	82
Prod(ton)	0	21	0	162	0	10	4	18	28	40	100
%	0	14	0	7	6	37	0	37	0	0	100
<b>Banana:</b>											
1990	0	77	0	72	29	400	0	80	0	0	658
Prod(ton)	0	178	0	87	72	480	0	480	0	0	1297
1991	0	0	0	0	0	0	0	0	0	0	0
Prod(ton)	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0
Prod(ton)	0	0	0	0	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0	0	0	0	0
Prod(ton)	0	0	0	0	0	0	0	0	0	0	0
1994	0	0	0	0	0	0	0	0	0	0	0
Prod(ton)	0	15	0	14	6	80	0	16	0	0	132
Average	0	12	0	11	4	61	0	12	0	0	100
Area(ha)	0	36	0	17	14	96	0	96	0	0	259
%	0	14	0	7	6	37	0	37	0	0	100

Data source: Agriculture and Forestry Services of Champasak Province.

Table III-2 Area and Production on Major Crops in Champasak Province(S/S)

Crop/Year	Pakse	Sansoumboun	Phongthong	Bachiang	Pakxong	Pathoumphone	Champasak	Soukourma	Mouliaparnok	Khong	Total
Cotton:											
1990	0	40	0	0	0	0	4	25	0	0	69
Prod(ton)	0	20	0	0	0	0	3	10	0	0	33
1991	0	150	0	20	0	0	4	25	0	0	199
Area(ha)	0	90	0	10	0	0	7	4	0	0	111
Prod(ton)	0	30	0	49	0	0	0	25	0	0	104
1992	0	18	0	28	0	0	0	5	0	0	51
Area(ha)	0	30	0	99	0	0	0	0	0	0	129
Prod(ton)	0	20	0	20	0	0	0	0	0	0	40
1994	0	30	0	42	0	0	0	0	0	0	72
Area(ha)	0	18	0	21	0	0	0	0	0	0	39
Prod(ton)	0	56	0	42	0	0	2	15	0	0	115
Average	0	49	0	37	0	0	1	13	0	0	100
Area(ha)	0	33	0	20	0	0	1	2	0	0	56
Prod(ton)	0	59	0	36	0	0	3	3	0	0	100
%											

Data source: Agriculture and Forestry Services of Champasak Province.



Table III-3 Area and Production of Major Crops in Salavan Province(1/2)

Crop/Year		Salavan	Laongam	Khonvedone	Vapy	Nakhone pheng	Toumlane	Ta-oy	Samouay	Total
<b>Total Rice:</b>										
1991	Area(ha)	10,510	4,880	8,820	5,050	6,060	2,230	2,220	650	40,150
	Prod(ton)	31,170	8,050	29,340	17,590	15,180	4,910	2,770	870	109,880
1992	Area(ha)	10,510	5,020	8,870	4,950	6,110	2,230	2,050	830	40,570
	Prod(ton)	29,060	8,470	28,690	19,910	14,890	5,130	3,700	1,080	110,930
1993	Area(ha)	10,260	4,600	8,510	5,050	5,060	2,340	2,400	910	39,130
	Prod(ton)	25,260	8,020	14,440	8,200	10,420	5,610	1,020	1,100	74,070
1994	Area(ha)	10,660	5,060	8,980	4,980	6,100	2,420	1,980	910	41,090
	Prod(ton)	35,060	8,680	31,220	17,070	15,290	6,380	1,440	1,190	116,330
Average	Area(ha)	10,493	4,890	8,795	5,008	5,833	2,305	2,163	825	40,310
	%	26	12	22	12	14	6	5	2	100
	Prod(ton)	30,138	8,305	25,923	15,693	13,945	5,508	2,233	1,060	102,803
	%	29	8	25	15	14	5	2	1	100
<b>Coffee:</b>										
1991	Area(ha)	230	6,840	0	0	0	0	0	0	7,070
	Prod(ton)	15	420	0	0	0	0	0	0	435
1992	Area(ha)	240	6,940	0	0	0	0	0	0	7,180
	Prod(ton)	18	590	0	0	0	0	0	0	608
1993	Area(ha)	250	7,020	0	0	0	0	0	0	7,270
	Prod(ton)	24	440	0	0	0	0	0	0	464
1994	Area(ha)	250	7,050	0	0	0	0	0	0	7,300
	Prod(ton)	11	1,240	0	0	0	0	0	0	1,251
Average	Area(ha)	243	6,963	0	0	0	0	0	0	7,205
	%	3	97	0	0	0	0	0	0	100
	Prod(ton)	17	673	0	0	0	0	0	0	690
	%	2	98	0	0	0	0	0	0	100
<b>Cardamom:</b>										
1991	Area(ha)	230	1,650	0	0	0	0	0	0	1,880
	Prod(ton)	15	50	0	0	0	0	0	0	65
1992	Area(ha)	240	1,720	0	0	0	0	0	0	1,960
	Prod(ton)	18	77	0	0	0	0	0	0	95
1993	Area(ha)	250	2,850	0	0	0	0	0	0	3,100
	Prod(ton)	24	94	0	0	0	0	0	0	118
1994	Area(ha)	250	3,990	0	0	0	0	0	0	4,240
	Prod(ton)	11	95	0	0	0	0	0	0	106
Average	Area(ha)	243	2,553	0	0	0	0	0	0	2,795
	%	9	91	0	0	0	0	0	0	100
	Prod(ton)	17	79	0	0	0	0	0	0	96
	%	18	82	0	0	0	0	0	0	100

Data source: Agriculture and Forestry Services of Salavan Province.

