

**ラオス国森林減少抑制のための
参加型土地・森林管理プロジェクトに係る
REDD+認証・登録支援業務**

**技術成果報告書
「標本木調査の取りまとめ結果」**

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独立行政法人国際協力機構（JICA）

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一般社団法人日本森林技術協会

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-目次-

第1章 調査の目的.....	1
第2章 調査方法	3
1. 調査対象地	3
2. 各森林タイプで算定対象とした炭素プール.....	3
3. 標本木破壊調査の対象木	4
4. 各対象木のバイオマス算定方法.....	4
5. 相対成長式(アロメトリ式)の開発	5
第3章 調査結果	6
1. 標本木の解析結果.....	6
2. 開発した相対成長式(アロメトリ式)	9
3. 対象地における炭素ストック量の動態.....	10
参考資料 1 IPCC 排出係数データベースの整理・分析	11
参考資料 2 標本木破壊調査の様子(写真).....	22

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第1章 調査の目的

本業務では、ルアンプラバン県全域及びポンサイ郡ホアイキン村落クラスターを対象に参照レベルの設定を進めたが、参照レベルを設定するためには、別途実施した衛星画像解析によって得られた経年的な森林タイプごとの面積変化（詳細は技術協力成果品「森林動態の解析結果」を参照されたい）に、森林タイプごとの単位面積あたり炭素ストック量（本業務における排出係数）を乗じることによって、森林タイプごとの経年的な炭素ストック量の動態を算定することが求められた（図1）。その結果として、対象地において森林タイプごとに面積変化した場合（森林タイプが変化した場合）の炭素ストック量の増減（排出または吸収）が求められ、その傾向が参照レベル算定の基礎となるという認識の下で作業を進めた。

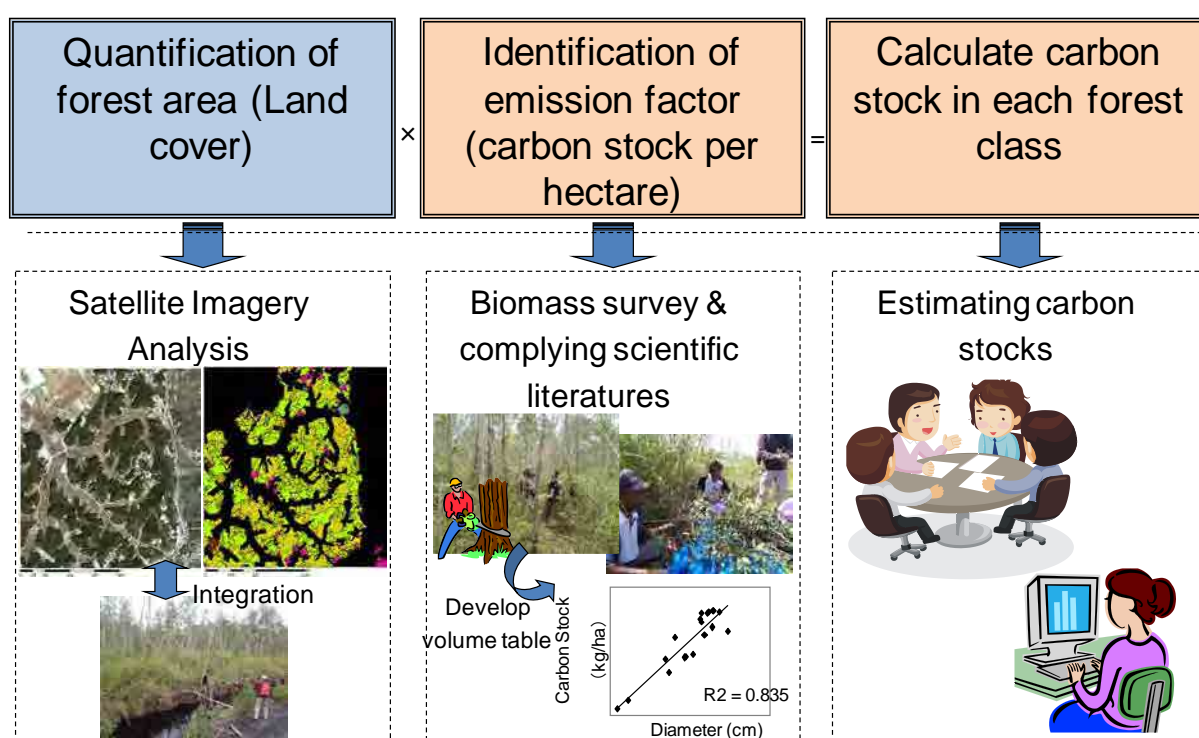


図1 森林タイプごとの炭素ストック量の算定フロー

以上より、排出係数とは狭義には森林における炭素蓄積量に関する係数のうち、幹材積、材積からバイオマスへの換算係数、幹バイオマスから枝葉バイオマスへの換算係数（拡大係数）と細分化されるが、広義には森林タイプごとに示される面積あたりの炭素ストック量を指す。

本業務では、以上の狭義と広義の双方の観点から、森林タイプそれぞれの炭素ストック量を定量化することが参照レベルの設定にあたって必要であると認識し、このために排出係数の開発を進めた。なお、参照レベルの設定は、技術協力成果品「森林動態の解析結果」、技術協力成果品「森林プロット調査の取りまとめ結果」、そして本技術協力成果品の3つを活用することで進めたが、3つの技術協力成果品の関係は以下の通りとなる（図2）。そして、3つの技術協力成果品により得られた参照レベルは、業務完了報告書に整理した。

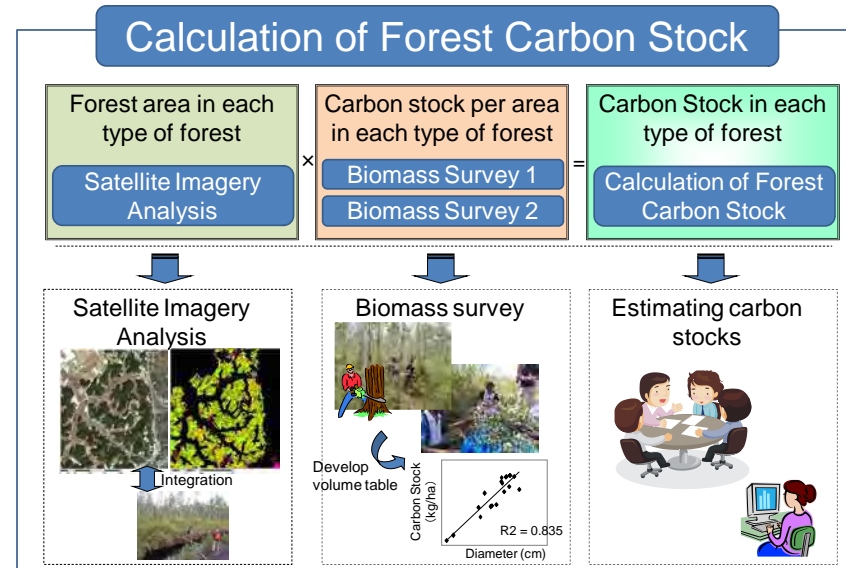
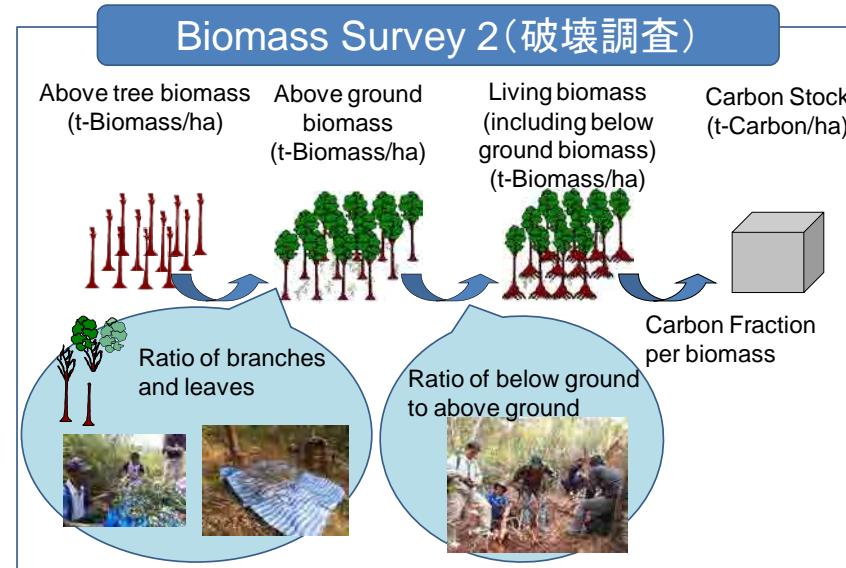
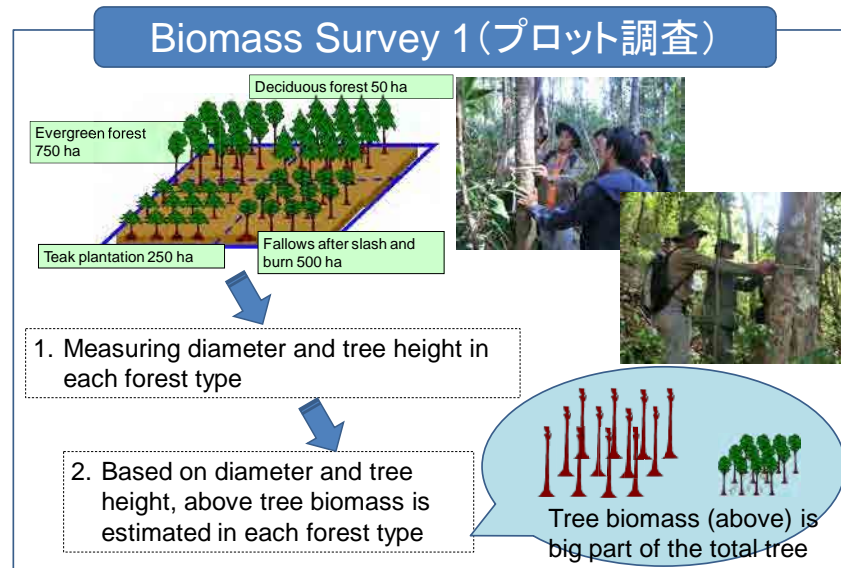
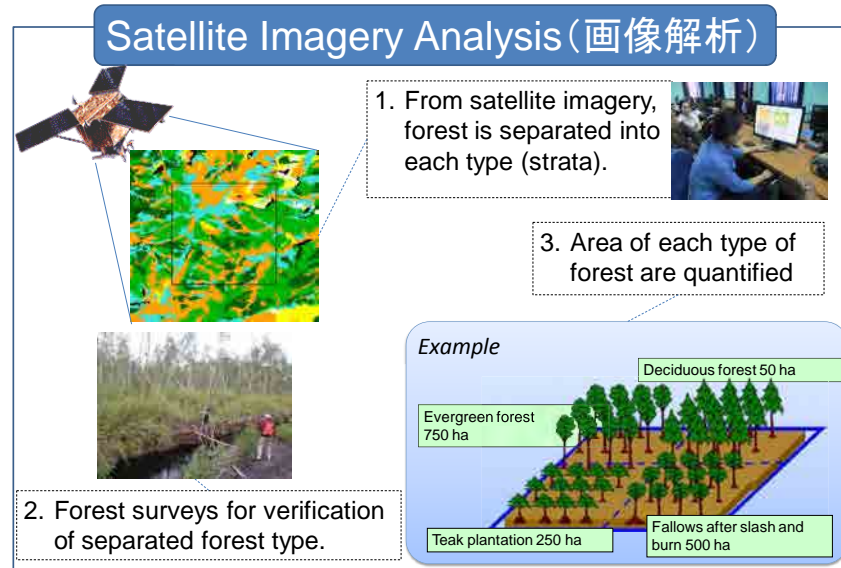


図2 技術協力成果品の関係

第2章 調査方法

1. 調査対象地

上述した通りルアンプラバン県全域、及びポンサイ郡ホアイキン村落クラスターを対象に参照レベルの設定を進めることを目的とすることから、本調査ではルアンプラバン県内における平均的な林分で調査を進める必要があった。このため、技術協力成果品「森林動態の解析結果」を作成するために実施した衛星画像の解析結果、及び解析にあたって実施した現地踏査 (Ground Truth) の結果に基づき、調査対象地はルアンプラバン県ポンサイ郡ホアイキン村落クラスターのうち、標高約 700m に位置する林分を対象にした。なお、本来であれば対象地はルアンプラバン県全域から均等に選定するのが望ましいが、ポンサイ郡ホアイキン村落クラスターはルアンプラバン県の概ね中央に位置し、また標高も概ね平均であったこと、加えて標本木の伐採許可や県・郡・大学の協力といった調査を進める上での体制面を考慮して対象とした。

2. 各森林タイプで算定対象とした炭素プール

本業務で計測の対象とする炭素プールは、IPCC に基づき 5 つに区分できるが (図 3)、本業務では地上部バイオマス (幹・枝)、地下部バイオマス (根) の 2 つを算定対象とし、その他の炭素プールである枯死木、落枝落葉、そして土壌有機炭素は算定対象外とした。

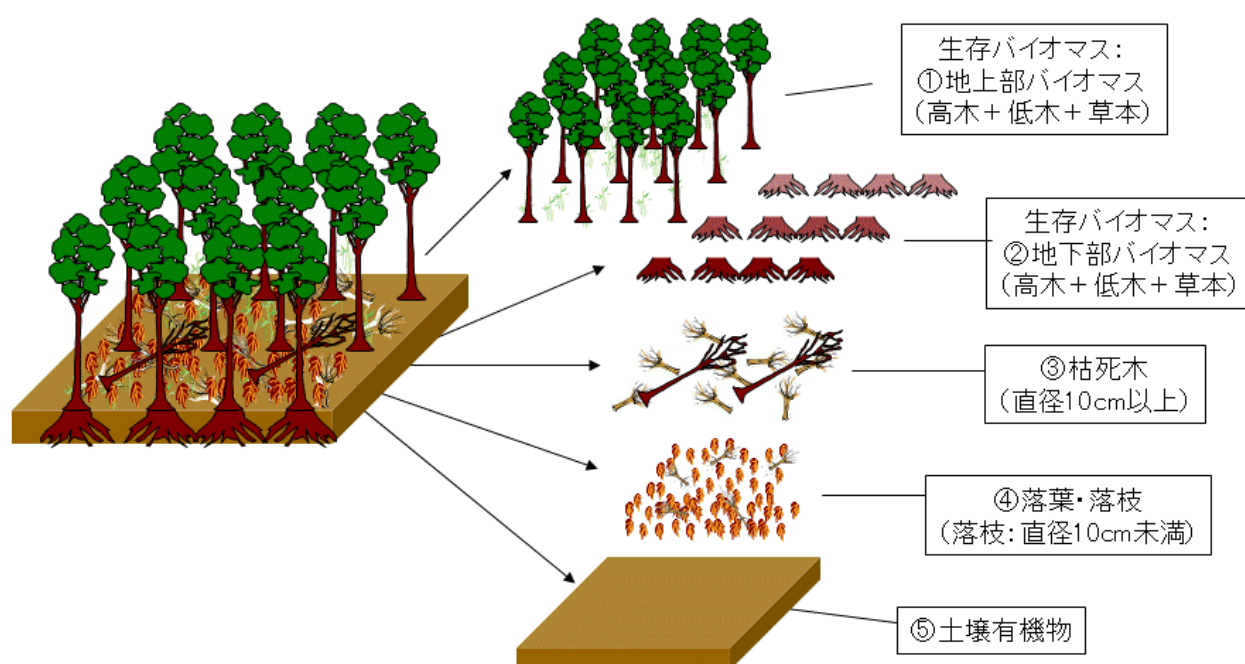


図3 森林における5つの炭素プール

なお、枯死木及び落葉落枝については人為影響による森林タイプの変化が起こった場合でも排出・吸収量が微量であること、土壌有機炭素については、先行研究をレビューした結果から焼畑等の人為影響が起こった場合でも大きな排出源にはならないことから、算定対象外とした (詳細は技術協力成