Table III-3 Area and Production of Major Crops in Salavan Province(2/2)

Crop Year		Salavan	Laongam	Khongxedone	Vapy	Nakhone	Toumlane	Ta-oy	Samouay	Total
<b>Soybeans:</b>										
1991	Area(ha)	0	310	0	70	0	0	0	0	380
	Prod(ton)	0	220	0	50	0	0	0	0	270
1992	Area(ha)	0	53	0	20	0	0	0	0	73
	Prod(ton)	0	40	0	15	0	0	0	0	55
1993	Area(ha)	0	430	0	190	0	0	0	0	620
	Prod(ton)	0	340	0	150	0	0	0	0	490
1994	Area(ha)	0	760	0	30	0	0	0	0	790
	Prod(ton)	0	760	0	20	0	0	0	0	780
Average	Area(ha)	0	388	0	78	0	0	0	0	466
	%	0	83	0	17	0	0	0	0	100
	Prod(ton)	0	340	0	59	0	0	0	0	399
	%	0	85	0	15	0	0	0	0	100
<b>Groundnut:</b>										
1991	Area(ha)	250	220	0	0	0	0	0	0	470
	Prod(ton)	250	180	0	0	0	0	0	0	430
1992	Area(ha)	280	120	0	0	0	0	0	0	400
	Prod(ton)	180	80	0	0	0	0	0	0	260
1993	Area(ha)	280	180	0	0	0	0	0	0	460
	Prod(ton)	280	210	0	0	0	0	0	0	490
1994	Area(ha)	150	300	0	0	0	0	0	0	450
	Prod(ton)	150	250	0	0	0	0	0	0	400
Average	Area(ha)	240	205	0	0	0	0	0	0	445
	%	54	46	0	0	0	0	0	0	100
	Prod(ton)	215	180	0	0	0	0	0	0	395
	%	54	46	0	0	0	0	0	0	100
<b>Banana:</b>										
1991	Area(ha)	0	260	0	0	0	0	0	0	260
	Prod(ton)	0	1,800	0	0	0	0	0	0	1,800
1992	Area(ha)	0	290	0	0	0	0	0	0	290
	Prod(ton)	0	2,200	0	0	0	0	0	0	2,200
1993	Area(ha)	0	350	0	0	0	0	0	0	350
	Prod(ton)	0	2,800	0	0	0	0	0	0	2,800
1994	Area(ha)	70	580	0	0	0	0	0	0	650
	Prod(ton)	200	2,400	0	0	0	0	0	0	2,600
Average	Area(ha)	18	370	0	0	0	0	0	0	388
	%	4	83	0	0	0	0	0	0	87
	Prod(ton)	50	2,300	0	0	0	0	0	0	2,350
	%	13	582	0	0	0	0	0	0	595
<b>Cotton:</b>										
1991	Area(ha)	220	350	0	0	0	0	0	0	570
	Prod(ton)	110	70	0	0	0	0	0	0	180
1992	Area(ha)	90	130	0	0	0	0	0	0	220
	Prod(ton)	60	25	0	0	0	0	0	0	85
1993	Area(ha)	100	170	0	0	0	0	0	0	270
	Prod(ton)	70	50	0	0	0	0	0	0	120
1994	Area(ha)	110	210	0	0	20	0	0	0	340
	Prod(ton)	60	60	0	0	10	0	0	0	130
Average	Area(ha)	130	215	0	0	5	0	0	0	350
	%	37	61	0	0	1	0	0	0	100
	Prod(ton)	75	51	0	0	3	0	0	0	129
	%	58	40	0	0	2	0	0	0	100

Data source: Agriculture and Forestry Services of Salavan Province.

Table III-4 Area and Production/Livestock in Sekong Province in 1994

Crops/Livestock	Laman	Thateng	Dakcheung	Kaloun	Total
<b>Rice total:</b>					
Area(ha)	1,676	1,475	1,955	2,233	7,339
Prod.(ton)	2,925	2,241	2,991	2,960	11,117
%	26.3	20.2	26.9	26.6	100.0
<b>Lowland rice:</b>					
Area(ha)	623	270	375	48	1,316
Prod.(ton)	1,557	675	937	120	3,289
%	47.3	20.5	28.5	3.6	100.0
<b>Upland rice:</b>					
Area(ha)	1,053	1,205	1,580	2,185	6,023
Prod.(ton)	1,368	1,566	2,054	2,840	7,828
%	17.5	20.0	26.2	36.3	100.0
<b>Cardamom:</b>					
Total Area(ha)		545	4	10	559
New area(ha)		65	0	0	65
Yielding area(ha)		480	4	10	494
Prod(ton)		96	0.80	2.00	99
%		97.2	0.8	2.0	100.0
<b>Coffee:</b>					
Total Area(ha)	41	1,374	3	3	1,421
New area(ha)		174	3	3	180
Yielding area(ha)	41	1,200	0	0	1,241
Prod(ton)		720	0	0	720
		100.0	0.0	0.0	100.0
<b>Livestock:</b>					
Buffalo	5,500	4,300	2,730	2,228	14,758
Cattle	3,000	5,000	910	883	9,793
Pig	10,700	9,500	8,910	3,508	32,618
Poultry	15,000	18,600	12,100	11,230	56,930

Data source: Agriculture and Forestry Services of Sekong Province.

Table III-5 Livestock in Laos and Related Southern Provinces

Year	Item	Population			Buffalo			Cattle			Pig			Goat & Sheep			Poultry		
		(human)	Growth rate	No.	Growth rate	No.	No. per capita	Growth rate	No.	No. per capita	Growth rate	No.	No. per capita	Growth rate	No.	No. per capita	Growth rate	No.	No. per capita
1990	Laos total:	4104	100	1071.8	100	0.3	841.9	100	0.2	1392.1	100	0.3	139.4	100	0.0	7884.5	100	1.9	
	Saravan	225	100	63.8	100	0.3	76.8	100	0.3	69.1	100	0.3	2.7	100	0.0	441.3	100	2.0	
	Sekong	57	100	20.2	100	0.4	12.3	100	0.2	26.6	100	0.5	2.6	100	0.0	95.7	100	1.7	
	Champasak	453	100	119.0	100	0.3	106.1	100	0.2	104.2	100	0.2	0.5	100	0.0	1520.0	100	3.4	
	South-Total	735	100	203.0	100	0.3	195.2	100	0.3	200.0	100	0.3	5.9	100	0.0	2057.0	100	2.8	
	%/national	17.9		18.9		23.2		14.4		14.4		4.2				26.1			
1991	Laos total:	4250	3.6	1103.9	3.0	0.3	892.4	6.0	0.2	1433.2	2.9	0.3	154.7	11.0	0.0	8361.3	6.0	2.0	
	Saravan	231	2.7	65.7	3.0	0.3	81.4	6.0	0.4	71.2	3.0	0.3	3.0	10.6	0.0	467.8	6.0	2.0	
	Sekong	59	3.5	20.9	3.0	0.4	13.1	6.0	0.2	27.4	3.0	0.5	2.9	11.2	0.0	101.4	6.0	1.7	
	Champasak	465	2.6	122.6	3.0	0.3	112.4	6.0	0.2	107.4	3.0	0.2	0.6	11.1	0.0	1611.2	6.0	3.5	
	South-Total	755	2.7	209.1	3.0	0.3	206.9	6.0	0.3	206.0	3.0	0.3	6.5	10.9	0.0	2180.4	6.0	2.9	
	%/national	17.8		18.9		23.2		14.4		14.4		4.2				26.1			
1992	Laos total:	4360	2.6	1130.7	2.4	0.3	983.0	11.3	0.2	1560.6	8.9	0.4	104.0	-32.8	0.0	8906.0	6.5	2.0	
	Saravan	237	2.6	70.9	7.9	0.3	93.0	14.2	0.4	103.0	44.7	0.4	2.9	-4.3	0.0	396.0	-15.3	1.7	
	Sekong	59	0.0	22.3	7.0	0.4	13.5	3.4	0.2	34.5	25.9	0.6	3.0	3.8	0.1	138.0	36.1	2.3	
	Champasak	477	2.6	129.7	5.8	0.3	131.7	17.2	0.3	131.4	22.4	0.3	0.3	-51.7	0.0	1316.0	-18.3	2.8	
	South-Total	773	2.4	222.9	6.6	0.3	238.2	15.1	0.3	268.9	30.6	0.3	6.2	-5.1	0.0	1850.0	-15.2	2.4	
	%/national	17.7		19.7		24.0		17.2		17.2		5.9				20.8			
1993	Laos total:	4474	2.6	1134.2	0.3	0.3	1019.8	2.7	0.2	1624.7	4.1	0.4	127.6	22.7	0.0	10091.1	13.3	2.3	
	Saravan	243	2.5	69.0	-2.8	0.3	91.0	-2.1	0.4	117.9	14.5	0.5	3.7	28.0	0.0	651.5	64.5	2.7	
	Sekong	60	1.7	21.9	-1.7	0.4	14.5	7.4	0.2	34.8	0.8	0.6	5.6	88.0	0.1	114.0	-17.4	1.9	
	Champasak	490	2.7	133.0	2.6	0.3	129.9	-1.4	0.3	123.0	-6.4	0.3	0.6	89.7	0.0	1813.6	37.8	3.7	
	South-Total	793	2.6	223.9	0.4	0.3	235.4	-1.2	0.3	275.7	2.5	0.3	9.8	58.6	0.0	2579.1	39.4	3.3	
	%/national	17.7		19.7		23.1		17.0		17.0		7.7				25.6			
1994	Laos total:	4591	2.6	1168.0	3.0	0.3	1081.1	6.0	0.2	1673.5	3.0	0.4	141.8	11.2	0.0	10696.5	6.0	2.3	
	Saravan	250	2.9	71.0	3.0	0.3	96.5	6.0	0.4	121.5	3.0	0.5	-4.1	10.8	0.0	690.6	6.0	2.8	
	Sekong	63	5.0	22.6	3.1	0.4	15.4	6.2	0.2	35.8	2.9	0.6	6.2	11.7	0.1	120.8	6.0	1.9	
	Champasak	504	2.9	137.0	3.0	0.3	137.7	6.0	0.3	126.7	3.0	0.3	0.6	9.1	0.0	1922.4	6.0	3.8	
	South-Total	817	3.0	230.6	3.0	0.3	249.6	6.0	0.3	284.0	3.0	0.3	10.9	11.2	0.0	2733.8	6.0	3.3	
	%/national	17.8		19.7		23.1		17.0		17.0		7.7				25.6			
Aver	Laos total:	4356	2.4	1121.7	1.8	0.3	965.6	5.68	0.2	1536.8	4.0	0.4	133.5	0.3	0.0	9187.9	7.1	2.1	
	Saravan	237	2.2	68.1	2.3	0.3	87.7	5.14	0.4	96.6	15.1	0.4	3.3	10.0	0.0	529.4	11.3	2.2	
	Sekong	60	2.1	21.6	2.3	0.4	13.8	5.00	0.2	31.8	6.9	0.5	-4.0	27.7	0.1	114.0	5.2	1.9	
	Champasak	478	2.3	128.3	3.0	0.3	123.6	5.97	0.3	118.5	4.3	0.2	0.5	2.2	0.0	1636.6	5.3	3.4	
	South-Total	775	2.2	217.9	2.7	0.3	225.0	5.58	0.3	246.9	8.4	0.3	7.9	17.1	0.0	2280.1	6.6	2.9	
	%/national	17.8		19.4		23.3		16.1		16.1		5.9				24.8			

Data source: Data source for 1990 to 1993 is Agricultural Statistics Yearbook 1993, MAFF, and data for 1994 is Basic Statistics 1994, CPC.