果品「森林プロット調査の取りまとめ結果」の参考資料 1 を参照されたい。

3. 標本木破壊調査の対象木

排出係数の開発にあたり、対象地の森林の大部分を占める Deciduous Forest (DF) 及び Evergreen Forest (EF) を対象に標本木破壊調査を実施した。標本木破壊調査は、対象とする森林タイプに優占する樹木の、胸高直径を独立変数とした幹、枝、根の器官別のバイオマス式を調製するためのものである。対象木はプロット調査（技術協力成果品「森林プロット調査の取りまとめ結果」）で計測した主要な樹種につき、個体サイズの最小から最大をカバーするのが望ましく、それぞれ伐倒した樹木のうち、幹・枝・根の器官別に計測した。

選定した樹木の樹種を同定し、常緑もしくは落葉の別を記録した。本調査では、合計 39 本を選定し、幹部についてはバイオマスの大部分を占めることから全てを計測したが、枝・葉・根については割合が幹ほどには高くないにも関わらず人手と時間を要することから、計測本数を減らしてそれぞれ 28 本、23 本、15 本を計測対象とした。

4. 各対象木のバイオマス算定方法

幹の炭素ストック量の算定にあたっては、伐倒後に算定した幹材積、そして一部採取した幹材の乾燥試料から求める乾重率を乗じることによりバイオマスが求められる。バイオマスの算定は以下の手順に従った。

1. 幹バイオマスの算定にあたっては、基本的に幹を 1m ごとに区分して（玉切りして）その両端の直径を計測し、両端断面積の平均に区分長を乗じて区分材積を求めた（スマリアン式）。なお、根元側から最も遠い梢端部については三角錐の求積式で区分材積を求めた。
2. 枝と根については、それぞれにつき生重量と、一部採取した乾燥試料の乾重率を生重量に乗じて器官バイオマスを求めた。
3. 大径木については調査のためだけに伐り倒すのは郡の許可も村人の理解も得られにくいので、村人によって火入れ前に伐り倒された木や、道路拡張等工事に伴って重機で掘り出された根を計測するのが望ましく、その方法に従った。

なお、乾重率の算定にあたっては、各器官からサンプルを採取し、生重量を計量したうえ、乾燥機 80℃ で恒量に達するまで乾燥させ、絶乾重量を計量することで求めた。乾重率より幹の容積密度、及び幹バイオマスに対する枝・葉・根の割合（拡大係数）を求めた（図 4）。

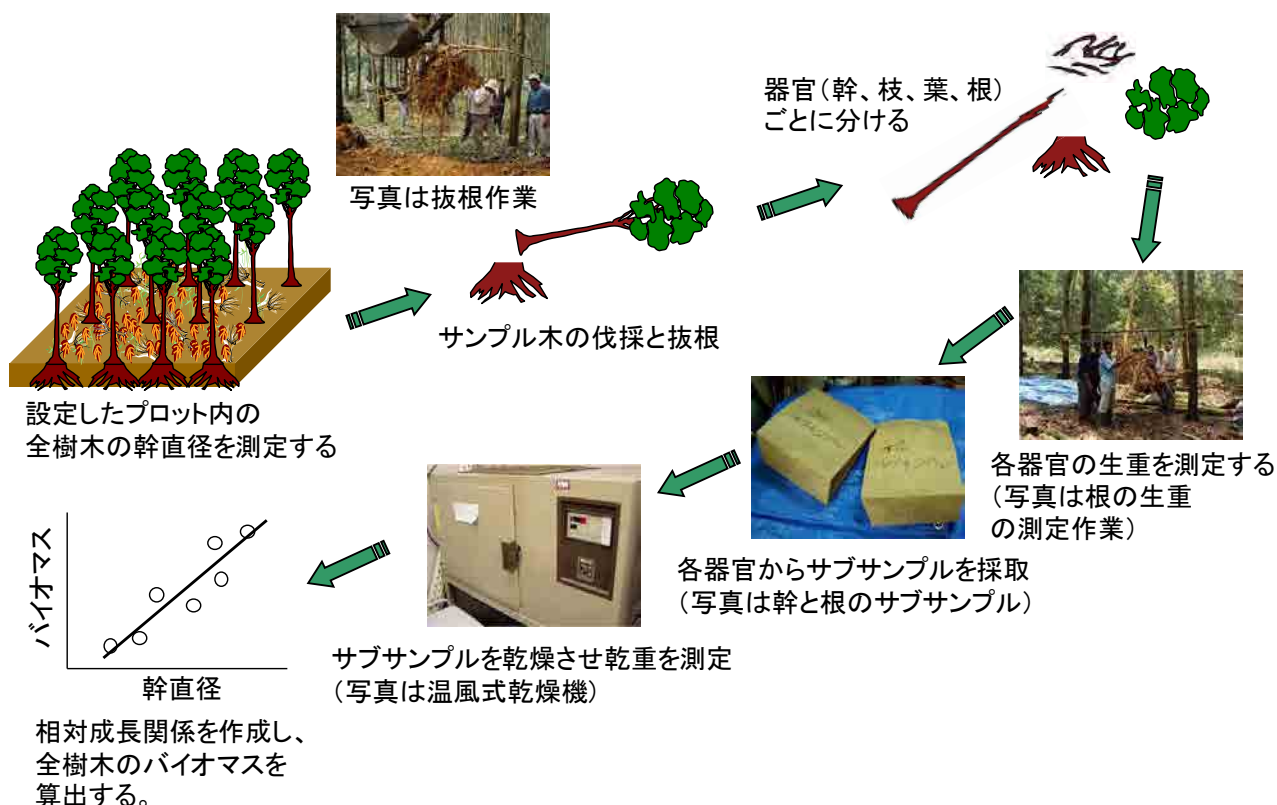


図4 器官別のバイオマス算定方法

5. 相対成長式（アロメトリ式）の開発

標本木調査の結果から、各標本木の胸高直径、幹・枝・根のバイオマスを得て、それらを用いて胸高直径を独立変数とした幹、枝、根の器官別のバイオマス式を調製した。相対成長式（アロメトリ式）は以下の式で表される。

$$B = a \times D^b \dots\dots\dots \text{式 (1)}$$

B： 器官別のバイオマス (kg)

D： 胸高直径 (cm)

第3章 調査結果

1. 標本木の解析結果

本調査で得られた標本木の詳細を次ページの表1に示す。標本木の胸高直径は最小が5.0cm、最大が115.0cmであり、小径木から大径木までバランスよく抽出することができた。なお、標本木の樹種は、全て現地名を記録できたものの学名への変換が半数に留まっており、樹種同定には課題を残した。

胸高直径と樹高をみると、大径にも拘らずそれほど高くない。この現象は山岳地帯ゆえに生じていると思われるが、程度の差こそあれ対象地域の大部分で共通していることから、相対成長式（アロメトリ式）の精度には大きな問題はないと考えられた。

乾重率を求めるためのサンプルに基づく分析からは、幹では容積密度が $0.54\sim0.86\text{g/cm}^3$ であったこと、枝の乾重率で $0.44\sim0.81\text{g/g}$ であったこと、同じく葉の乾重率で $0.38\sim0.69\text{g/g}$ 、根の乾重率で $0.40\sim0.63\text{g/g}$ だったことが分かった。これらの値はIPCC Emission Factor Databaseに掲載されている代表的な値と大きな差がなく、十分に適用可能であることが示唆された。

表 1 標本木の特性

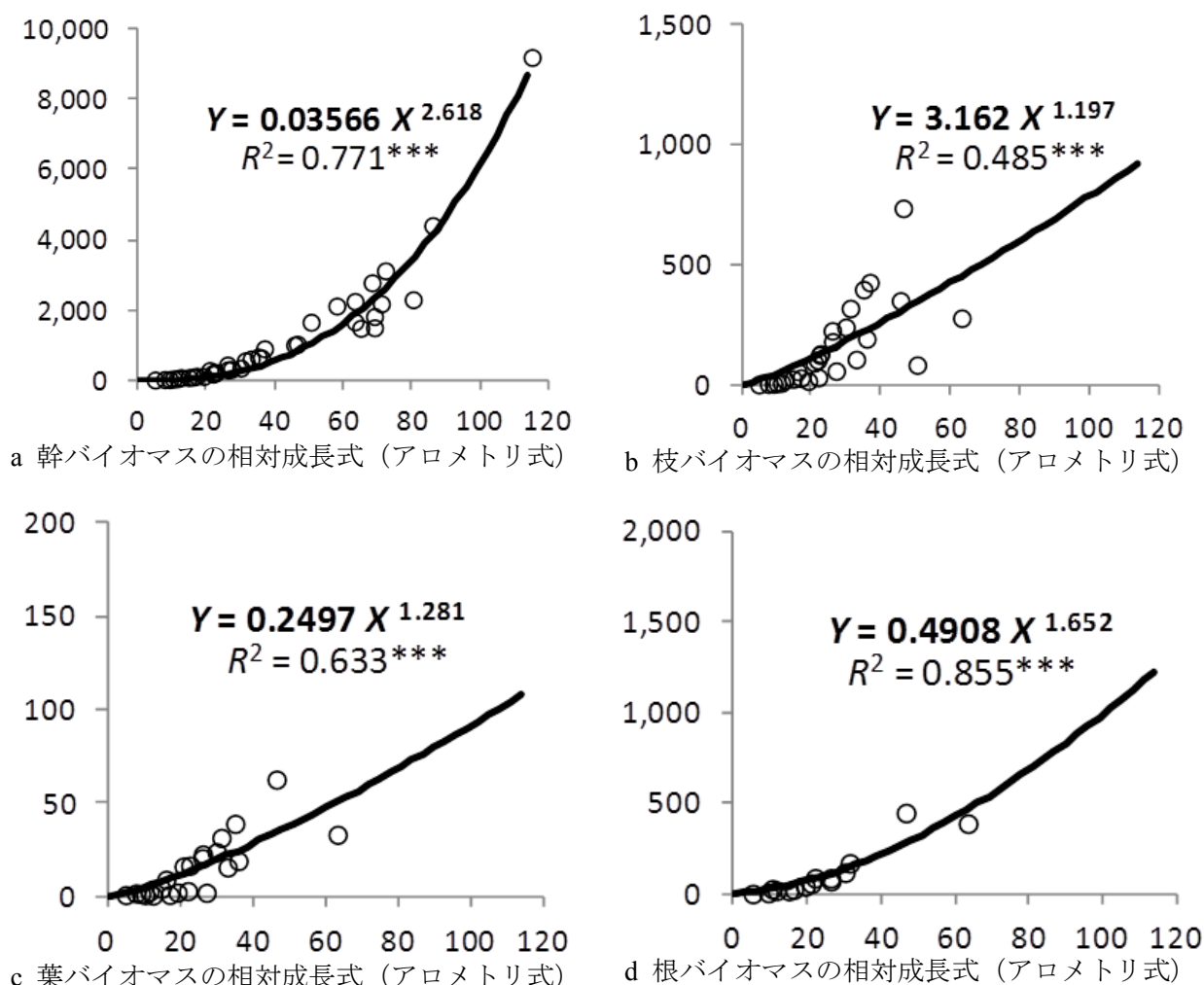
Species		Evergreen/ Deciduous	dbh	height	Stem Volume	Green weight(kg)			Subsamples				Biomass (kg)			
Local	Scientific					Branch	Leaf	Root	Stem bulk density	Weight ratio (g/ g)			Stem	Branch	Leaf	Root
									(g/cm ³ ,ton/m ³)	Branch	Leaf	Root				
Mai Tao		D	5.0	5.80	0.008	2.4	1.8	2.4	0.659	0.59	0.44	0.49	5.1	1.4	0.8	1.2
Salaphid Kham		D	7.8	10.79	0.031	5.0	3.6		0.565	0.63	0.47		17.6	3.2	1.7	
Kor Khee Mu	<i>Lithocarpus silvicularum</i>	E	9.2	7.50	0.024	7.0	2.9	11.3	0.677	0.55	0.49	0.56	16.6	3.8	1.4	6.4
Kor Nung Xang	<i>Quercus vestita</i> Rehd. & Wils	D	10.3	9.36	0.046	11.8	1.5	44.0	0.740	0.57	0.56	0.62	33.8	6.7	0.8	27.2
Kor Khee Mu	<i>Lithocarpus silvicularum</i>	E	11.5	10.86	0.058	16.0	5.5	30.9	0.719	0.52	0.47	0.60	42.0	8.3	2.6	18.5
Kor Khee Mu	<i>Lithocarpus silvicularum</i>	E	12.5	11.85	0.102	35.9	1.0		0.704	0.60	0.59		72.0	21.4	0.6	
Kor Nung Xang	<i>Quercus vestita</i> Rehd. & Wils	D	14.8	11.53	0.920	42.3	7.1	28.4	0.789	0.57	0.58	0.62	73.0	24.0	4.1	17.5
Mai Kor Kibe	<i>Castanopsis ceracantha</i> Hick. et A.Camus	E	16.1	12.40	0.121	87.8	14.1	44.6	0.718	0.64	0.64	0.57	86.9	56.1	9.0	25.3
Mai Mee Kai		D	17.1	15.70	0.167	50.4	1.8		0.674	0.56	0.49		112.7	28.4	0.9	
Mai Mee Kai		D	19.2	13.50	0.189	33.4	4.8	104.9	0.557	0.48	0.45	0.40	105.2	16.1	2.1	42.2
Mi Kor Kak	<i>Castanopsis ceracantha</i> Rehder & Wils	E	20.9	18.00	0.326	143.2	25.0	95.5	0.842	0.64	0.64	0.61	274.3	91.9	16.0	58.0
Mai Koh Douey	<i>Castanopsis argyrophylla</i>	E	21.9	17.00	0.271	137.7		157.8	0.641	0.75		0.56	173.7	102.9		87.7
Mai Mee Kai		D	22.1	18.10	0.336	56.5	5.1		0.627	0.54	0.57		210.6	30.7	2.9	
Mai Koh Douey	<i>Castanopsis argyrophylla</i>	E	22.5	15.80	0.327	208.9			0.627	0.59			204.9	124.1		
Mai Koh Douey	<i>Castanopsis argyrophylla</i>	E	22.7	17.16	0.354	235.4	34.0		0.608	0.55	0.49		215.3	128.8	16.5	
Mi Kor Kak	<i>Castanopsis ceracantha</i> Rehder & Wils	E	26.1	18.30	0.502	339.4	30.8	145.0	0.861	0.66	0.67	0.60	431.6	224.7	20.5	87.3
Mai Koh Douey	<i>Castanopsis argyrophylla</i>	E	26.2	18.30	0.472	321.6	43.6	130.7	0.621	0.56	0.52	0.55	293.3	179.6	22.5	72.0
Mai Mee Kai		D	27.2	16.10	0.494	106.0	3.8		0.619	0.54	0.53		306.0	57.5	2.0	
Mai Koh Douey	<i>Castanopsis argyrophylla</i>	E	30.0	16.19	0.573	430.8	53.5	235.3	0.635	0.56	0.44	0.50	341.1	239.7	23.7	118.6