Table III-6 Livestock in Champasak Province

Stock/Year	Pakse	Sanasoumbou	Phonethong	Bachiang	Pakxong	Pathoumphon	Champasak	Soukouna	Mounlapano	Khong	Total
<b>Buffalo:</b>											
1990	3,680	16,480	18,180	3,276	2,719	17,296	14,743	9,485	9,684	26,716	122,259
1991	3,712	14,276	20,718	3,568	2,719	17,296	14,866	9,485	10,111	28,958	125,709
1992	3,694	15,780	17,495	2,928	3,317	12,601	14,802	11,211	10,423	29,688	121,939
1993	3,785	16,116	18,079	2,851	2,215	13,700	15,098	11,497	10,629	31,592	125,562
1994	3,925	17,072	18,200	3,307	2,405	14,151	13,517	11,502	1,086	32,623	117,788
Average	3,759	15,945	18,534	3,186	2,675	15,009	14,605	10,636	8,387	29,915	122,651
<b>Cattle:</b>											
1990	2,878	14,690	21,472	3,021	20,255	9,715	15,022	10,848	5,563	8,513	111,977
1991	2,888	15,680	21,427	3,455	20,255	9,715	15,121	10,843	7,033	12,205	118,622
1992	3,175	16,980	21,114	5,761	23,969	11,427	15,862	13,385	7,090	12,955	131,718
1993	3,095	16,431	22,567	6,798	21,320	9,953	16,178	13,838	6,622	13,513	130,315
1994	3,315	18,438	22,600	7,845	23,040	10,102	14,702	12,124	7,300	14,257	133,723
Average	3,070	16,444	21,836	5,376	21,768	10,182	15,377	12,208	6,722	12,289	125,271
<b>Pig:</b>											
1990	8,710	15,800	10,008		6,850	6,188	9,595	6,200	6,622	35,173	105,146
1991	8,229	17,222	7,600	8,810	6,850	6,118	9,215	6,138	9,545	36,251	115,978
1992	7,343	18,500	6,987	21,000	9,425	5,041	9,221	6,568	9,071	38,234	131,390
1993	9,914	19,251	8,534	6,372	5,230	5,559	9,313	5,635	7,002	39,712	116,522
1994	8,750	25,029	6,800	6,546	5,641	6,135	7,836	5,364	8,300	40,808	121,209
Average	8,589	19,160	7,986	10,682	6,799	5,808	9,036	5,981	8,108	38,036	118,049
<b>Poultry:</b>											
1990	43,954	115,242	156,223	23,945	23,547	80,664	158,540	41,300	39,324	449,178	1,131,917
1991	52,100	116,987	156,200	12,359	17,827	78,711	158,260	59,925	29,347	511,216	1,192,932
1992	57,278	236,213	77,812	92,560	17,566	20,670	131,650	64,179	89,300	529,232	1,316,460
1993	64,013	218,356	160,751	30,729	21,250	13,642	160,839	50,100	78,958	536,216	1,334,854
1994	67,903	378,866	220,935	32,168	22,000	80,233	179,356	54,094	104,000	547,155	1,686,710
Average	57,050	213,133	154,384	38,352	20,438	54,784	157,729	53,920	68,186	514,599	1,332,575

Data source: Agriculture and Forestry Services of Champasak Province.

Table III-7 Livestock in Salavan Province

Stock/Year	Salavan	Laongam Chonxedon	Vapy	Nakhone Toumlane	Ta-oy	Samouay	Total		
<b>Buffalo:</b>									
1990	19,750	2,840	10,810	6,730	8,300	8,160	3,390	850	60,830
1991	2,050	2,990	11,400	6,830	8,540	8,280	3,570	1,090	41,750
1992	20,350	3,140	11,740	6,930	8,520	8,410	3,540	1,140	63,770
1993	20,660	3,290	12,090	7,040	9,310	8,530	3,730	1,160	65,810
1994	17,640	3,410	11,550	7,000	9,680	8,660	4,170	1,100	63,210
Average	16,090	3,134	11,518	6,906	8,870	8,408	3,680	1,068	59,674
<b>Cattle:</b>									
1990	18,150	9,810	12,300	8,760	17,150	2,090	1,300	1,080	70,640
1991	18,600	10,490	12,560	8,930	17,830	2,240	1,510	2,670	74,830
1992	19,070	11,230	12,870	9,110	18,040	2,550	1,610	1,780	76,260
1993	19,550	11,390	13,190	8,950	19,860	2,630	2,040	2,290	79,900
1994	16,980	11,400	13,350	8,920	20,850	2,700	2,050	2,370	78,620
Average	18,470	10,864	12,854	8,934	18,746	2,442	1,702	2,038	76,050
<b>Pig:</b>									
1990	8,730	7,090	10,770	9,020	12,770	3,150	2,760	1,680	55,970
1991	25,880	11,570	14,640	11,600	12,690	4,950	9,680	2,500	93,510
1992	27,900	20,930	16,030	11,840	12,860	4,690	4,200	1,530	99,980
1993	25,120	21,930	10,670	15,400	17,350	5,000	5,200	1,640	102,310
1994	16,830	15,640	11,410	16,160	19,430	9,760	5,300	1,950	96,480
Average	20,892	15,432	12,704	12,804	15,020	5,510	5,428	1,860	89,650
<b>Poultry:</b>									
1990	62,640	11,030	71,430	62,170	21,500	112,330	15,930	3,650	360,680
1991	223,300	39,500	118,570	65,960	26,400	30,620	47,470	16,870	568,690
1992	79,540	24,200	168,450	75,110	27,560	17,810	14,200	5,920	412,790
1993	401,500	25,200	94,230	97,640	43,100	16,520	15,400	5,800	699,390
1994	130,650	43,170	93,620	105,000	64,660	16,430	23,110	10,750	487,390
Average	179,526	28,620	109,260	81,176	36,644	38,742	23,222	8,598	505,788

Data source: Agriculture and Forestry Services of Salavan Province.

Table III-8 Crop Area and Production/Livestock in Pakxong District in 1994 by Zone (Study Area)

Zone	No. of household (No.)	Agn. area (ha)	Coffee		Tea		Rice		Cardamom		Vegetables		Cattle		Buffalo		Horse		Pig		Poultry		Other		Sewery			
			Area (ha)	Prod. (ton)	Area (ha)	Prod. (ton)	Area (ha)	Prod. (ton)	Area (ha)	Prod. (ton)	Area (ha)	Prod. (ton)	Area (ha)	Prod. (ton)	Area (ha)	Prod. (ton)	Area (ha)	Prod. (ton)	Area (ha)	Prod. (ton)	Area (ha)	Prod. (ton)	Area (ha)	Prod. (ton)	Area (ha)	Prod. (ton)	Area (ha)	Prod. (ton)
<b>Zone 1</b>																												
Total	1016	2558	247	637	5	1.2	7.5	3.6																				
Average/household			2.4	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Average yield						0.2		0.5																				
<b>Zone 2</b>																												
Total	1215	3225	2848	1443	350	83.3	27	19.3																				
Average/household			2.3	1.2	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Average yield						0.24		0.71																				
<b>Zone 3</b>																												
Total	1125	3314	3206	1234	20	13.2																						
Average/household			2.8	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Average yield						0.4																						
<b>Zone 4</b>																												
Total	948	3070	2687	924			46	35.6	7	0.9	330	125																
Average/household			2.8	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Average yield						0.3		0.8		0.1	0.4																	
<b>Zone 5</b>																												
Total	358	1129	671	182	0	0	10	8.6	0	0	260	75	77	1880														
Average/household			1.9	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Average yield						0.3		0.9		0.3	0.5																	
<b>Zone 6</b>																												
Total	824	2503	2181	666			152	130			170	48																
Average/household			2.6	0.8	0.0	0.0	0.2	0.2	0.0	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Average yield						0.3		0.9		0.3																		
<b>Zone 7</b>																												
Total	662	1723	1569	419	5	1.4	149	124																				
Average/household			2.4	0.6	0.0	0.0	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Average yield						0.3		0.8																				
<b>Zone 8</b>																												
Total	812	2836	419	175			191	141			226	47.6																
Average/household			0.5	0.2	0.0	0.0	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Average yield						0.4		0.7		0.2																		
<b>Zone 9</b>																												
Total	469	257	130	34.2	0	0	122	129	3.4	3																		
Average/household			0.3	0.1	0.0	0.0	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Average yield						0.3		1.0		0.5																		
<b>District Total</b>																												
Total	7439	18615	16138	5714.2	380	99	705	585	238	51	760	246	184	3029	46	22.5	55	550	77	1380	0	0	32	165	0	0	32	165
Average/household			2.2	0.8	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Average yield						0.4		0.83		0.21	0.32	0.165																

Data source: Pakxong District Agriculture and Forestry Services.

Table III-9 Crop Area and Production/Livestock in Bachiang District in 1994 by Zone (Study Area)

Zone	No. of House hold	Upland Rice		Lowland Rice		Coffee		Cardamom		Groundnut		Soybeans		Banana		Durian		Pineapple		Livestock										
		Area (ha)	Prod. (ton)	Area (ha)	Prod. (ton)	Area (ha)	Prod. (ton)	Total Yielding (ha)	Prod. (ton)	Area (ha)	Prod. (ton)	Area (ha)	Prod. (ton)	Area (ha)	Prod. (ton)	Area (ha)	Prod. (ton)	Area (ha)	Prod. (ton)	Area (ha)	Prod. (ton)	Buffalo	Cattle	Pig	Poultry					
<b>Zone 1</b>																														
Total	906	1,747	824	1592	40	131	142	37	32	266	196	58.8	136	354	67	87	271	181	90	1049.8	1.1	0.5	0.6	1.5	166	1480	2196	3745		
Average/household		1.9	0.9	1.8	0.0	0.1	0.2	0.0	0.0	0.1	0.2	0.4	0.1	0.1	0.1	0.3	0.2	0.1	1.2	0.0	0.0	0.0	0.0	0.0	0.2	1.6	2.4	4.1		
Average yield					3.3		0.5		0.30		2.6					5.8						3.0								
<b>Zone 2</b>																														
Total	630	711	431	647	52	130	1	0	0.5	178	156	46.8	0	0	17	17	32	29	3	168	0	0	0	0	0	0	0	0	0	
Average/household		1.1	0.7	1.0	0.1	0.2	0.0	0.0	0.0	0.3	0.2	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Average yield					2		3			1.0		0.3				5.8														
<b>Zone 3</b>																														
Total	1183	958	394	591	241	603	133	11	36.6	136	128	3.1	0	0	28	28	20	8	117	26	17	9	51.0	988	2107	1084	8231			
Average/household		0.8	0.3	0.5	0.2	0.5	0.1	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Average yield					1.5		2.5		0.3		0.0					6						3.0								
<b>Zone 4</b>																														
Total	866	798	407	611	38	95	190	45	43.5	46	28	8.4	0	0	46	34	12	204	71	21	21	50	63.0	135	307	604	3638			
Average/household		0.9	0.5	0.7	0.0	0.1	0.2	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.2	0.1	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Average yield					1.5		2.5		0.3		0.3					6						3.0								
<b>Zone 5</b>																														
Total	430	347	98	147	106	265	88	34	16.2	24	7	2.1	0	0	29	24	5	139	2	1.5	2	0.5	4.5	243	652	231	1803			
Average/household		0.8	0.2	0.3	0.2	0.6	0.2	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Average yield					1.5		2.5		0.3		0.3					5.8						3.0								
<b>Zone 6</b>																														
Total	473	176	104	156	62	155	1	1	0	0	0	0	0	0	5	5	0	29	4	3	1	9.0	286	370	239	2320				
Average/household		0.4	0.2	0.3	0.1	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Average yield					1.5		2.5															3.0								
<b>District total</b>																														
Total	4488	4650	2258	3744	539	1379	555	128	129	650	515	119	136	354	84	104	411	293	118	1707	104	43	61	129	1261	2106	5660	5150	21002	
Average/household		1.1	0.5	0.8	0.1	0.3	0.1	0.0	0.1	0.1	0.0	0.0	0.1	0.0	0.1	0.0	0.1	0.1	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Average yield					1.7		2.6		0.3		0.2					1.2				5.8		3.0								

Production of groundnut is in shell. Production of Durian is estimated as 200 tree/ha, and 15 fruit/tree on average.





Table III-11 Crop Area and Production/Livestock in Salavan District in 1994 by Zone (Study Area)

Zone	No. of Agri House-hold	Lowland Rice		Upland Rice		Groundnut		Coffee		Banana		Maize		Chilly		Cotton		Cardamom		Livestock				
		Total area (ha)	Production (ton)	Total area (ha)	Production (ton)	Total area (ha)	Production (ton)	Total area (ha)	Production (ton)	Total area (ha)	Production (ton)	Total area (ha)	Production (ton)	Total area (ha)	Production (ton)	Total area (ha)	Production (ton)	Total area (ha)	Production (ton)	Cattle	Buffalo	Pig	Poultry	
<b>Zone 1</b>																								
Total	503	858	786	2358	72	173															997	898	820	5834
Average/family		1.7	1.6	4.7	0.1	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	1.8	1.6	11.6
Average yield				3.0		2.4																		
<b>Zone 2</b>																								
Total	1030	1226	1160	3480	66	99															1741	1522	1340	11740
Average		1.2	1.1	3.4	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.7	1.5	1.3	11.4
Average yield				3.0		1.5																		
<b>Zone 3</b>																								
Total	64	57	53	159.0	4	6															153	192	200	344
Average		0.9	0.8	2.5	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4	3.0	3.1	5.4
Average yield				3.0		1.5																		
<b>Zone 4</b>																								
Total	1145	728	387	1161	17	26	175	175	54	16	4	12	8	16	23	7	29	15	31	9	1741	1522	1340	11740
Average		0.6	0.3	1.0	0.0	0.0	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	1.3	1.2	10.3
Average yield				3.0		1.5																		
<b>Total</b>																								
Total/average	2742	2869	2386	7158	159	304	175	175	54	16	4	12	8	16	23	7	29	15	31	9	4632	4134	3700	29658
Average/household		1.0	0.9	2.6	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.7	1.5	1.3	10.8
Average yield				3.0		1.5																		

Data source: Salavan District Agriculture and Forestry services.