表1 つづき

Species		Evergreen/ Deciduous	dbh	height	Stem Volume	Green weight(kg)			Subsamples				Biomass (kg)			
Local	Scientific					Branch	Leaf	Root	Stem bulk density	Weight ratio (g/g)			Stem	Branch	Leaf	Root
			(cm)	(m)	(m³)				(g/cm³,ton/m³)	Branch	Leaf	Root				
Mi Kor Kak	<i>Castanopsis ceracantha</i> Rehder & Wils	E	31.3	18.95	0.680	468.6	45.7	269.1	0.809	0.68	0.69	0.63	550.1	317.6	31.3	169.8
Mai Mee Kai		D	33.0	24.88	0.979	187.2	27.6		0.613	0.56	0.56		600.6	105.7	15.6	
Mai Koh Douey	<i>Castanopsis argyrophylla</i>	E	35.1	22.80	1.047	705.0	76.7		0.630	0.56	0.51		659.9	396.0	38.8	
Mai Mee Kai		D	36.0	25.53	0.999	346.7	29.5		0.631	0.55	0.64		630.2	191.2	19.0	
Mai Koh Khek		E	36.9	20.20	1.065	643.5			0.837	0.66			891.8	425.1		
Mai Mee Kai		D	45.7	25.86	1.839	550.0			0.542	0.63			996.2	349.2		
Mai Kor Lin		D	46.5	21.45	1.627	1338.7	134.9	810.7	0.627	0.55	0.46	0.55	1,021.1	733.6	62.4	447.6
Mai Mee Kai		D	50.5	26.30	2.265	101.3			0.727	0.81			1,645.9	82.4		
Kor Khee Mu	<i>Lithocarpus silvicularum</i>	E	58.0	28.00	3.009				0.700				2,106.2			
Mai Kor San		E	63.3	24.80	4.001	625.9	87.5	910.4	0.559	0.44	0.38	0.43	2,238.3	277.0	33.0	388.6
Mai Koh Khek	<i>Castanopsis ceracantha</i> Rehder & Wils	E	63.3	19.49	1.980				0.837				1,657.7			
Mai Mee Kai		D	65.0	18.27	2.363				0.624				1,473.9			
Mai Mee Kai		D	68.3	29.30	4.438				0.624	0.54			2,767.4			
Mai Mee Kai		D	69.0	21.55	2.388				0.624				1,489.4			
Mai Mee Kai		D	69.0	18.60	2.898				0.624				1,807.1			
Kor Khee Mu	<i>Lithocarpus silvicularum</i>	E	71.0	20.40	3.097				0.700				2,168.2			
Mai Kor Kheng	<i>Lithocarpus silvicularum</i> (King)Rehd. et wils.	E	72.2	22.10	3.711				0.837				3,107.0			
Mai Koh Douey	<i>Castanopsis argyrophylla</i>	E	80.3	16.80	3.644				0.627				2,285.4			
Mai Hai		?	86.0	34.50	6.563				0.669				4,390.7			
Mai Wa		?	115.0	31.60	13.672				0.671				9,169.8			

2. 開発した相対成長式（アロメトリ式）

上記の標本木の解析結果を用いて開発した相対成長式（アロメトリ式）（胸高直径を独立変数とした幹、枝、根の器官別のバイオマス式）を以下の図5示した。



※図中の***は有意水準0.1%で有意であることを示す。

図5 胸高直径に対する幹・枝・葉・根のバイオマスの回帰

幹では独立変数である胸高直径の範囲が広く、相関係数が高く良好な回帰となった。枝・葉・根は最大径が幹に及ばず、また幂指数が若干低めではあるものの、有意な回帰となった。枝のばらつきが若干大きくなったが、これは広葉樹ゆえ枝別れの仕方とその区別によると考えられた。幹と枝でひとまとめにすることで回帰の質が数値上は良好になるが、拡大係数の算出が不可能になるなど不都合となるため、本調査では器官別に別個に相対成長式（アロメトリ式）を開発した。

なお、上記の表1中には図5の相対成長式（アロメトリ式）により推定されたバイオマスも示されている。それらの結果から、胸高直径が大きくなるに従って器官バイオマスは大きくなり、地上部拡大係数と地上部バイオマスに対する地下部バイオマスは小さくなっていることが分かった。これらの傾向や値は IPCC Emission Factor Database と整合していた（詳細は巻末の参考資料1を参照されたい）。

3. 対象地における炭素ストック量の動態

開発した相対成長式（アロメトリ式）は、別途実施したプロット調査の結果（技術協力成果品「標本木調査の取りまとめ結果」）を用いることにより、森林タイプごとの炭素ストック量が算定でき、さらに経年的な森林タイプごとの面積変化を解析した調査（技術協力成果品「森林動態の解析結果」）から経年的な炭素ストック量の増減を算定することができた。以上、3つの技術協力成果品から明らかになった対象地における炭素ストック量の動態は、図6の通りとなった。

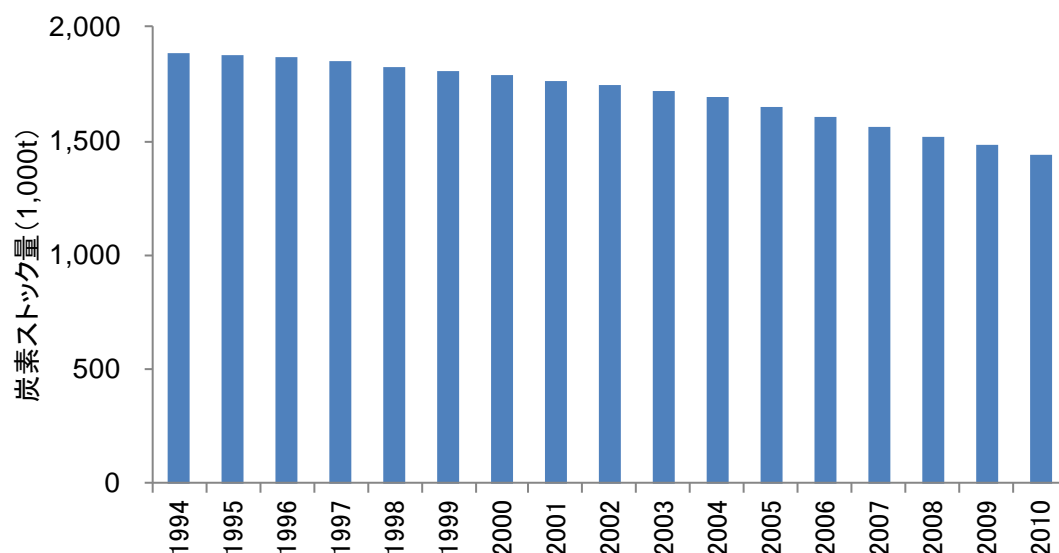


図6 対象地における炭素ストック量の動態

参考資料 1 IPCC 排出係数データベースの整理・分析

IPCC の排出・吸収量算定ガイドライン（1996 年改訂 IPCC ガイドライン、LULUCF 分野におけるグッドプラクティスガイダンス、2006 年 IPCC ガイドライン）、及び Emission Factor Database において整備されているパラメータを抽出・分析した。本来、算定に用いられるパラメータは対象地のデータを用いて設定すべきであるが、データ整備が困難な場合、IPCC の既定値を使用することが推奨される。なお、表中の参照では、便宜的に以下の略称を用いた。

1996GL : 1996 年改訂 IPCC ガイドライン
GPG-LULUCF : LULUCF 分野におけるグッドプラクティスガイダンス
2006GL : 2006 年 IPCC ガイドライン

1. バイオマスストック量

1.1 地上バイオマス

1.1.1 全森林

Domain	Ecological zone	Unit	Data	References
Tropical Asia	Continental	Tropical rain forest	[t-dm/ha]	225.0 1996GL (V3, Chp5, Table 5-4)
		Tropical moist deciduous forest	[t-dm/ha]	185.0 1996GL (V3, Chp5, Table 5-4)
		Tropical dry forest	[t-dm/ha]	100.0 1996GL (V3, Chp5, Table 5-4)
		Tropical shrubland	[t-dm/ha]	75.0 1996GL (V3, Chp5, Table 5-4)
		Tropical mountain system	[t-dm/ha]	190.0 1996GL (V3, Chp5, Table 5-4)
	Insular	Tropical rain forest	[t-dm/ha]	275.0 1996GL (V3, Chp5, Table 5-4)
		Tropical moist deciduous forest	[t-dm/ha]	175.0 1996GL (V3, Chp5, Table 5-4)
		Tropical dry forest	[t-dm/ha]	- 1996GL (V3, Chp5, Table 5-4)
		Tropical shrubland	[t-dm/ha]	- 1996GL (V3, Chp5, Table 5-4)
		Tropical mountain system	[t-dm/ha]	255.0 1996GL (V3, Chp5, Table 5-4)
Lao RDR	-	[m3/ha]	29.0	GPG-LULUCF (Chp3, Table 3A.1.4)
		[t-dm/ha]	31.0	GPG-LULUCF (Chp3, Table 3A.1.4)

1.1.2 天然林

Domain	Ecological zone	Unit	Data	References
Tropical	Tropical rain forest	[t-dm/ha]	300.0	2006GL (V4, Chp4, Table 4.12)
	Tropical moist deciduous forest	[t-dm/ha]	180.0	2006GL (V4, Chp4, Table 4.12)
	Tropical dry forest	[t-dm/ha]	130.0	2006GL (V4, Chp4, Table 4.12)
	Tropical shrubland	[t-dm/ha]	70.0	2006GL (V4, Chp4, Table 4.12)
	Tropical mountain system	[t-dm/ha]	140.0	2006GL (V4, Chp4, Table 4.12)
Tropical Asia	Continental	Tropical rain forest	[t-dm/ha]	280.0 2006GL (V4, Chp4, Table 4.7), GPG-LULUCF (Chp3, Table 3A.1.2)
		Tropical moist deciduous forest	[t-dm/ha]	180.0 2006GL (V4, Chp4, Table 4.7), GPG-LULUCF (Chp3, Table 3A.1.2)
		Tropical dry forest	[t-dm/ha]	130.0 2006GL (V4, Chp4, Table 4.7), GPG-LULUCF (Chp3, Table 3A.1.2)
		Tropical shrubland	[t-dm/ha]	60.0 2006GL (V4, Chp4, Table 4.7), GPG-LULUCF (Chp3, Table 3A.1.2)
		Tropical mountain system (R>1000)	[t-dm/ha]	220.0 2006GL (V4, Chp4, Table 4.7), GPG-LULUCF (Chp3, Table 3A.1.2)
	Insular	Tropical rain forest	[t-dm/ha]	350.0 2006GL (V4, Chp4, Table 4.7), GPG-LULUCF (Chp3, Table 3A.1.2)
		Tropical moist deciduous forest	[t-dm/ha]	290.0 2006GL (V4, Chp4, Table 4.7), GPG-LULUCF (Chp3, Table 3A.1.2)
		Tropical dry forest	[t-dm/ha]	160.0 2006GL (V4, Chp4, Table 4.7), GPG-LULUCF (Chp3, Table 3A.1.2)
		Tropical shrubland	[t-dm/ha]	70.0 2006GL (V4, Chp4, Table 4.7), GPG-LULUCF (Chp3, Table 3A.1.2)
		Tropical mountain system (R>1000)	[t-dm/ha]	360.0 2006GL (V4, Chp4, Table 4.7), GPG-LULUCF (Chp3, Table 3A.1.2)

1.1.3 人工林

Domain	Ecological zone		Unit	Data	References
Tropical	Tropical rain forest		[t-dm/ha]	150.0	2006GL (V4, Chp4, Table 4.12)
	Tropical moist deciduous forest		[t-dm/ha]	120.0	2006GL (V4, Chp4, Table 4.12)
	Tropical dry forest		[t-dm/ha]	60.0	2006GL (V4, Chp4, Table 4.12)
	Tropical shrubland		[t-dm/ha]	30.0	2006GL (V4, Chp4, Table 4.12)
	Tropical mountain system		[t-dm/ha]	90.0	2006GL (V4, Chp4, Table 4.12)
Tropical Asia	Broadleaf	Tropical rain forest	[t-dm/ha]	220.0	2006GL (V4, Chp4, Table 4.8), GPG-LULUCF (Chp3, Table 3A.1.3)
		Tropical moist deciduous forest	[t-dm/ha]	180.0	2006GL (V4, Chp4, Table 4.8), GPG-LULUCF (Chp3, Table 3A.1.3)
		Tropical dry forest	[t-dm/ha]	90.0	2006GL (V4, Chp4, Table 4.8), GPG-LULUCF (Chp3, Table 3A.1.3)
		Tropical shrubland	[t-dm/ha]	40.0	2006GL (V4, Chp4, Table 4.8), GPG-LULUCF (Chp3, Table 3A.1.3)
		Tropical mountain system	[t-dm/ha]	150.0	2006GL (V4, Chp4, Table 4.8), GPG-LULUCF (Chp3, Table 3A.1.3)
	Other species	Tropical rain forest	[t-dm/ha]	130.0	2006GL (V4, Chp4, Table 4.8), GPG-LULUCF (Chp3, Table 3A.1.3)
		Tropical moist deciduous forest	[t-dm/ha]	100.0	2006GL (V4, Chp4, Table 4.8), GPG-LULUCF (Chp3, Table 3A.1.3)
		Tropical dry forest	[t-dm/ha]	60.0	2006GL (V4, Chp4, Table 4.8), GPG-LULUCF (Chp3, Table 3A.1.3)
		Tropical shrubland	[t-dm/ha]	30.0	2006GL (V4, Chp4, Table 4.8), GPG-LULUCF (Chp3, Table 3A.1.3)
		Tropical mountain system	[t-dm/ha]	80.0	2006GL (V4, Chp4, Table 4.8), GPG-LULUCF (Chp3, Table 3A.1.3)

1.2 枯死有機物

Pool	Climate/Forest type		Unit	Data	References
Dead wood	Tropical		[t-dm/ha]	18.2	GPG-LULUCF (Chp3, Table 3.2.2)
Litter	Tropical	Broadleaf deciduous	[t-C/ha]	2.1	2006GL (V4, Chp2, Table 2.2)
		Needleleaf evergreen	[t-C/ha]	5.2	2006GL (V4, Chp2, Table 2.2)

1.3 土壌

土壌炭素ストック量は、リファレンス量に人為活動に応じた係数（ストック変化）を乗じることによって算定する。

1.3.1 リファレンス量

Climate region	Soil type	Unit	Data	References
Tropical - Wet	HAC soils	[t-C/ha]	44	2006GL (V4, Chp2, Table 2.3), GPG-LULUCF (Chp3, Table 3.2.4)
	LAC soils	[t-C/ha]	60	2006GL (V4, Chp2, Table 2.3), GPG-LULUCF (Chp3, Table 3.2.4)
	Sandy soils	[t-C/ha]	66	2006GL (V4, Chp2, Table 2.3), GPG-LULUCF (Chp3, Table 3.2.4)
	Volcanic soils	[t-C/ha]	130	2006GL (V4, Chp2, Table 2.3), GPG-LULUCF (Chp3, Table 3.2.4)
	Wetland soils	[t-C/ha]	86	2006GL (V4, Chp2, Table 2.3), GPG-LULUCF (Chp3, Table 3.2.4)
Tropical - Moist	HAC soils	[t-C/ha]	65	2006GL (V4, Chp2, Table 2.3), GPG-LULUCF (Chp3, Table 3.2.4)
	LAC soils	[t-C/ha]	47	2006GL (V4, Chp2, Table 2.3), GPG-LULUCF (Chp3, Table 3.2.4)
	Sandy soils	[t-C/ha]	39	2006GL (V4, Chp2, Table 2.3), GPG-LULUCF (Chp3, Table 3.2.4)
	Volcanic soils	[t-C/ha]	70	2006GL (V4, Chp2, Table 2.3), GPG-LULUCF (Chp3, Table 3.2.4)
	Wetland soils	[t-C/ha]	86	2006GL (V4, Chp2, Table 2.3), GPG-LULUCF (Chp3, Table 3.2.4)
Tropical - Dry	HAC soils	[t-C/ha]	38	2006GL (V4, Chp2, Table 2.3), GPG-LULUCF (Chp3, Table 3.2.4)
	LAC soils	[t-C/ha]	35	2006GL (V4, Chp2, Table 2.3), GPG-LULUCF (Chp3, Table 3.2.4)
	Sandy soils	[t-C/ha]	31	2006GL (V4, Chp2, Table 2.3), GPG-LULUCF (Chp3, Table 3.2.4)
	Volcanic soils	[t-C/ha]	50	2006GL (V4, Chp2, Table 2.3), GPG-LULUCF (Chp3, Table 3.2.4)
	Wetland soils	[t-C/ha]	86	2006GL (V4, Chp2, Table 2.3), GPG-LULUCF (Chp3, Table 3.2.4)
Tropical - Montane	HAC soils	[t-C/ha]	88	2006GL (V4, Chp2, Table 2.3), GPG-LULUCF (Chp3, Table 3.2.4)
	LAC soils	[t-C/ha]	63	2006GL (V4, Chp2, Table 2.3), GPG-LULUCF (Chp3, Table 3.2.4)
	Sandy soils	[t-C/ha]	34	2006GL (V4, Chp2, Table 2.3), GPG-LULUCF (Chp3, Table 3.2.4)
	Volcanic soils	[t-C/ha]	80	2006GL (V4, Chp2, Table 2.3), GPG-LULUCF (Chp3, Table 3.2.4)
	Wetland soils	[t-C/ha]	86	2006GL (V4, Chp2, Table 2.3), GPG-LULUCF (Chp3, Table 3.2.4)