Table III-12 Crop Area and Production/Livestock in Thateng District in 1994 by Zone (Study Area)

Zone	No. of household (No.)	Agri. area (ha)	Coffee		Rice		Cardamom Area (ha)	Prod. (ton)	Cattle	Buff	Pig	Poultry	Goat	Horse	Fibery (ha)			
			Area (ha)	Prod. (ton)	Area (ha)	Prod. (ton)												
<b>Zone 1</b>																		
Total/average	294	450	134	59	183	329	34	68	99	29.7	106	120	60	60	35	9	0	
Average/household		1.5	0.5	0.2	0.6	1.1	0.1	0.2	0.3	0.1	0.4	0.4	0.2	0.2	0.1	0.0	0.0	
Average yield				0.44		1.80		2.00		0.30								
* Livestock in zone 1 is of 116 households of two villages.																		
<b>Zone 2</b>																		
Total/average	1057	944	324	83.4	447	805	44	88	129	21.1	1153	415	538	2939	116	13	0	
Average/household		0.9	0.3	0.1	0.4	0.8	0.0	0.1	0.1	0.0	1.1	0.4	0.5	2.8	0.1	0.0	0.0	
Average yield			0.26			1.8		2.0		0.2								
* Livestock in zone 1 is of 116 households of two villages.																		
<b>Zone 3</b>																		
Total/average	659	636	230	48.5	244	439	118	232	44	7.7	267	514	530	2447	0	0	0	
Average/household		1.0	0.3	0.1	0.4	0.7	0.2	0.4	0.1	0.0	0.4	0.8	0.8	3.7	0.0	0.0	0.0	
Average yield			0.21			1.80		1.97		0.18								
* Livestock in zone 3 is of 384 households of 10 villages.																		
<b>Zone 4</b>																		
Total/average	654	595	280	71	231	416	77	152	6	1.4	220	43	0	0	0	0	1	
Average/household		0.9	0.5	0.3	3.3	1.8	0.2	2.0	0.0	0.2	157.1	0.2	0.0				0.0	
Average yield			0.25			1.80		1.97		0.23								
* Livestock in zone 4 is of 256 households of 4 villages.																		
<b>District Total</b>																		
Total/average	2664	2625	968	261.9	1105	1989	273	540	278	59.9	1746	1092	1128	5446	151	22	1	0
Average/household		1.0	0.4	0.3	4.2	1.8	0.1	2.0	0.5	0.2	29.1	0.6	1.0	4.8	0.0	0.1	0.0	0.0
Average yield			0.27			1.80		1.98		0.22								0.00

Data source: Thateng District Agriculture and Forestry Services.

Table III-13 Present Farming Practices

Inputs:	Unit	Rice		Coffee*	Tea	Cardamon**	Cabbage	Potato	Groundnut	Soybeans	Maize	Pineapple *****
		Upland	Lowland									
1 Nursery/seedling	Yield t/ha	1.5	2.6	*0.3	0.26	0.3	8	10	1	1	1	25
Seed	Kg	80	50				0.8	700	45	60	15	
Seedling	No./ha		0	625	4000	20000						10000
Fertilizer	Kg		0	0	0							0
Chemicals	Kg		0	0	0							0
2 Labour force:	man/day											
Field preparation		43	37			5	20	20	40	40	40	40
Fencing		16	0				10	10	10	10	10	
Nursery		0	10				10					
Transplanting/seedling		17	28			10	10	7	10	10	5	
Weeding		56	17	90	90	20	20	20	10	15	10	10
Irrigation/watering		0	0	0	0		10					
Harvesting/threshing		66	56	50	70	20	15	10	20	15	10	15
Drying				20	20	5						
Pruning				10	10							
sub-total		198	148	170	190	60	95	67	90	90	75	65
3 Animal power												
Plowing/harrowing		0	15	0	0	0	10	10	0	0	0	0
Transportation		0	3	1	0	0	3	4	2	2	2	10
4 Material:												
Fertilizers	Kg	0	***100	0	0	0	***400	150	0	0	0	0
Chemicals	Lit.	0	0	0	0	0	2	1	0	0	0	0
5 Others												

Spacing: Coffee 4mx4m Groundnut 0.3mx0.3m

Cardamon 0.7mx0.7m Soybeans 0.7mx0.7m

Cabbage 1mx1m

Pineapple 1mx1m,

Tea 4000 trees/ha

\* Robusta shares about 90% of the coffee in the area, unbullied dry cber

\*\* Mix-culture with upland rice, yield is with cupsle.