1.3.2 スtock変化係数

(1) 土地利用

Land-use category	Level	Temperature regime	Moisture regime	Data	References
Forest land	-	-	-	1.00	2006GL (V4, Chp4, Page 4.25)
Cropland	Long-term cultivated	Tropical	Dry	0.58	2006GL (V4, Chp5, Table 5.5)
			Moist/Wet	0.48	2006GL (V4, Chp5, Table 5.5)
		Tropical montane	-	0.64	2006GL (V4, Chp5, Table 5.5)
	Paddy rice	All	Dry and Moist/Wet	1.10	2006GL (V4, Chp5, Table 5.5)
	Perennial/Tree crop	All	Dry and Moist/Wet	1.00	2006GL (V4, Chp5, Table 5.5)
	Set aside (<20yr)	Temperate/Boreal and Tropical	Dry	0.93	2006GL (V4, Chp5, Table 5.5)
			Moist/Wet	0.82	2006GL (V4, Chp5, Table 5.5)
		Tropical montane	-	0.88	2006GL (V4, Chp5, Table 5.5)
Grassland	All	All		1.00	2006GL (V4, Chp6, Table 6.2)
Settlements	All	All		1.00	2006GL (V4, Chp4, Page 4.40)

(2) 施肥

Land-use category	Level	Temperature regime	Moisture regime	Data	References
Forest land	-	-	-	1.00	2006GL (V4, Chp4, Page 4.25)
Cropland	Low	Tropical	Dry	0.95	2006GL (V4, Chp5, Table 5.5)
			Moist/Wet	0.92	2006GL (V4, Chp5, Table 5.5)
		Tropical montane	-	0.94	2006GL (V4, Chp5, Table 5.5)
			-	0.94	2006GL (V4, Chp5, Table 5.5)
	Medium	All	Dry and Moist/Wet	1.00	2006GL (V4, Chp5, Table 5.5)
	High without manure	Temperate/Boreal and Tropical	Dry	1.04	2006GL (V4, Chp5, Table 5.5)
			Moist/Wet	1.11	2006GL (V4, Chp5, Table 5.5)
		Tropical montane	-	1.08	2006GL (V4, Chp5, Table 5.5)
	High without manure	Temperate/Boreal and Tropical	Dry	1.37	2006GL (V4, Chp5, Table 5.5)
			Moist/Wet	1.44	2006GL (V4, Chp5, Table 5.5)
		Tropical montane	-	1.41	2006GL (V4, Chp5, Table 5.5)
Grassland	Medium	All		1.00	2006GL (V4, Chp6, Table 6.2)
	High	All		1.11	2006GL (V4, Chp6, Table 6.2)
Settlements	All	All		1.00	2006GL (V4, Chp4, Page 4.40)

(3) 監理

Land-use category	Level	Temperature regime	Moisture regime	Data	References
Forest land	-	-	-	1.00	2006GL (V4, Chp4, Page 4.25)
Cropland	Tillage (Full)	All	Dry and Moist/Wet	1.00	2006GL (V4, Chp5, Table 5.5)
	Tillage (Reduced)	Tropical	Dry	1.09	2006GL (V4, Chp5, Table 5.5)
			Moist/Wet	1.15	2006GL (V4, Chp5, Table 5.5)
		Tropical montane	-	1.09	2006GL (V4, Chp5, Table 5.5)
	Tillage (No-till)	Tropical	Dry	1.17	2006GL (V4, Chp5, Table 5.5)
			Moist/Wet	1.22	2006GL (V4, Chp5, Table 5.5)
		Tropical montane	-	1.16	2006GL (V4, Chp5, Table 5.5)
Grassland	Nominally managed (non-degraded)	All	-	1.00	2006GL (V4, Chp6, Table 6.2)
	Moderately degraded grassland	Tropical	-	0.97	2006GL (V4, Chp6, Table 6.2)
		Tropical montane	-	0.96	2006GL (V4, Chp6, Table 6.2)
	Severely degraded	All	-	0.70	2006GL (V4, Chp6, Table 6.2)
	Improved grassland	Tropical	-	1.17	2006GL (V4, Chp6, Table 6.2)
		Tropical montane	-	1.16	2006GL (V4, Chp6, Table 6.2)
Settlements	All	All		1.00	2006GL (V4, Chp4, Page 4.40)

2. バイオマス成長量（地上部）

2.1 天然林

Climate domain		Ecological zone	Unit	Data	References
Tropical		Tropical rain forest	[t-dm/ha/yr]	7.0	2006GL (V4, Chp4, Table 4.12)
		Tropical moist deciduous forest	[t-dm/ha/yr]	5.0	2006GL (V4, Chp4, Table 4.12)
		Tropical dry forest	[t-dm/ha/yr]	2.4	2006GL (V4, Chp4, Table 4.12)
		Tropical shrubland	[t-dm/ha/yr]	1.0	2006GL (V4, Chp4, Table 4.12)
		Tropical mountain system	[t-dm/ha/yr]	1.0	2006GL (V4, Chp4, Table 4.12)
Tropical Asia	Continental	Tropical rain forest	[t-dm/ha/yr]	2.2	2006GL (V4, Chp4, Table 4.9), GPG-LULUCF (Chp3, Table 3A.1.5)
			[t-dm/ha/yr]	7.0	2006GL (V4, Chp4, Table 4.9), GPG-LULUCF (Chp3, Table 3A.1.5)
		Tropical moist deciduous forest	[t-dm/ha/yr]	2.0	2006GL (V4, Chp4, Table 4.9), GPG-LULUCF (Chp3, Table 3A.1.5)
			[t-dm/ha/yr]	9.0	2006GL (V4, Chp4, Table 4.9), GPG-LULUCF (Chp3, Table 3A.1.5)
		Tropical dry forest	[t-dm/ha/yr]	1.5	2006GL (V4, Chp4, Table 4.9), GPG-LULUCF (Chp3, Table 3A.1.5)
			[t-dm/ha/yr]	6.0	2006GL (V4, Chp4, Table 4.9), GPG-LULUCF (Chp3, Table 3A.1.5)
		Tropical shrubland	[t-dm/ha/yr]	1.3	2006GL (V4, Chp4, Table 4.9), GPG-LULUCF (Chp3, Table 3A.1.5)
			[t-dm/ha/yr]	5.0	2006GL (V4, Chp4, Table 4.9), GPG-LULUCF (Chp3, Table 3A.1.5)
		Tropical mountain system	[t-dm/ha/yr]	1.0	2006GL (V4, Chp4, Table 4.9), GPG-LULUCF (Chp3, Table 3A.1.5)
			[t-dm/ha/yr]	5.0	2006GL (V4, Chp4, Table 4.9), GPG-LULUCF (Chp3, Table 3A.1.5)
	Insular	Tropical rain forest	[t-dm/ha/yr]	3.4	2006GL (V4, Chp4, Table 4.9), GPG-LULUCF (Chp3, Table 3A.1.5)
			[t-dm/ha/yr]	13.0	2006GL (V4, Chp4, Table 4.9), GPG-LULUCF (Chp3, Table 3A.1.5)
		Tropical moist deciduous forest	[t-dm/ha/yr]	3.0	2006GL (V4, Chp4, Table 4.9), GPG-LULUCF (Chp3, Table 3A.1.5)
			[t-dm/ha/yr]	11.0	2006GL (V4, Chp4, Table 4.9), GPG-LULUCF (Chp3, Table 3A.1.5)
		Tropical dry forest	[t-dm/ha/yr]	2.0	2006GL (V4, Chp4, Table 4.9), GPG-LULUCF (Chp3, Table 3A.1.5)
			[t-dm/ha/yr]	7.0	2006GL (V4, Chp4, Table 4.9), GPG-LULUCF (Chp3, Table 3A.1.5)
		Tropical shrubland	[t-dm/ha/yr]	1.0	2006GL (V4, Chp4, Table 4.9), GPG-LULUCF (Chp3, Table 3A.1.5)
			[t-dm/ha/yr]	2.0	2006GL (V4, Chp4, Table 4.9), GPG-LULUCF (Chp3, Table 3A.1.5)
		Tropical mountain system	[t-dm/ha/yr]	3.0	2006GL (V4, Chp4, Table 4.9), GPG-LULUCF (Chp3, Table 3A.1.5)
			[t-dm/ha/yr]	12.0	2006GL (V4, Chp4, Table 4.9), GPG-LULUCF (Chp3, Table 3A.1.5)

2.2 人工林

Climate domain		Ecological zone	Unit	Data	References
Tropical		Tropical rain forest	[t-dm/ha/yr]	15.0	2006GL (V4, Chp4, Table 4.12)
		Tropical moist deciduous forest	[t-dm/ha/yr]	10.0	2006GL (V4, Chp4, Table 4.12)
		Tropical dry forest	[t-dm/ha/yr]	8.0	2006GL (V4, Chp4, Table 4.12)
		Tropical shrubland	[t-dm/ha/yr]	5.0	2006GL (V4, Chp4, Table 4.12)
		Tropical mountain system	[t-dm/ha/yr]	5.0	2006GL (V4, Chp4, Table 4.12)
Tropical Asia	Eucalyptus sp.	Tropical rain forest	[t-dm/ha/yr]	5.0	2006GL (V4, Chp4, Table 4.10), GPG-LULUCF (Chp3, Table 3A.1.6)
		Tropical moist deciduous forest	[t-dm/ha/yr]	8.0	2006GL (V4, Chp4, Table 4.10), GPG-LULUCF (Chp3, Table 3A.1.6)
		Tropical dry forest	[t-dm/ha/yr]	15.0	2006GL (V4, Chp4, Table 4.10), GPG-LULUCF (Chp3, Table 3A.1.6)
		Tropical shrubland	[t-dm/ha/yr]	6.0	2006GL (V4, Chp4, Table 4.10), GPG-LULUCF (Chp3, Table 3A.1.6)
		Tropical mountain system (R>1000)	[t-dm/ha/yr]	3.0	2006GL (V4, Chp4, Table 4.10), GPG-LULUCF (Chp3, Table 3A.1.6)
	Other	Tropical rain forest	[t-dm/ha/yr]	5.0	2006GL (V4, Chp4, Table 4.10), GPG-LULUCF (Chp3, Table 3A.1.6)
		Tropical moist deciduous forest	[t-dm/ha/yr]	8.0	2006GL (V4, Chp4, Table 4.10), GPG-LULUCF (Chp3, Table 3A.1.6)
		Tropical dry forest	[t-dm/ha/yr]	7.0	2006GL (V4, Chp4, Table 4.10), GPG-LULUCF (Chp3, Table 3A.1.6)
		Tropical shrubland	[t-dm/ha/yr]	6.0	2006GL (V4, Chp4, Table 4.10), GPG-LULUCF (Chp3, Table 3A.1.6)
		Tropical mountain system (R>1000)	[t-dm/ha/yr]	5.0	2006GL (V4, Chp4, Table 4.10), GPG-LULUCF (Chp3, Table 3A.1.6)

3. バイオマス拡大係数

バイオマス拡大係数とは、地上部幹材積に対する地上部全材積（枝や葉を含む）の比率である。GPG-LULUCF までは材積の比率（無次元）として示されたが、2006 年 IPCC ガイドラインでは容積密度まで含まれた値が示された。ここでは両方の値を示す。

3.1 容積密度を含まない係数

Climate zone	Forest type	Min DBH (cm)	Unit	Data	References
Tropical	Pines	10	[t-dm/t-dm]	1.30	overbark, GPG-LULUCF (Chp3, Table 3A.1.10)
	Broadleaf	10	[t-dm/t-dm]	3.40	overbark, GPG-LULUCF (Chp3, Table 3A.1.10)

3.2 容積密度を含む係数

Climate zone	Forest type	Stock level (m3)	Unit	Data	References
Humid Tropical	Natural forests	<10	[t-dm/m3]	10.00	including bark, 2006GL (V4, Chp4, Table 4.5)
		11-20	[t-dm/m3]	4.44	including bark, 2006GL (V4, Chp4, Table 4.5)
		21-40	[t-dm/m3]	3.11	including bark, 2006GL (V4, Chp4, Table 4.5)
		41-60	[t-dm/m3]	2.28	including bark, 2006GL (V4, Chp4, Table 4.5)
		61-80	[t-dm/m3]	1.89	including bark, 2006GL (V4, Chp4, Table 4.5)
		81-120	[t-dm/m3]	1.67	including bark, 2006GL (V4, Chp4, Table 4.5)
		120-200	[t-dm/m3]	1.44	including bark, 2006GL (V4, Chp4, Table 4.5)
		>200	[t-dm/m3]	1.05	including bark, 2006GL (V4, Chp4, Table 4.5)
	Conifers	<10	[t-dm/m3]	4.44	including bark, 2006GL (V4, Chp4, Table 4.5)
		11-20	[t-dm/m3]	1.94	including bark, 2006GL (V4, Chp4, Table 4.5)
		21-40	[t-dm/m3]	1.39	including bark, 2006GL (V4, Chp4, Table 4.5)
		41-60	[t-dm/m3]	1.11	including bark, 2006GL (V4, Chp4, Table 4.5)
		61-80	[t-dm/m3]	0.89	including bark, 2006GL (V4, Chp4, Table 4.5)
		81-120	[t-dm/m3]	0.84	including bark, 2006GL (V4, Chp4, Table 4.5)
		120-200	[t-dm/m3]	0.77	including bark, 2006GL (V4, Chp4, Table 4.5)
		>200	[t-dm/m3]	0.77	including bark, 2006GL (V4, Chp4, Table 4.5)
Dry Tropical	Hardwoods	<20	[t-dm/m3]	5.55	including bark, 2006GL (V4, Chp4, Table 4.5)
		21-40	[t-dm/m3]	2.11	including bark, 2006GL (V4, Chp4, Table 4.5)
		41-80	[t-dm/m3]	0.89	including bark, 2006GL (V4, Chp4, Table 4.5)
		>80	[t-dm/m3]	0.73	including bark, 2006GL (V4, Chp4, Table 4.5)
	Conifers	<20	[t-dm/m3]	6.67	including bark, 2006GL (V4, Chp4, Table 4.5)
		21-40	[t-dm/m3]	1.33	including bark, 2006GL (V4, Chp4, Table 4.5)
		41-80	[t-dm/m3]	0.67	including bark, 2006GL (V4, Chp4, Table 4.5)
		>80	[t-dm/m3]	0.61	including bark, 2006GL (V4, Chp4, Table 4.5)

4. 地上バイオマスに対する地下バイオマスの比率

Ecological zone	AGB (t/ha)	Unit	Data	References
Tropical rainforest	-	[t-dm/t-dm]	0.37	2006GL (V4, Chp4, Table 4.4)
Tropical moist deciduous forest	<125	[t-dm/t-dm]	0.20	2006GL (V4, Chp4, Table 4.4)
	>125	[t-dm/t-dm]	0.24	2006GL (V4, Chp4, Table 4.4)
Tropical dry forest	<20	[t-dm/t-dm]	0.56	2006GL (V4, Chp4, Table 4.4)
	>20	[t-dm/t-dm]	0.28	2006GL (V4, Chp4, Table 4.4)
Tropical shrubland	-	[t-dm/t-dm]	0.40	2006GL (V4, Chp4, Table 4.4)
Tropical mountain system	-	[t-dm/t-dm]	0.27	2006GL (V4, Chp4, Table 4.4)
Secondary tropical/Sub-tropical forest	<125	[t-dm/t-dm]	0.42	GPG-LULUCF (Chp3, Table 3A.1.8)
Primary tropical/Sub-tropical moist forest	-	[t-dm/t-dm]	0.24	GPG-LULUCF (Chp3, Table 3A.1.8)
Tropical/Sub-tropical dry forest	-	[t-dm/t-dm]	0.27	GPG-LULUCF (Chp3, Table 3A.1.8)
Conifer forest/Plantation	<50	[t-dm/t-dm]	0.46	GPG-LULUCF (Chp3, Table 3A.1.8)
	50-150	[t-dm/t-dm]	0.32	GPG-LULUCF (Chp3, Table 3A.1.8)
	>150	[t-dm/t-dm]	0.23	GPG-LULUCF (Chp3, Table 3A.1.8)
Temperate/Sub-tropical/Tropical grassland	-	[t-dm/t-dm]	1.58	GPG-LULUCF (Chp3, Table 3A.1.8)
Tidal marsh	-	[t-dm/t-dm]	1.04	GPG-LULUCF (Chp3, Table 3A.1.8)
Pachymorph bamboo	-	[t-dm/t-dm]	0.82	Jumpei Toriyama (dominated communities in slash-and-burn agricultural systems with fallow periods of only 1-3 years common in Luang Prabang Province in Lao PDR)

5. 容積密度

Species	Unit	Data			References
		Applied	Min	Max	
Acacia mangium (3 year old)	[t-dm/m ³]	0.320			Yoshiyuki Kiyono, Journal of Forest Planning (Indonesia, West Java)
Acacia mangium (5 year old)	[t-dm/m ³]	0.419			Yoshiyuki Kiyono, Journal of Forest Planning (Indonesia, West Java)
Acacia mangium (8-10 year old)	[t-dm/m ³]	0.457			Yoshiyuki Kiyono, Journal of Forest Planning (Indonesia, West Java)
Adina cordifolia	[t-dm/m ³]	0.585	0.580	0.590	2006GL (V4, Chp4, Table 4.13)
Aegle marmelo	[t-dm/m ³]	0.750			2006GL (V4, Chp4, Table 4.13)
Agathis sp.	[t-dm/m ³]	0.440			2006GL (V4, Chp4, Table 4.13)
Aglaia llanosiana	[t-dm/m ³]	0.890			2006GL (V4, Chp4, Table 4.13)
Alangium longiflorum	[t-dm/m ³]	0.650			2006GL (V4, Chp4, Table 4.13)
Albizzia amara	[t-dm/m ³]	0.700			2006GL (V4, Chp4, Table 4.13)
Albizzia falcata	[t-dm/m ³]	0.250			2006GL (V4, Chp4, Table 4.13)
Aleurites trisperma	[t-dm/m ³]	0.430			2006GL (V4, Chp4, Table 4.13)
Alnus japonica	[t-dm/m ³]	0.430			2006GL (V4, Chp4, Table 4.13)
Alphitonia zizyphoides	[t-dm/m ³]	0.500			2006GL (V4, Chp4, Table 4.13)
Alphonsea arborea	[t-dm/m ³]	0.690			2006GL (V4, Chp4, Table 4.13)
Alseodaphne longipes	[t-dm/m ³]	0.490			2006GL (V4, Chp4, Table 4.13)
Amoora sp.	[t-dm/m ³]	0.600			2006GL (V4, Chp4, Table 4.13)
Anisophyllea zeylanica	[t-dm/m ³]	0.460			2006GL (V4, Chp4, Table 4.13)
Anisoptera sp.	[t-dm/m ³]	0.540			2006GL (V4, Chp4, Table 4.13)
Anogeissus latifolia	[t-dm/m ³]	0.785	0.780	0.790	2006GL (V4, Chp4, Table 4.13)
Anthocephalus chinensis	[t-dm/m ³]	0.345	0.330	0.360	2006GL (V4, Chp4, Table 4.13)
Antidesma pleuricum	[t-dm/m ³]	0.590			2006GL (V4, Chp4, Table 4.13)
Aphanamiris perrottetiana	[t-dm/m ³]	0.520			2006GL (V4, Chp4, Table 4.13)
Araucaria bidwillii	[t-dm/m ³]	0.430			2006GL (V4, Chp4, Table 4.13)
Artocarpus sp.	[t-dm/m ³]	0.580			2006GL (V4, Chp4, Table 4.13)
Azadirachta sp.	[t-dm/m ³]	0.520			2006GL (V4, Chp4, Table 4.13)
Balanocarpus sp.	[t-dm/m ³]	0.760			2006GL (V4, Chp4, Table 4.13)
Barringtonia edulis	[t-dm/m ³]	0.480			2006GL (V4, Chp4, Table 4.13)
Bauhinia sp.	[t-dm/m ³]	0.670			2006GL (V4, Chp4, Table 4.13)
Beilschmiedia tawa	[t-dm/m ³]	0.580			2006GL (V4, Chp4, Table 4.13)
Berrya cordifolia	[t-dm/m ³]	0.780			2006GL (V4, Chp4, Table 4.13)
Bischofia javanica	[t-dm/m ³]	0.580	0.540	0.620	2006GL (V4, Chp4, Table 4.13)
Bleasdalea vitiensis	[t-dm/m ³]	0.430			2006GL (V4, Chp4, Table 4.13)
Boswellia serrata	[t-dm/m ³]	0.500			2006GL (V4, Chp4, Table 4.13)
Bridelia squamosa	[t-dm/m ³]	0.500			2006GL (V4, Chp4, Table 4.13)
Buchenavia latifolia	[t-dm/m ³]	0.450			2006GL (V4, Chp4, Table 4.13)
Bursera serrata	[t-dm/m ³]	0.590			2006GL (V4, Chp4, Table 4.13)
Butea monosperma	[t-dm/m ³]	0.480			2006GL (V4, Chp4, Table 4.13)
Calophyllum sp.	[t-dm/m ³]	0.530			2006GL (V4, Chp4, Table 4.13)
Calycarpa arborea	[t-dm/m ³]	0.530			2006GL (V4, Chp4, Table 4.13)
Cananga odorata	[t-dm/m ³]	0.290			2006GL (V4, Chp4, Table 4.13)
Canarium sp.	[t-dm/m ³]	0.440			2006GL (V4, Chp4, Table 4.13)
Canthium monstrosum	[t-dm/m ³]	0.420			2006GL (V4, Chp4, Table 4.13)
Carallia calycina	[t-dm/m ³]	0.660			2006GL (V4, Chp4, Table 4.13)
Cassia javanica	[t-dm/m ³]	0.690			2006GL (V4, Chp4, Table 4.13)
Castanopsis philippensis	[t-dm/m ³]	0.510			2006GL (V4, Chp4, Table 4.13)
Casuarina equisetifolia	[t-dm/m ³]	0.830			2006GL (V4, Chp4, Table 4.13)
Casuarina nodiflora	[t-dm/m ³]	0.850			2006GL (V4, Chp4, Table 4.13)
Cedrela odorata	[t-dm/m ³]	0.380			2006GL (V4, Chp4, Table 4.13)
Cedrela toona	[t-dm/m ³]	0.430			2006GL (V4, Chp4, Table 4.13)
Ceiba pentandra	[t-dm/m ³]	0.230			2006GL (V4, Chp4, Table 4.13)
Celtis luzonica	[t-dm/m ³]	0.490			2006GL (V4, Chp4, Table 4.13)
Chisocheton pentandrus	[t-dm/m ³]	0.520			2006GL (V4, Chp4, Table 4.13)
Chloroxylon swietenia	[t-dm/m ³]	0.780	0.760	0.800	2006GL (V4, Chp4, Table 4.13)
Chukrasia tabularis	[t-dm/m ³]	0.570			2006GL (V4, Chp4, Table 4.13)
Citrus grandis	[t-dm/m ³]	0.590			2006GL (V4, Chp4, Table 4.13)
Cleidion speciflorum	[t-dm/m ³]	0.500			2006GL (V4, Chp4, Table 4.13)
Cleistanthus collinus	[t-dm/m ³]	0.880			2006GL (V4, Chp4, Table 4.13)
Cleistocalyx sp.	[t-dm/m ³]	0.760			2006GL (V4, Chp4, Table 4.13)
Cochlospermum gossypium	[t-dm/m ³]	0.270			2006GL (V4, Chp4, Table 4.13)
Cocos nucifera	[t-dm/m ³]	0.500			2006GL (V4, Chp4, Table 4.13)

ラオス国森林減少抑制のための参加型土地・森林管理プロジェクトに係る REDD+認証・登録支援業務
技術協力成果品「標本木調査の取りまとめ結果」

Species	Unit	Data			References
		Applied	Min	Max	
Colona serratifolia	[t-dm/m3]	0.330			2006GL (V4, Chp4, Table 4.13)
Combretodendron quadrialatum	[t-dm/m3]	0.570			2006GL (V4, Chp4, Table 4.13)
Cordia sp.	[t-dm/m3]	0.530			2006GL (V4, Chp4, Table 4.13)
Cotylelobium sp.	[t-dm/m3]	0.690			2006GL (V4, Chp4, Table 4.13)
Crataeva religiosa	[t-dm/m3]	0.530			2006GL (V4, Chp4, Table 4.13)
Cratoxylon arborescens	[t-dm/m3]	0.400			2006GL (V4, Chp4, Table 4.13)
Cryptocarya sp.	[t-dm/m3]	0.590			2006GL (V4, Chp4, Table 4.13)
Cubilia cubili	[t-dm/m3]	0.490			2006GL (V4, Chp4, Table 4.13)
Cullenia excelsa	[t-dm/m3]	0.530			2006GL (V4, Chp4, Table 4.13)
Cynometra sp.	[t-dm/m3]	0.800			2006GL (V4, Chp4, Table 4.13)
Dacrycarpus imbricatus	[t-dm/m3]	0.460	0.450	0.470	2006GL (V4, Chp4, Table 4.13)
Dacrydium sp.	[t-dm/m3]	0.460			2006GL (V4, Chp4, Table 4.13)
Dacryodes sp.	[t-dm/m3]	0.610			2006GL (V4, Chp4, Table 4.13)
Dalbergia paniculata	[t-dm/m3]	0.640			2006GL (V4, Chp4, Table 4.13)
Decussocarpus vitiensis	[t-dm/m3]	0.370			2006GL (V4, Chp4, Table 4.13)
Degeneria vitiensis	[t-dm/m3]	0.350			2006GL (V4, Chp4, Table 4.13)
Dehaasia triandra	[t-dm/m3]	0.640			2006GL (V4, Chp4, Table 4.13)
Dialium sp.	[t-dm/m3]	0.800			2006GL (V4, Chp4, Table 4.13)
Dillenia sp.	[t-dm/m3]	0.590			2006GL (V4, Chp4, Table 4.13)
Diospyros sp.	[t-dm/m3]	0.700			2006GL (V4, Chp4, Table 4.13)
Diplodiscus paniculatus	[t-dm/m3]	0.630			2006GL (V4, Chp4, Table 4.13)
Dipterocarpus caudatus	[t-dm/m3]	0.610			2006GL (V4, Chp4, Table 4.13)
Dipterocarpus eurynchus	[t-dm/m3]	0.560			2006GL (V4, Chp4, Table 4.13)
Dipterocarpus gracilis	[t-dm/m3]	0.610			2006GL (V4, Chp4, Table 4.13)
Dipterocarpus grandiflorus	[t-dm/m3]	0.620			2006GL (V4, Chp4, Table 4.13)
Dipterocarpus kerrii	[t-dm/m3]	0.560			2006GL (V4, Chp4, Table 4.13)
Dipterocarpus kunstlerii	[t-dm/m3]	0.570			2006GL (V4, Chp4, Table 4.13)
Dipterocarpus sp.	[t-dm/m3]	0.610			2006GL (V4, Chp4, Table 4.13)
Dipterocarpus warburgii	[t-dm/m3]	0.520			2006GL (V4, Chp4, Table 4.13)
Dracontomelon sp.	[t-dm/m3]	0.500			2006GL (V4, Chp4, Table 4.13)
Dryobalanops sp.	[t-dm/m3]	0.610			2006GL (V4, Chp4, Table 4.13)
Dypteres bordenii	[t-dm/m3]	0.750			2006GL (V4, Chp4, Table 4.13)
Durio sp.	[t-dm/m3]	0.530			2006GL (V4, Chp4, Table 4.13)
Dyera costulata	[t-dm/m3]	0.360			2006GL (V4, Chp4, Table 4.13)
Dysoxylum quercifolium	[t-dm/m3]	0.490			2006GL (V4, Chp4, Table 4.13)
Elaeocarpus serratus	[t-dm/m3]	0.400			2006GL (V4, Chp4, Table 4.13)
Embllica officinalis	[t-dm/m3]	0.800			2006GL (V4, Chp4, Table 4.13)
Endiandra laxiflora	[t-dm/m3]	0.540			2006GL (V4, Chp4, Table 4.13)
Endospermum sp.	[t-dm/m3]	0.380			2006GL (V4, Chp4, Table 4.13)
Enterolobium cyclocarpum	[t-dm/m3]	0.350			2006GL (V4, Chp4, Table 4.13)
Epicharis cumingiana	[t-dm/m3]	0.730			2006GL (V4, Chp4, Table 4.13)
Erythrina subumbrans	[t-dm/m3]	0.240			2006GL (V4, Chp4, Table 4.13)
Erythrophloeum densiflorum	[t-dm/m3]	0.650			2006GL (V4, Chp4, Table 4.13)
Eucalyptus citriodora	[t-dm/m3]	0.640			2006GL (V4, Chp4, Table 4.13)
Eucalyptus deglupta	[t-dm/m3]	0.340			2006GL (V4, Chp4, Table 4.13)
Eugenia sp.	[t-dm/m3]	0.650			2006GL (V4, Chp4, Table 4.13)
Fagraea sp.	[t-dm/m3]	0.730			2006GL (V4, Chp4, Table 4.13)
Ficus benamina	[t-dm/m3]	0.650			2006GL (V4, Chp4, Table 4.13)
Ganua obovatifolia	[t-dm/m3]	0.590			2006GL (V4, Chp4, Table 4.13)
Garcinia myrtifolia	[t-dm/m3]	0.650			2006GL (V4, Chp4, Table 4.13)
Garcinia sp.	[t-dm/m3]	0.750			2006GL (V4, Chp4, Table 4.13)
Gardenia turgida	[t-dm/m3]	0.640			2006GL (V4, Chp4, Table 4.13)
Garuga pinnata	[t-dm/m3]	0.510			2006GL (V4, Chp4, Table 4.13)
Gluta sp.	[t-dm/m3]	0.630			2006GL (V4, Chp4, Table 4.13)
Gmelina arborea	[t-dm/m3]	0.430	0.410	0.450	2006GL (V4, Chp4, Table 4.13)
Gmelina vitiensis	[t-dm/m3]	0.540			2006GL (V4, Chp4, Table 4.13)
Gonocaryum calleryanum	[t-dm/m3]	0.640			2006GL (V4, Chp4, Table 4.13)
Gonystylus punctatus	[t-dm/m3]	0.570			2006GL (V4, Chp4, Table 4.13)
Grewia tiliaefolia	[t-dm/m3]	0.680			2006GL (V4, Chp4, Table 4.13)
Hardwickia binata	[t-dm/m3]	0.730			2006GL (V4, Chp4, Table 4.13)