\*\*\* N:P:K=16:20:0

\*\*\*\*\* 85% of plant is harvested

Table III-14 Proposed Cropping Pattern for Basic Development Plan

(Unit:ha)

Altitude(m)	Crops	Existing area(ha)	Crops	Irrigated area		Non-irrigated area		Total		
				Wet	Dry	Wet	Dry	Wet	Dry	
I. above 1000	Coffee	10,280	Coffee(Robusta)	1,590	1,590	12,000	12,000	13,590	13,590	
	Tea	380	Tea	380	380	1,000	1,000	1,380	1,380	
	Upland rice	670	Upland rice	0	0	0	0	0	0	
	Lowland rice	0	Lowland rice	0	0	0	0	0	0	
	Vegetables	400	Vegetables	480	480	2,350	1,000	2,830	1,480	
	Cardamom	700	Cardamom	0	0	100	100	100	100	
	Field crops	*	Field crops	0	0	5,000	2,000	5,000	2,000	
	Sub-total	12,430			2,450	2,450	20,450	16,100	22,900	18,550
Potential for expansion	10,470							0		
Total area	22,900							22,900		
II. 600 ~ 1000	Coffee	10,100	Coffee(Robusta)	2,000	2,000	3,000	3,000	5,000	5,000	
			Coffee(Arabica)	4,255	4,255	25,000	25,000	29,255	29,255	
	Tea	0	Tea	0	0	0	0	0	0	
	Upland rice	3,470	Upland rice	0	0	300	0	300	0	
	Lowland rice	510	Lowland rice	2,090	2,090	0	0	2,090	2,090	
			Lowland rice	5,245		0	0	5,245	0	
	Vegetables	0	Vegetables		5,245	2,880	500	2,880	5,745	
			Vegetables		2,530			0	2,530	
	Cardamom	1,020	Cardamom	0	0	500	500	500	500	
			Field crops	2,530		12,000	0	14,530	0	
Sub-total	15,100			16,120	16,120	43,680	29,000	59,800	45,120	
Potential for expansion	44,700							0		
Total area	59,800							59,800		
III. 400 ~ 600	Coffee	2,000	Coffee(Robusta)	3,160	3,160	6,370	6,370	9,530	9,530	
	Tea	0	Tea	0	0	0	0	0	0	
	Upland rice	2,320	Upland rice	0	0	200	0	200	0	
	Lowland rice	500	Lowland rice	515	515	0	0	515	515	
			Lowland rice	4,355		0	0	4,355	0	
			Field crops		3,555			0	3,555	
	Vegetables	0	Vegetables	0	0	0	0	0	0	
	Cardamom	680	Cardamom	0	0	100	100	100	100	
			Fruit trees**			5,000	5,000	5,000	5,000	
	Sub-total	5,500			8,030	7,230	11,670	11,470	19,700	18,700
Potential for expansion	14,200							0		
Total area	19,700							19,700		
IV. below 400	Coffee	2,000	Coffee(Robusta)	0	0	2,000	2,000	2,000	2,000	
	Tea	0	Tea	0	0	0	0	0	0	
	Upland rice	2,480	Upland rice	0	0	200	0	200	0	
	Lowland rice	2,890	Lowland rice	7,635	7,635	0	0	7,635	7,635	
			Lowland rice	20,435				20,435	0	
			Field crops		8,805	2,830		2,830	8,805	
	Vegetables	0	Vegetables	0	0	0	0	0	0	
	Cardamom	720	Cardamom	0	0	100	100	100	100	
	Sub-total	8,090			28,070	16,440	5,130	2,100	33,200	18,540
	Potential for expansion	25,110							0	
Total area	33,200							33,200		
Total	Existing area	41,120	Proposed area	54,670	42,240	80,930	58,670	135,600	100,910	
	Potential for expansion	94,480						0		
	Grand total	135,600						135,600		
Total	Coffee	24,380	Coffee	11,005	11,005	48,370	48,370	59,375	59,375	
	Tea	380	Tea	380	380	1,000	1,000	1,380	1,380	
	Upland rice	8,940	Upland rice	0	0	700	0	700	0	
	Lowland rice	3,900	Lowland rice	40,275	10,240	0	0	40,275	10,240	
	Vegetables	400	Vegetables	480	8,255	5,230	1,500	5,710	9,755	
	Cardamom	3,120	Cardamom	0	0	800	800	800	800	
	Filed crops		Filed crops	2,530	12,360	19,830	2,000	22,360	14,360	
	Fruit trees		Fruit trees	0	0	5,000	5,000	5,000	5,000	
Total	41,120			54,670	42,240	80,930	58,670	135,600	100,910	

\* Existing area is negligible small.

\*\* Fruit trees such as Durian, bananas, etc.

Table III-15 Present Agricultural Condition in and around Selected Project Areas

Item	(Unit)	Project Area No.															(total)								
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		16							
Altitude	m-	900	900	1000	1000	850	800	800	900	900	800	100	200	600	700	1000	1000	400	200	300	400	600			
1 Village data:																									
- No. of village	nos.	7	3	2	1	3	4	1	6	5	2	11	6	13	5	5	1	75						1	75
- No. of household	nos.	760	247	254	100	196	398	48	417	491	233	936	381	885	243	166	28	5,783						28	5,783
- Population	nos.	4,152	1,388	1,257	526	821	2,041	205	2,126	2,575	1,158	4,887	2,184	5,759	1,559	851	138	31,627						138	31,627
2 Main crop area:																									
- Coffee	ha	1,673	731	391	132	98	221	18	10	1,272	470	187	0	0	0	92	5	5,300						5	5,300
- Tea	ha	231	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	231						0	231
- Upland rice	ha	5	0	103	2	16	98	15	76	346	105	578	2	114	0	65	7	1,532						7	1,532
- Lowland rice	ha	0	0	0	0	125	25	0	139	0	0	12	65	1,255	105	8	3	1,737						3	1,737
- Vegetables	ha	0	68	0	0	0	0	0	0	0	0	0	0	0	0	0	0	68						0	68
- Field crops	ha	0	0	0	0	0	0	0	0	0	0	90	104	0	41	0	0	235						0	235
- Cardamom	ha	0	0	0	0	0	0	0	7	0	0	282	0	0	0	0	0	289						0	289
3 Livestock:																									
- Cattle	heads	1,862	568	395	345	89	151	22	765	847	767	573	549	1,658	495	17	9,103						17	9,103	
- Buffalo	heads	0	0	0	59	61	217	22	403	0	0	61	621	1,748	580	20	3,792						20	3,792	
- Horse	heads	0	0	40	10	0	0	0	0	0	0	0	0	0	0	0	50						0	50	
- Pig	heads	448	79	349	39	50	402	173	243	512	328	1,842	429	1,138	434	35	6,501						35	6,501	
- Goat	heads	0	7	0	0	0	0	12	0	0	0	0	0	0	0	0	19						0	19	
- Poultry	heads	5,454	597	279	419	510	958	124	3,815	1,573	1,179	3,659	2,993	12,006	2,901	400	36,867						400	36,867	
- Fishpond	ha	13	5	3	2	5	9	2	0	0	0	0	0	0	0	0	39						0	39	

\* Data were not available.