ラオス国森林減少抑制のための参加型土地・森林管理プロジェクトに係る REDD+認証・登録支援業務
技術協力成果品「標本木調査の取りまとめ結果」

Species	Unit	Data			References
		Applied	Min	Max	
Harpullia arborea	[t-dm/m3]	0.620			2006GL (V4, Chp4, Table 4.13)
Heritiera sp.	[t-dm/m3]	0.560			2006GL (V4, Chp4, Table 4.13)
Hevea brasiliensis	[t-dm/m3]	0.530			2006GL (V4, Chp4, Table 4.13)
Hibiscus tiliaceus	[t-dm/m3]	0.570			2006GL (V4, Chp4, Table 4.13)
Homalanthus populneus	[t-dm/m3]	0.380			2006GL (V4, Chp4, Table 4.13)
Homalium sp.	[t-dm/m3]	0.760			2006GL (V4, Chp4, Table 4.13)
Hopea acuminata	[t-dm/m3]	0.620			2006GL (V4, Chp4, Table 4.13)
Hopea sp.	[t-dm/m3]	0.640			2006GL (V4, Chp4, Table 4.13)
Intsia palembanica	[t-dm/m3]	0.680			2006GL (V4, Chp4, Table 4.13)
Kayea garciae	[t-dm/m3]	0.530			2006GL (V4, Chp4, Table 4.13)
Kingiodendron alternifolium	[t-dm/m3]	0.480			2006GL (V4, Chp4, Table 4.13)
Kleinhovia hospita	[t-dm/m3]	0.360			2006GL (V4, Chp4, Table 4.13)
Knema sp.	[t-dm/m3]	0.530			2006GL (V4, Chp4, Table 4.13)
Koompassia excelsa	[t-dm/m3]	0.630			2006GL (V4, Chp4, Table 4.13)
Koordersiodendron pinnatum	[t-dm/m3]	0.670	0.650	0.690	2006GL (V4, Chp4, Table 4.13)
Kydia calycina	[t-dm/m3]	0.720			2006GL (V4, Chp4, Table 4.13)
Lagerstroemia sp.	[t-dm/m3]	0.550			2006GL (V4, Chp4, Table 4.13)
Lannea grandis	[t-dm/m3]	0.500			2006GL (V4, Chp4, Table 4.13)
Leucaena leucocephala	[t-dm/m3]	0.640			2006GL (V4, Chp4, Table 4.13)
Lithocarpus soleriana	[t-dm/m3]	0.630			2006GL (V4, Chp4, Table 4.13)
Litsea sp.	[t-dm/m3]	0.400			2006GL (V4, Chp4, Table 4.13)
Lophopetalum sp.	[t-dm/m3]	0.460			2006GL (V4, Chp4, Table 4.13)
Macaranga denticulata	[t-dm/m3]	0.530			2006GL (V4, Chp4, Table 4.13)
Madhuca oblongifolia	[t-dm/m3]	0.530			2006GL (V4, Chp4, Table 4.13)
Mallotus philippinensis	[t-dm/m3]	0.640			2006GL (V4, Chp4, Table 4.13)
Mangifera sp.	[t-dm/m3]	0.520			2006GL (V4, Chp4, Table 4.13)
Maniltoa minor	[t-dm/m3]	0.760			2006GL (V4, Chp4, Table 4.13)
Mastixia philippinensis	[t-dm/m3]	0.470			2006GL (V4, Chp4, Table 4.13)
Melanorrhoea sp.	[t-dm/m3]	0.630			2006GL (V4, Chp4, Table 4.13)
Melia dubia	[t-dm/m3]	0.400			2006GL (V4, Chp4, Table 4.13)
Melicope triphylla	[t-dm/m3]	0.370			2006GL (V4, Chp4, Table 4.13)
Meliosma macrophylla	[t-dm/m3]	0.270			2006GL (V4, Chp4, Table 4.13)
Melochia umbellata	[t-dm/m3]	0.250			2006GL (V4, Chp4, Table 4.13)
Metrosideros collina	[t-dm/m3]	0.730	0.700	0.760	2006GL (V4, Chp4, Table 4.13)
Michelia sp.	[t-dm/m3]	0.430			2006GL (V4, Chp4, Table 4.13)
Microcos stylocarpa	[t-dm/m3]	0.400			2006GL (V4, Chp4, Table 4.13)
Micromelum compressum	[t-dm/m3]	0.640			2006GL (V4, Chp4, Table 4.13)
Milliusa velutina	[t-dm/m3]	0.630			2006GL (V4, Chp4, Table 4.13)
Mimusops elengi	[t-dm/m3]	0.720			2006GL (V4, Chp4, Table 4.13)
Mitragyna parviflora	[t-dm/m3]	0.560			2006GL (V4, Chp4, Table 4.13)
Myristica sp.	[t-dm/m3]	0.530			2006GL (V4, Chp4, Table 4.13)
Neesia sp.	[t-dm/m3]	0.530			2006GL (V4, Chp4, Table 4.13)
Neonauclea bernardoi	[t-dm/m3]	0.620			2006GL (V4, Chp4, Table 4.13)
Neotrewia cumingii	[t-dm/m3]	0.550			2006GL (V4, Chp4, Table 4.13)
Ochna foxworthyi	[t-dm/m3]	0.860			2006GL (V4, Chp4, Table 4.13)
Ochroma pyramidale	[t-dm/m3]	0.300			2006GL (V4, Chp4, Table 4.13)
Octomeles sumatrana	[t-dm/m3]	0.295	0.270	0.320	2006GL (V4, Chp4, Table 4.13)
Oroxylon indicum	[t-dm/m3]	0.320			2006GL (V4, Chp4, Table 4.13)
Ougenia dalbergioides	[t-dm/m3]	0.700			2006GL (V4, Chp4, Table 4.13)
Palaquium sp.	[t-dm/m3]	0.550			2006GL (V4, Chp4, Table 4.13)
Pangium edule	[t-dm/m3]	0.500			2006GL (V4, Chp4, Table 4.13)
Parashorea stellata	[t-dm/m3]	0.590			2006GL (V4, Chp4, Table 4.13)
Paratrophis glabra	[t-dm/m3]	0.770			2006GL (V4, Chp4, Table 4.13)
Parinari sp.	[t-dm/m3]	0.680			2006GL (V4, Chp4, Table 4.13)
Parkia roxburghii	[t-dm/m3]	0.340			2006GL (V4, Chp4, Table 4.13)
Payena sp.	[t-dm/m3]	0.550			2006GL (V4, Chp4, Table 4.13)
Peltophorum pterocarpum	[t-dm/m3]	0.620			2006GL (V4, Chp4, Table 4.13)
Pentace sp.	[t-dm/m3]	0.560			2006GL (V4, Chp4, Table 4.13)
Phaeanthus ebracteolatus	[t-dm/m3]	0.560			2006GL (V4, Chp4, Table 4.13)
Phyllocladus hypophyllus	[t-dm/m3]	0.530			2006GL (V4, Chp4, Table 4.13)

ラオス国森林減少抑制のための参加型土地・森林管理プロジェクトに係る REDD+認証・登録支援業務
技術協力成果品「標本木調査の取りまとめ結果」

Species	Unit	Data			References
		Applied	Min	Max	
Pinus caribaea	[t-dm/m3]	0.480			2006GL (V4, Chp4, Table 4.13)
Pinus insularis	[t-dm/m3]	0.475	0.470	0.480	2006GL (V4, Chp4, Table 4.13)
Pinus merkusii	[t-dm/m3]	0.540			2006GL (V4, Chp4, Table 4.13)
Pisonia umbellifera	[t-dm/m3]	0.210			2006GL (V4, Chp4, Table 4.13)
Pittosporum pentandrum	[t-dm/m3]	0.510			2006GL (V4, Chp4, Table 4.13)
Planchonia sp.	[t-dm/m3]	0.590			2006GL (V4, Chp4, Table 4.13)
Podocarpus sp.	[t-dm/m3]	0.430			2006GL (V4, Chp4, Table 4.13)
Polyalthia flava	[t-dm/m3]	0.510			2006GL (V4, Chp4, Table 4.13)
Polyscias nodosa	[t-dm/m3]	0.380			2006GL (V4, Chp4, Table 4.13)
Pometia sp.	[t-dm/m3]	0.540			2006GL (V4, Chp4, Table 4.13)
Pouteria villamilii	[t-dm/m3]	0.470			2006GL (V4, Chp4, Table 4.13)
Premna tomentosa	[t-dm/m3]	0.960			2006GL (V4, Chp4, Table 4.13)
Pterocarpus marsupium	[t-dm/m3]	0.670			2006GL (V4, Chp4, Table 4.13)
Quercus sp.	[t-dm/m3]	0.700			2006GL (V4, Chp4, Table 4.13)
Radermachera pinnata	[t-dm/m3]	0.510			2006GL (V4, Chp4, Table 4.13)
Salmalia malabarica	[t-dm/m3]	0.325	0.320	0.330	2006GL (V4, Chp4, Table 4.13)
Samanea saman	[t-dm/m3]	0.455	0.450	0.460	2006GL (V4, Chp4, Table 4.13)
Sandoricum vidalii	[t-dm/m3]	0.430			2006GL (V4, Chp4, Table 4.13)
Sapindus saponaria	[t-dm/m3]	0.580			2006GL (V4, Chp4, Table 4.13)
Sapium luzontcum	[t-dm/m3]	0.400			2006GL (V4, Chp4, Table 4.13)
Schleichera oleosa	[t-dm/m3]	0.960			2006GL (V4, Chp4, Table 4.13)
Schrebera swietenoides	[t-dm/m3]	0.820			2006GL (V4, Chp4, Table 4.13)
Semicarpus anacardium	[t-dm/m3]	0.640			2006GL (V4, Chp4, Table 4.13)
Serialbizia acle	[t-dm/m3]	0.570			2006GL (V4, Chp4, Table 4.13)
Serianthes melanesica	[t-dm/m3]	0.480			2006GL (V4, Chp4, Table 4.13)
Sesbania grandiflora	[t-dm/m3]	0.400			2006GL (V4, Chp4, Table 4.13)
Shorea assamica forma philippinensis	[t-dm/m3]	0.410			2006GL (V4, Chp4, Table 4.13)
Shorea astylosa	[t-dm/m3]	0.730			2006GL (V4, Chp4, Table 4.13)
Shorea ciliata	[t-dm/m3]	0.750			2006GL (V4, Chp4, Table 4.13)
Shorea contorta	[t-dm/m3]	0.440			2006GL (V4, Chp4, Table 4.13)
Shorea palosapis	[t-dm/m3]	0.390			2006GL (V4, Chp4, Table 4.13)
Shorea plagata	[t-dm/m3]	0.700			2006GL (V4, Chp4, Table 4.13)
Shorea polita	[t-dm/m3]	0.470			2006GL (V4, Chp4, Table 4.13)
Shorea robusta	[t-dm/m3]	0.720			2006GL (V4, Chp4, Table 4.13)
Shorea sp.(balau)	[t-dm/m3]	0.700			2006GL (V4, Chp4, Table 4.13)
Shorea sp.(dark red meranti)	[t-dm/m3]	0.550			2006GL (V4, Chp4, Table 4.13)
Shorea sp.(light red meranti)	[t-dm/m3]	0.400			2006GL (V4, Chp4, Table 4.13)
Sloanea javanica	[t-dm/m3]	0.530			2006GL (V4, Chp4, Table 4.13)
Soymida febrifuga	[t-dm/m3]	0.970			2006GL (V4, Chp4, Table 4.13)
Spathodea campanulata	[t-dm/m3]	0.250			2006GL (V4, Chp4, Table 4.13)
Stemonurus luzoniensis	[t-dm/m3]	0.370			2006GL (V4, Chp4, Table 4.13)
Sterculia vitiensis	[t-dm/m3]	0.310			2006GL (V4, Chp4, Table 4.13)
Stereospermum suaveolens	[t-dm/m3]	0.620			2006GL (V4, Chp4, Table 4.13)
Strombosia philippinensis	[t-dm/m3]	0.710			2006GL (V4, Chp4, Table 4.13)
Strychnos potatorum	[t-dm/m3]	0.880			2006GL (V4, Chp4, Table 4.13)
Swietenia macrophylla	[t-dm/m3]	0.510	0.490	0.530	2006GL (V4, Chp4, Table 4.13)
Swintonia foxworthyi	[t-dm/m3]	0.620			2006GL (V4, Chp4, Table 4.13)
Swintonia sp.	[t-dm/m3]	0.610			2006GL (V4, Chp4, Table 4.13)
Sycopsis dunni	[t-dm/m3]	0.630			2006GL (V4, Chp4, Table 4.13)
Syzygium sp.	[t-dm/m3]	0.725	0.690	0.760	2006GL (V4, Chp4, Table 4.13)
Tamarindus indica	[t-dm/m3]	0.750			2006GL (V4, Chp4, Table 4.13)
Tectona grandis	[t-dm/m3]	0.525	0.500	0.550	2006GL (V4, Chp4, Table 4.13)
Terminalia citrina	[t-dm/m3]	0.710			2006GL (V4, Chp4, Table 4.13)
Terminalia copelandii	[t-dm/m3]	0.460			2006GL (V4, Chp4, Table 4.13)
Terminalia microcarpa	[t-dm/m3]	0.530			2006GL (V4, Chp4, Table 4.13)
Terminalia nitens	[t-dm/m3]	0.580			2006GL (V4, Chp4, Table 4.13)
Terminalia pterocarpa	[t-dm/m3]	0.480			2006GL (V4, Chp4, Table 4.13)
Terminalia tomentosa	[t-dm/m3]	0.750	0.730	0.770	2006GL (V4, Chp4, Table 4.13)
Ternstroemia megacarpa	[t-dm/m3]	0.530			2006GL (V4, Chp4, Table 4.13)
Tetrameles nudiflora	[t-dm/m3]	0.300			2006GL (V4, Chp4, Table 4.13)

Species	Unit	Data			References
		Applied	Min	Max	
Tetramerista glabra	[t-dm/m3]	0.610			2006GL (V4, Chp4, Table 4.13)
Thespesia populnea	[t-dm/m3]	0.520			2006GL (V4, Chp4, Table 4.13)
Trema orientalis	[t-dm/m3]	0.310			2006GL (V4, Chp4, Table 4.13)
Tristania sp.	[t-dm/m3]	0.800			2006GL (V4, Chp4, Table 4.13)
Turpinia ovalifolia	[t-dm/m3]	0.360			2006GL (V4, Chp4, Table 4.13)
Vateria indica	[t-dm/m3]	0.470			2006GL (V4, Chp4, Table 4.13)
Vatica sp.	[t-dm/m3]	0.690			2006GL (V4, Chp4, Table 4.13)
Vitex sp.	[t-dm/m3]	0.650			2006GL (V4, Chp4, Table 4.13)
Wrightia tinctoria	[t-dm/m3]	0.750			2006GL (V4, Chp4, Table 4.13)
Xanthophyllum excelsum	[t-dm/m3]	0.630			2006GL (V4, Chp4, Table 4.13)
Xylia xylocarpa	[t-dm/m3]	0.770	0.730	0.810	2006GL (V4, Chp4, Table 4.13)
Zanthoxylum rhetsa	[t-dm/m3]	0.330			2006GL (V4, Chp4, Table 4.13)
Zizyphus sp.	[t-dm/m3]	0.760			2006GL (V4, Chp4, Table 4.13)

6. 炭素含有率

Domain	Part of tree	Unit	Data	References
All	-	[t-C/t-dm]	0.47	2006GL (V4, Chp4, Table 4.3)
Tropical and sub-tropical	All	[t-C/t-dm]	0.47	2006GL (V4, Chp4, Table 4.3)
	wood	[t-C/t-dm]	0.49	2006GL (V4, Chp4, Table 4.3)
	wood, tree d<10cm	[t-C/t-dm]	0.46	2006GL (V4, Chp4, Table 4.3)
	wood, tree d>10cm	[t-C/t-dm]	0.49	2006GL (V4, Chp4, Table 4.3)
	foliage	[t-C/t-dm]	0.47	2006GL (V4, Chp4, Table 4.3)
	foliage, tree d<10cm	[t-C/t-dm]	0.43	2006GL (V4, Chp4, Table 4.3)
	foliage, tree d>10cm	[t-C/t-dm]	0.46	2006GL (V4, Chp4, Table 4.3)

7. 火災に伴う燃焼

7.1 バイオマスの燃焼量

Vegetation type	Sub-category	Unit	Data	References
Primary tropical forest (slash and burn)	All	[t/ha]	119.6	2006GL (V4, Chp2, Table 2.4)
	Primary tropical forest	[t/ha]	83.9	2006GL (V4, Chp2, Table 2.4)
	Primary open tropical forest	[t/ha]	163.6	2006GL (V4, Chp2, Table 2.4)
	Primary tropical moist forest	[t/ha]	160.4	2006GL (V4, Chp2, Table 2.4)
	Primary tropical dry forest	[t/ha]	-	2006GL (V4, Chp2, Table 2.4)
Secondary tropical forest (slash and burn)	All	[t/ha]	42.2	2006GL (V4, Chp2, Table 2.4)
	Young secondary tropical forest (3-5 yr)	[t/ha]	8.1	2006GL (V4, Chp2, Table 2.4)
	Intermediate secondary tropical forest (6-10 yr)	[t/ha]	41.1	2006GL (V4, Chp2, Table 2.4)
	Advanced secondary tropical forest (14-17 yr)	[t/ha]	46.4	2006GL (V4, Chp2, Table 2.4)
All tertiary tropical forest		[t/ha]	54.1	2006GL (V4, Chp2, Table 2.4)
Eucalyptus forests	All	[t/ha]	69.4	2006GL (V4, Chp2, Table 2.4)
	Wildfire	[t/ha]	53.0	2006GL (V4, Chp2, Table 2.4)
	Prescribed fire – (surface)	[t/ha]	16.0	2006GL (V4, Chp2, Table 2.4)
	Post logging slash burn	[t/ha]	168.4	2006GL (V4, Chp2, Table 2.4)
	Felled and burned (land-clearing fire)	[t/ha]	132.6	2006GL (V4, Chp2, Table 2.4)
All Shrublands		[t/ha]	14.3	2006GL (V4, Chp2, Table 2.4)
Peatland		[t/ha]	41.0	2006GL (V4, Chp2, Table 2.4)

7.2 ガス別の排出係数

Gas	Category	Unit	Data	References
CO ₂	Savanna and grassland	[g/kg-dm]	1,613	2006GL (V4, Chp2, Table 2.5)
	Agricultural residues	[g/kg-dm]	1,515	2006GL (V4, Chp2, Table 2.5)
	Tropical forest	[g/kg-dm]	1,580	2006GL (V4, Chp2, Table 2.5)
	Extra tropical forest	[g/kg-dm]	1,569	2006GL (V4, Chp2, Table 2.5)
	Biofuel burning	[g/kg-dm]	1,550	2006GL (V4, Chp2, Table 2.5)
CH ₄	Savanna and grassland	[g/kg-dm]	2.30	2006GL (V4, Chp2, Table 2.5)
	Agricultural residues	[g/kg-dm]	2.70	2006GL (V4, Chp2, Table 2.5)
	Tropical forest	[g/kg-dm]	6.80	2006GL (V4, Chp2, Table 2.5)
	Extra tropical forest	[g/kg-dm]	4.70	2006GL (V4, Chp2, Table 2.5)
	Biofuel burning	[g/kg-dm]	6.10	2006GL (V4, Chp2, Table 2.5)
N ₂ O	Savanna and grassland	[g/kg-dm]	0.21	2006GL (V4, Chp2, Table 2.5)
	Agricultural residues	[g/kg-dm]	0.07	2006GL (V4, Chp2, Table 2.5)
	Tropical forest	[g/kg-dm]	0.20	2006GL (V4, Chp2, Table 2.5)
	Extra tropical forest	[g/kg-dm]	0.26	2006GL (V4, Chp2, Table 2.5)
	Biofuel burning	[g/kg-dm]	0.06	2006GL (V4, Chp2, Table 2.5)

8. 攪乱に伴うバイオマス損失比率

Ecological zone	Data	References
Default (stand-replacing disturbance)	1.0	2006GL (V4, Chp2, Page 2.18)
Insect disturbance	0.3	2006GL (V4, Chp2, Page 2.18)

9. 有機土壌からの CO₂ 排出係数

Categories		Climate	Unit	Data	References
Forest land	Drained organic soils	Tropical	[t-C/ha/yr]	1.36	2006GL (V4, Chp4, Table 4.6)
Cropland	Cultivated organic soil	Tropical/Sub-tropical	[t-C/ha/yr]	20.00	2006GL (V4, Chp5, Table 5.6)
Grassland	Drained organic soils	Tropical/Sub-tropical	[t-C/ha/yr]	5.00	2006GL (V4, Chp6, Table 6.3)
Peatland	Peat extraction	Tropical	[t-C/ha/yr]	2.00	2006GL (V4, Chp7, Table 7.4)
Settlements	Deep drainage	Tropical/Sub-tropical	[t-C/ha/yr]	20.00	2006GL (V4, Chp5, Table 5.6)
Other land	-	-	-	-	2006GL (V4, Chp9, Page 9.7) It is assumed that the stock changes in organic soils are minimal because drainage is unlikely in "Other Lands".

参考資料 2 標本木破壊調査の様子（写真）



バイオマス調査協力先 スパヌボン大学訪問
(2012年11月12日、ルアンプラバン)



バイオマス調査協力先 スパヌボン大学訪問
(2012年11月12日、ルアンプラバン)



バイオマス調査のキックオフミーティング
(2012年11月13日、ルアンプラバン)



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**技術成果報告書
「社会経済調査の取りまとめ結果」**

平成 26 年 10 月（2014 年 10 月）

独立行政法人国際協力機構（JICA）

三菱 UFJ リサーチ & コンサルティング株式会社

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ラオス国森林減少抑制のための参加型土地・森林管理プロジェクトに係る REDD+認証・登録支援業務
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-目次-

第1章 本技協力成果品の位置付け.....	1
第2章 ルアンプラバン県(準国ベース)を対象とした取組	2
1. 調査方法	2
2. 調査結果	5
第3章 ポンサイ郡を対象とした取組.....	11
調査 1 ポンサイ郡社会経済開発計画や統計の分析による森林減少・劣化のドライバー抽出・分析.....	13
1. 対象地の基礎情報.....	14
2. ポンサイ郡における社会経済の特徴.....	16
調査 2 村落住民へのインタビューによる森林減少・劣化のドライバー抽出・分析.....	17
1. 森林減少・劣化のドライバー特定	17
2. 森林及び森林資源利用の状況.....	22
3. 生計維持に必要な能力の現状	24
調査 3 対象地における Human Resources 及び Natural Resources を把握.....	28
1. ホアイキン村落クラスターの現状.....	28
2. 森林減少・劣化の課題分析と目的分析.....	29
調査 4 Demonstration Activity の選定	33
1. Demonstration Activity の選定	33
2. 住民特性に配慮した実施アプローチの分析	36
まとめ(プロジェクト活動の段階的な実施)	39
参考資料 1 ルアンプラバン県各郡の社会経済開発計画要約.....	44
参考資料 2 社会経済調査の質問票	68
参考資料 3 社会経済調査の様子(写真)	77
別冊 1: Socio-economic Survey and Analysis to Identify Drivers of Forest Changes Houay Khing and Sop Chia Village Clusters, Phonxay District, Luanf Prabang	
別冊 2: Developing livelihood and capacity development strategies for Houaykhing Village, Luang Prabang Province, LAO PDR	

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技術協力成果品「社会経済調査の取りまとめ結果」

第1章 本技協力成果品の位置付け

本業務では、ルアンプラバン県及びルアンプラバン県ポンサイ郡内のホアイキン村落クラスターという異なる2つのスケールを対象とし、それぞれ準国ベースとプロジェクトベースの REDD プラス事業を実施・支援するための作業を進めた。

準国ベースと位置付けられるルアンプラバン県を対象にした取組では、UNFCCC での議論、及び VCS といった自主的市場における REDD プラスへの取組動向に留意しつつ準国ベースの参照レベルの開発を進め、社会経済調査の結果は参照レベルにおいて森林動態を把握・推計するための因子 (National/Regional Circumstances) として活用することを目的とした。

一方、プロジェクトベースとして位置付けられるホアイキン村落クラスターを対象にした取組では、準国ベースと同じく参照レベルの開発を進めるとともに、対象地における森林減少・劣化の要因（ドライバー）を特定すること、さらに特定したドライバーに対して効果的な対策（Project Activity）を選定することを目的に社会経済調査を実施した。つまり、プロジェクトベースを対象にした社会経済調査では、具体的な PD の骨格情報を社会経済調査から得ることとし、対象地であるホアイキン村落クラスターにおける各民族の土地利用方法や生活様式といった詳細な分析まで行い、数十年間に及ぶ REDD プラス事業の永続性を担保した Project Activity となるよう取組を進めた。

なお、社会経済調査は技術協力プロジェクト「PAREDD」から図1に示すような対象地の土地・森林利用に関する基礎情報の提供を受けながら調査を進め、適宜 PAREDD へも調査結果を還元しながら進めた。

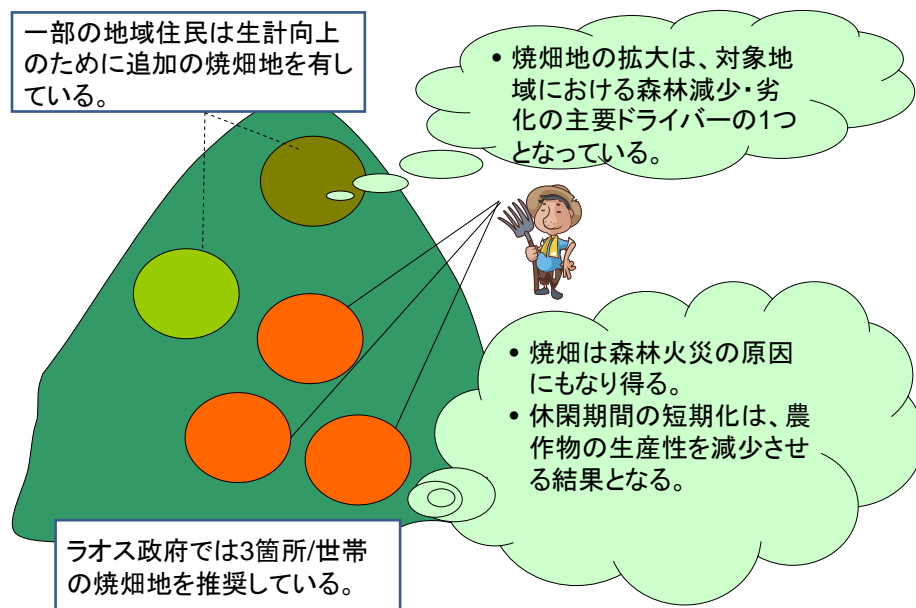


図1 本業務の開始段階で PAREDD から提供されたホアイキン村落クラスターにおける土地利用（イメージ）

第2章 ルアンプラバン県（準国ベース）を対象とした取組

1. 調査方法

準国ベースであるルアンプラバン県を対象にした参照レベルの策定にあたっては、技術協力成果品「森林動態の解析結果」、技術協力成果品「標本木調査の取りまとめ結果」、そして技術協力成果品「森林プロット調査の取りまとめ結果」に基づき経年的な森林動態・炭素動態を明らかにするとともに、本成果物から得られるルアンプラバン県の National/Regional Circumstances を反映することが必要になる。このため、参照レベルの算定に必要な National/Regional Circumstances として、社会経済に関する因子を特定するための調査を実施し、以下に示す図 2 における青線（参照レベル）が直線的ないし曲線的に回帰するかを社会経済因子（National/Regional Circumstances）から解析する作業を進めた。

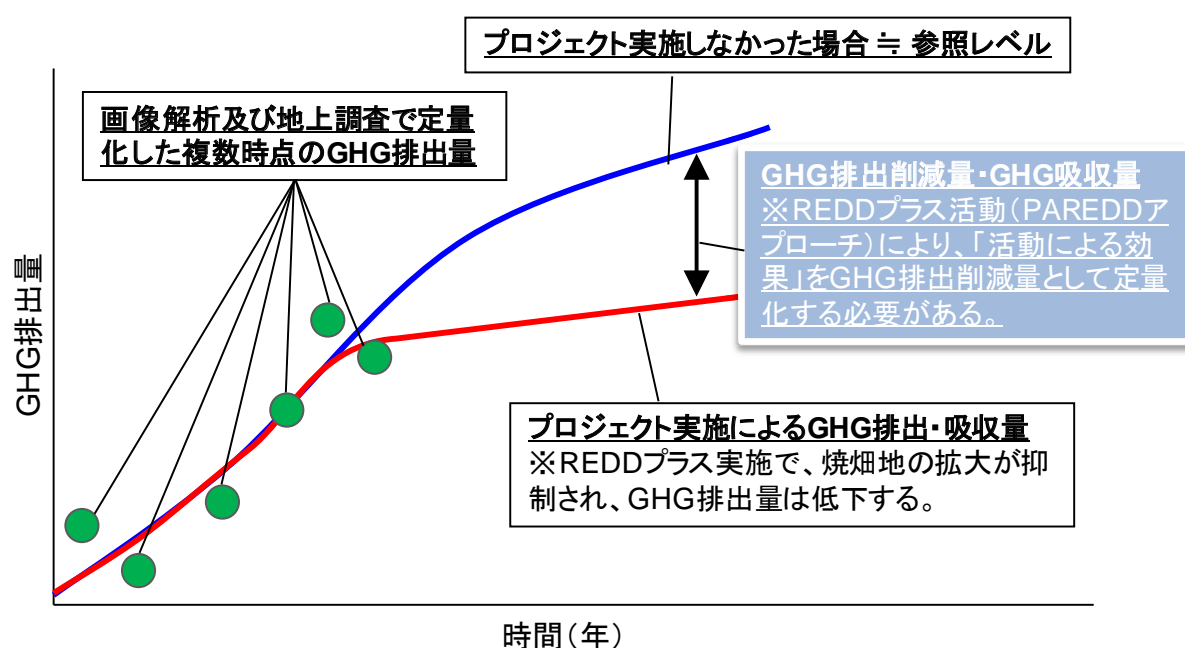


図2 ルアンプラバン県における参照レベルの考え方

具体的には、ルアンプラバン県 PAFO が毎年公表している SEDP に基づいて、森林減少・劣化のドライバーを含む社会経済的特徴を把握した。さらにルアンプラバン県の人口、GDP、農業等の統計情報を収集し、森林減少・劣化と相関関係の高い統計情報を抽出し、参照レベル算定に必要な社会経済に関する因子を分析した。その他、本調査では関連する社会経済関連のデータ（主に経済社会統計や農業統計等）を入手し（表1）、社会経済的特徴の把握のために用いた。

表 1 本調査で収集した社会経済関連資料一覧

No	資料名	統計年	発行年	番号・サイン等	入手先
I	Provincial Documents				
	Socioeconomic Development Plan (SEDP)	2010-2011	Oct 2010	№02, 13 Jan 2011	DPI
	SEDP and Development Direction towards 2020	2008-2009	Dec 2008	Supported by GPAR-LPQ	DPI
	SEDP	2006-2007	Oct 2006	№292, 1 Nov 2006	DPI
	SEDP	2005-2006	Aug 2005	No signature and stamp	DPI
	SEDP	2003-2004	-	№292, 14 Oct 2003	DPI
	SEDP Five-Year (2006-2010) + SEDP Implementation of 2001-2005	2006-2010 2001-2005	(soft copy)		DPI
	SEDP Five-Year (2011-2015) + SEDP Implementation of 2006-2010	2011-2015 2006-2010	(soft copy)		DPI
	Agricultural Statistics Yearbook 2010	2006-2010	May 2011		MAF
	LPQ Statistical Data Yearbook	1990-1995			DPI
	LPQ Statistical Data Yearbook	1996-2000			DPI
	LPQ Statistical Data Yearbook	2001-2005			DPI
	LPQ Statistical Data Yearbook	2006			DPI
	LPQ Statistical Data Yearbook	2007			DPI
	LPQ Statistical Data Yearbook	2008			DPI
	LPQ Statistical Data Yearbook	2009			DPI
	LPQ Statistical Data Yearbook	2010			DPI
	LPQ Statistical Data Yearbook	2011			DPI
	Industry and Commerce Sector Implementation 2008-2009 and Development Direction 2009-2010	2008-2009 2009-2010		№1280, 8 Oct 2009	DOIC
	Processing and Commerce Development Plan	2011-2015		№0318, 11 Mar 2010	DOIC
	Compiled Strategic Plan on Forestry Management and Protection – LPQ	2008-2020		-	
	2006-2010 Agriculture and Forestry Implementation Report and Development Direction 2011-2015	2006-2010 2011-2015		№1061, 24 Nov 2009	PAFO
	2010-2011 Agriculture and Forestry Sector Implementation and Development Plan 2011-2012	2010-2011 2011-2012		№559, 27 Sept 2011	PAFO
	9-Month Agriculture and Forestry Sector Implementation + the last Quarter Plan and Development Plan 2012-2013	2011-2012 2012-2013		№537, 28 Jun 2012	PAFO