Table III-16 Proposed Cropping Pattern in Selected Project Areas

Project No.	Present				With Project			
	Wet season		Dry season		Wet season		Dry season	
	Crops	Area (ha)	Crops	Area (ha)	Crops	Area (ha)	Crops	Area (ha)
1.	Coffee	640	Coffee	640	Coffee	640	Coffee	640
	Tea	88	Tea	88	Tea	88	Tea	88
	Upland rice	5			Field crops	5	Vegetables	5
	<b>Total</b>	<b>733</b>	<b>Total</b>	<b>728</b>	<b>Total</b>	<b>733</b>	<b>Total</b>	<b>733</b>
2.	Field crops	0	Coffee	0	Field crops	25	Field crops	25
	Vegetables	0	Vegetables	0	Vegetables	25	Vegetables	25
	<b>Total</b>	<b>0</b>	<b>Total</b>	<b>0</b>	<b>Total</b>	<b>50</b>	<b>Total</b>	<b>50</b>
3.	Coffee	391	Coffee	391	Coffee	647	Coffee	647
	Upland rice	103			Upland rice	0	Vegetables	103
					Vegetables	103		
	<b>Total</b>	<b>494</b>	<b>Total</b>	<b>391</b>	<b>Total</b>	<b>750</b>	<b>Total</b>	<b>750</b>
4.	Coffee	132	Coffee	132	Coffee	372	Coffee	372
	Upland rice	2			Upland rice	0	Vegetables	98
					Vegetables	98		
	<b>Total</b>	<b>134</b>	<b>Total</b>	<b>132</b>	<b>Total</b>	<b>470</b>	<b>Total</b>	<b>470</b>
5.	Coffee	98	Coffee	98	Coffee	98	Coffee	98
	Lowland rice	125			Lowland rice	332	Lowland rice	125
	Upland rice	16			Field crops	191	Vegetables	398
	<b>Total</b>	<b>239</b>	<b>Total</b>	<b>98</b>	<b>Total</b>	<b>621</b>	<b>Total</b>	<b>621</b>
6.	Coffee	170	Coffee	170	Coffee	170	Coffee	170
	Upland rice	75					Vegetables	75
	Lowland rice	19			Lowland rice	94	Lowland rice	19
	<b>Total</b>	<b>264</b>	<b>Total</b>	<b>170</b>	<b>Total</b>	<b>264</b>	<b>Total</b>	<b>264</b>
7.	Coffee	18	Coffee	18	Coffee	280	Coffee	280
	Upland rice	15			Lowland rice	38	Vegetables	61
					Vegetables	23		
	<b>Total</b>	<b>33</b>	<b>Total</b>	<b>18</b>	<b>Total</b>	<b>341</b>	<b>Total</b>	<b>341</b>
8.	Coffee	10	Coffee	10	Coffee	10	Coffee	10
	Cardamom	7	Cardamom	7	Cardamom	7	Cardamom	7
	Upland rice	76			Lowland rice	980	Field crops	980
	Lowland rice	139			Lowland rice	1600	Lowland rice	1600
<b>Total</b>	<b>232</b>	<b>Total</b>	<b>17</b>	<b>Total</b>	<b>2,597</b>	<b>Total</b>	<b>2,597</b>	
9.	Coffee	865	Coffee	865	Coffee	865	Coffee	865
	Upland rice	236			Lowland rice	80	Field crops	80
					Lowland rice	160	Fallow	160
<b>Total</b>	<b>1,101</b>	<b>Total</b>	<b>865</b>	<b>Total</b>	<b>1,105</b>	<b>Total</b>	<b>1,105</b>	
10.	Coffee	368	Coffee	368	Coffee	368	Coffee	368
	Upland rice	82			Lowland rice	41	Vegetables	82
					Vegetables	41		
<b>Total</b>	<b>450</b>	<b>Total</b>	<b>368</b>	<b>Total</b>	<b>450</b>	<b>Total</b>	<b>450</b>	
11.	Coffee	187	Coffee	187	Coffee	187	Coffee	187
	Lowland rice	12			Lowland rice	420	Field crops	420
	Cardamom	282	Cardamom	282	Lowland rice	3890	Fallow	3890
	Field crops	90						
	Upland rice	578						
	<b>Total</b>	<b>1149</b>	<b>Total</b>	<b>469</b>	<b>Total</b>	<b>4,497</b>	<b>Total</b>	<b>4,497</b>
12.	Lowland rice	65			Lowland rice	1240	Field crops	1240
	Upland rice	2			Lowland rice	560	Fallow	560
	Filed crops	104						
	<b>Total</b>	<b>171</b>			<b>Total</b>	<b>1,800</b>	<b>Total</b>	<b>1,800</b>
13.	Lowland rice	1255			Lowland rice	1500	Lowland rice	1500
	Upland rice	114			Lowland rice	640	Field crops	640
					Lowland rice	1700	Fallow	1700
	<b>Total</b>	<b>1369</b>			<b>Total</b>	<b>3,840</b>	<b>Total</b>	<b>3,840</b>
14.	Lowland rice	105			Lowland rice	240	Lowland rice	240
	Field crops	41			Lowland rice	400	Fallow	400
	<b>Total</b>	<b>146</b>			<b>Total</b>	<b>640</b>	<b>Total</b>	<b>640</b>
15.	Coffee	92	Coffee	92	Coffee	92	Coffee	92
	Lowland rice	8			Lowland rice	2808	Lowland rice	1896
	Upland rice	65					Field crops	912
	<b>Total</b>	<b>165</b>	<b>Total</b>	<b>92</b>	<b>Total</b>	<b>2,900</b>	<b>Total</b>	<b>2,900</b>
16.	Coffee	5	Coffee	5	Coffee	5	Coffee	5
	Lowland rice	3			Lowland rice	346	Lowland rice	178
	Upland rice	7					Field crops	168
	<b>Total</b>	<b>15</b>	<b>Total</b>	<b>5</b>	<b>Total</b>	<b>351</b>	<b>Total</b>	<b>351</b>
<b>Grand total</b>	<b>6,695</b>		<b>3,353</b>		<b>21,408</b>		<b>21,408</b>	