表 1 つづき

No	資料名	統計年	発行年	番号・サイン等	入手先
II	District Documents				
	SEDP – Pak Seng	2012-2013	-	№291	DPI
	SEDP – Xieng Ngeun	2009-2010	5 Mar 2009	-	DPI
	Investment Plan – Xieng Nguen	2009-2010	Feb 2009	-	DPI
	A 9-month (SEDP) implement report and the last-quarter development plan – Pak Ou	2012-2013	-	№30, 26 Jun 2012	DPI
	SEDP Implementation Report and Development Plan for 2011-2012 – Nan	2010-2011		№12, 26 Jan 2012	DPI
	SEDP - Muang Luang Prabang	2012-2013	-	№151, 20 Mar 2012	
	SEDP Implementation Report and SEDP 2011-2012 – Muang Luang Prabang	2010-2011		№120, 12 Dec 2012	
	2010 Implementation and 2011 Plan – Muang Luang Prabang	2010	-	30 Dec 2011	DPI
	Statistical Data on Poverty Assessment...	2010-2011	-	№49, 23 Apr 2011	DPI
	SEDP – Chomphet	2008-2009	-	№023, 21 May 2008	DPI
	SEDP Implementation Report and Development Plan for 2011-2012 – Viengkham	2010-2011		№01, 13 Jan 2012	DPI
	Proposed SEDP – Nam Bak	2012-2013		№29, 23 Mar 2012	DPI
	A First-6-Month SEDP Implementation Report and the Last-6-Month Development Plan – Phon Thong	2011-2012	7 Mar 2012	№16, 09 Mar 2012	DPI
	SEDP – Phonsay	2004-2005	Jun 2004		DPI
	A First-6-Month SEDP Implementation Report and the Last-6-Month Development Plan – Phou Khoun	2006	28 Mar 2006	№98, 28 Mar 2006	DPI
	SEDP- Ngoi	2010-2015	Jan 2010	No signature and stamp	DPI
	District Political Performance Report	2004-2009	Jan 2010	-	-

表 1 つづき

No	資料名	統計年	発行年	番号・サイン等	入手先
III	List of projects (public and private)				
	Public Investment Projects (PIP) – LPQ	2011-2012	-	Approved by MPI/Govt.	MPI/DPI
	Public Investment Projects (PIP) – LPQ	2010-2011	-	Approved by MPI/Govt.	MPI/DPI
	Public Investment Projects (PIP) – LPQ	2009-2010	-	Approved by MPI/Govt.	MPI/DPI
	Public Investment Projects (PIP) – LPQ	2008-2009	-	Approved by MPI/Govt.	MPI/DPI
	Public Investment Projects (PIP) – LPQ	2007-2008	-	Approved by MPI/Govt.	MPI/DPI
	Public Investment Projects (PIP) – LPQ	2006-2007	-	Approved by MPI/Govt.	MPI/DPI
	Public Investment Projects (PIP) – LPQ	2005-2006	-	Approved by MPI/Govt.	MPI/DPI
	Public Investment Projects (PIP) – LPQ	2004-2005	-	Approved by MPI/Govt.	MPI/DPI
	Public Investment Projects (PIP) – LPQ	2003-2004	-	Approved by MPI/Govt.	MPI/DPI
	List of hydro development projects – LPQ	2000	-		MEM
	List of private-foreign investment projects – LPQ	1990-2012	-	№286, 2 Apr 2012	DPI

(注) PAFO = Provincial Agriculture and Forestry Office, MAF = Ministry of Agriculture and Forestry, MPI = Ministry of Planning and Investment, DPI = Provincial Department of Planning and Investment, MEM = Ministry of Energy and Mining, DOIC = Provincial Department of Industry and Commerce

2. 調査結果

2.1 社会経済開発計画から得たルアンプラバン県の特徴

ルアンプラバン県の森林減少・劣化のドライバーを含む社会経済的特徴について、SEDP に基づき以下の通り土地利用に関係する生計活動の特徴を整理した。

2.1.1 農業・畜産業

ルアンプラバン県には 2010 年 10 月段階で 782 の村があり、そのうち 230 が貧困村として位置付けされており、世帯割合では全体の約 12.4% (8,847 世帯) が貧困世帯となっていた。そうした中、SEDP では貧困を撲滅するため生計と密接に関係する土地・森林の管理・利用方法に着目し、とくに非持続的かつ安定的に収入を得ることのできない焼畑移動耕作への対策を進めていた。

焼畑移動耕作の代替となる生計手段として、SEDP では東南アジア一帯で進められている水田開発が挙げられていた。ルアンプラバン県でも水田開発が進められてはいたが、2010 年段階では水田からのコメ生産が十分ではなく、結果としてルアンプラバン県では約 9 ヶ月分に消費するコメしか生産・供給できておらず、水田開発が進まないことが焼畑移動耕作を減少させることの足かせとなっていた。また、ルアンプラバン県では稲作栽培に加え家畜飼育を主要輸出製品とする取組も進められていた。具体的には牧場等での家畜飼育、牧草地の栽培、動物へのワクチン接種といった取組が実施されており、焼畑移動耕作に代わる生計手段を模索していた。

その他、ラオス政府もしくはルアンプラバン県政府は、それぞれの地域の潜在能力を活かした地元生産品の奨励を行ってきた。代表的な例としては、有機栽培野菜、産業用植物・樹木・果樹栽培等であり、2010 年段階で栽培面積は約 33 千 ha に達していた。主だった生産品としては、ハトムギ（マクドーイ）、ゴマ、ピーナッツ、大豆、茶葉、オレンジ、非木材林産物（例えば、ほうき草、こうぞ、天然ゴム、サンダルウッド等）、タバコ、とうもろこし、天然ゴム、紙用樹木、チーク、シタンの根、牛（水牛含む）、ヤギ、豚、馬、卵等が挙げられた。

2.1.2 林産業（持続可能な森林管理と焼畑移動耕作の減少）

ルアンプラバン県は、統計上では約 967 千 ha（県面積の 57.3%）が森林に覆われており、保全林は約 63 千 ha、保護林は約 628 千 ha、生産林は約 275 千 ha となっていた（2010 年段階）。生産林における種類別では、チーク林が約 26 千 ha、ゴム農園が約 13 千 ha 等の構成となっていた。

これまで、ルアンプラバン県では、森林管理及び木材生産の管理を基幹産業として位置付けてきた。このため、林産業に係る地方のインフラ調査、製材工場、家具工場における検査・管理を進めてきた他、野生動物や水中に生息する動物のモニタリングといった取組も実施してきた。

加えて、ルアンプラバン県では焼畑移動耕作の削減策として代替生計の導入を支援しており、植林、家畜飼育、土地・森林管理についての訓練等を行ってきた。

2.1.3 エネルギーと鉱山業

ルアンプラバンにおける電化率は 2009～2010 年にかけて大幅に上昇し、2010 年段階では 782 村のうち 630 村（約 50 千世帯）が電化するに至った。そうした中、ルアンプラバン県では山岳地形を活かした多数の水力発電プロジェクトが計画・実施されるに至り、得られた電力は海外に輸出されるとともに、山岳地における電化率の向上にも寄与していた。

鉱業に関しては、ラオスの法律に基づいて政府が鉱山ビジネスの検査・管理を実施していた。そうした中、ルアンプラバン県内には金等の鉱物が埋蔵されており、近年では海外資本により注目されるに至った。その中では、タイや中国が鉱山ビジネスに関心を寄せていた。

2.1.4 製造業と貿易

ルアンプラバン県では製造業も進められており、国内外で消費されるセメント、レンガ、鉄鋼、瓦、釘、コンクリートの工場、そして製材所や家具産業（ルアンプラバン県内に 105 企業存在する）といった産業があった。手工業としては、海外からの旅行者等を対象にした土産物として、金・銀製品、織物（綿、絹）木材彫刻、手漉き紙といった手工業製品の生産が奨励されていた。

中国やベトナムとの国境に近いルアンプラバン県では、海外からの顧客（観光客を含む）を対象にした市場も整備されており、2010 年段階で合計 83 の市場があった。そして、ルアンプラバン県における輸出量は総額約 2,730 億 Kip に達していた（主にゴマ、紙製造用の木材、ハトムギ、とうもろこし、タバコ、ヤシ、非木材林産物、チーク木材、家具製品等を中国、ベトナム、タイ、韓国、台湾等に輸出）。

2.1.5 観光業

ルアンプラバン県では、ルアンプラバン市街が世界文化遺産として制定されて以降、観光業が経済発展のための最重要産業として位置付けられるに至った。ルアンプラバン県は観光業を円滑にす

るためのインフラ開発を進め、とくに隣接国をつなぐ道路の建設に重点を置いていた。また、町の美化、国際基準に見合った空港の整備、道路の舗装、電気・水供給、郵便、交通、花壇の整備といった活動に民間企業が参加することを促しており、さらにホテルやゲストハウスのサービスの向上も促進していた。ルアンプラバンには 2010 年段階で 210 千人の外国人観光客と、1,000 千人の国内観光客が訪れており、観光業は約 1.3 億 USD の経済効果をもたらしていた。

2.2 森林減少・劣化のドライバー特定

参照レベルの設定にあたって社会経済に関する指標を National/Regional Circumstances として反映するため、以下の図 3 に示した作業手順に基づき、ルアンプラバン県における森林減少（森林面積の変化）と相関関係を有する統計情報の抽出を進めた。

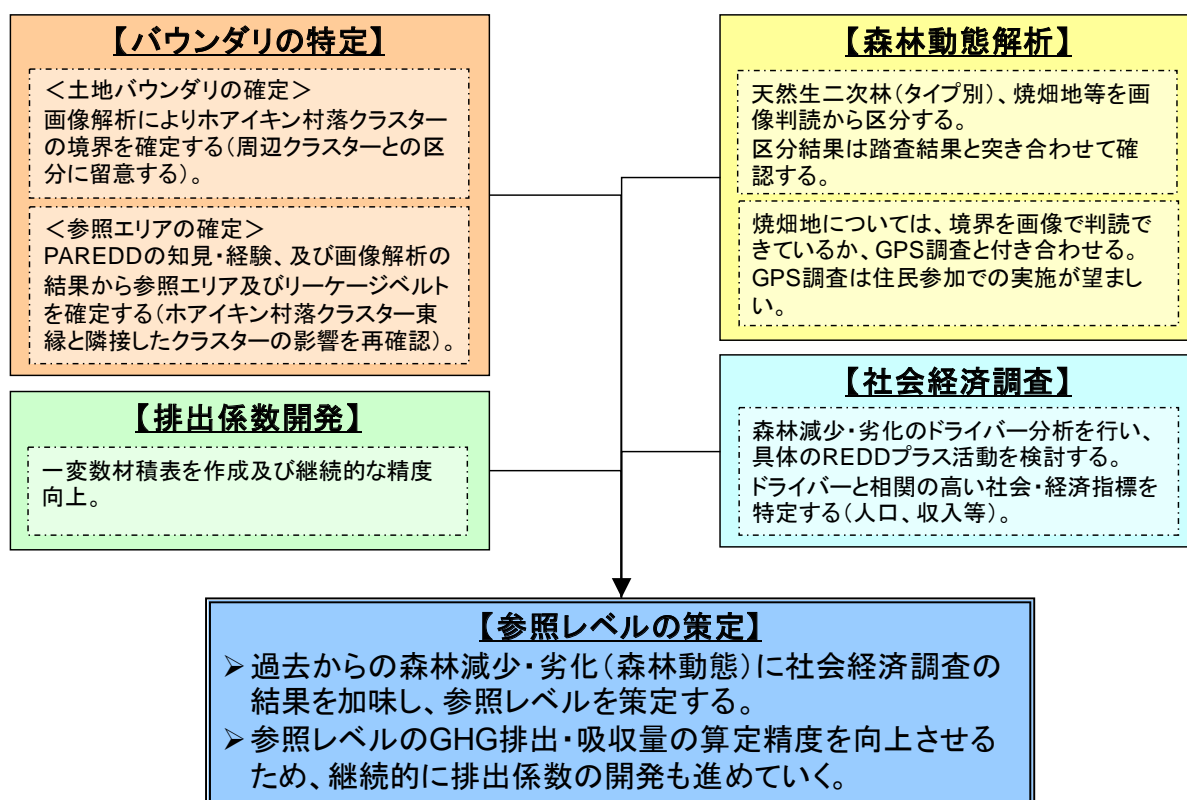


図 3 参照レベル設定にあたっての作業手順

その結果、SEDP から得られた焼畑移動耕作 (Rotational upland rice) の面積が、技術協力成果品「森林動態の解析結果」で得られた森林減少面積と正の相関があることが示された。また、水稻栽培 (Irrigated rice)、ハトムギ (Job's tear)、ゴマ (Sesame) 等の換金作物が森林減少面積と負の相関がある (森林減少の抑制に効果的である) ことが分かった (表 2)。なお、ルアンプラバン県内の 12 郡ごとの SEDP に基づく社会経済状況の整理は参考資料 1 を参照されたい。

表 2 森林面積の動態と関係する土地利用に関する統計の分析

		NC 1	NC 2	NC 3	NC 4	NC 5	NC 6	NC 7	NC 8	NC 9	NC 10	NC 11	NC 12	NC 13	NC 14	NC 15	NC 16	NC 17	NC 18	NC 19	NC 20	NC 21	NC 22	NC 23	NC 24	NC 25	NC 26	NC 27	NC 28	NC 29	NC 30	NC 31	NC 32	NC 33	NC 34
NC 1	Forest area	1.00																																	
NC 2	No. of Villages	-0.30	1.00																																
NC 3	Total	-0.40	0.68	1.00																															
NC 4	Male	-0.59	0.61	0.65	1.00																														
NC 5	Female	-0.58	0.61	0.65	1.00	1.00																													
NC 6	No. of HHs	-0.30	0.81	0.56	0.47	0.47	1.00																												
NC 7	Rain-fed rice - napii (ha)	-0.95	0.30	0.36	0.70	0.70	0.27	1.00																											
NC 8	Rain-fed rice - napii (production)	-0.97	0.32	0.38	0.65	0.64	0.35	0.97	1.00																										
NC 9	Irrigated rice - naxeng (ha)	-0.84	0.38	0.43	0.54	0.53	0.45	0.77	0.80	1.00																									
NC 10	Irrigated rice - naxeng (production)	-0.76	0.29	0.41	0.58	0.58	0.36	0.78	0.79	0.88	1.00																								
NC 11	Rotational upland rice (ha)	0.64	-0.29	-0.68	-0.20	-0.19	-0.30	-0.48	-0.56	-0.57	-0.49	1.00																							
NC 12	Rotational upland rice (production)	0.64	-0.32	-0.71	-0.23	-0.22	-0.34	-0.50	-0.58	-0.55	-0.50	0.99	1.00																						
NC 13	Sweet corn (ha)	-0.23	-0.12	-0.23	0.29	0.29	-0.26	0.36	0.32	-0.01	0.11	0.32	0.28	1.00																					
NC 14	Sweet corn (production)	-0.47	-0.02	-0.02	0.43	0.43	-0.18	0.57	0.52	0.19	0.29	0.05	0.02	0.93	1.00																				
NC 15	Jobs tear (ha)	-0.91	0.28	0.28	0.71	0.71	0.21	0.96	0.91	0.75	0.76	-0.35	-0.36	0.40	0.59	1.00																			
NC 16	Jobs tear (production)	-0.85	0.26	0.26	0.64	0.64	0.33	0.88	0.85	0.78	0.77	-0.37	-0.38	0.16	0.32	0.90	1.00																		
NC 17	Roots (ha)	-0.57	0.22	0.04	0.53	0.54	-0.09	0.67	0.59	0.35	0.38	0.00	-0.03	0.56	0.60	0.76	0.58	1.00																	
NC 18	Roots (production)	-0.60	0.32	0.19	0.58	0.59	-0.06	0.68	0.60	0.39	0.39	-0.14	-0.16	0.44	0.52	0.76	0.61	0.97	1.00																
NC 19	Vegetables (ha)	-0.49	0.15	0.01	0.37	0.37	0.14	0.56	0.55	0.36	0.42	-0.09	-0.09	0.44	0.52	0.56	0.41	0.52	0.48	1.00															
NC 20	Vegetables (production)	-0.51	0.29	0.22	0.51	0.51	0.25	0.58	0.58	0.38	0.42	-0.19	-0.19	0.38	0.48	0.53	0.42	0.50	0.50	0.93	1.00														
NC 21	Peanuts (ha)	-0.48	-0.05	-0.24	0.44	0.44	-0.08	0.58	0.55	0.37	0.39	0.25	0.23	0.74	0.69	0.66	0.60	0.71	0.61	0.63	0.56	1.00													
NC 22	Peanuts (production)	-0.72	0.11	0.04	0.65	0.65	0.07	0.80	0.75	0.60	0.60	-0.03	-0.04	0.62	0.70	0.86	0.80	0.72	0.68	0.66	0.63	0.92	1.00												
NC 23	Soy bean (ha)	-0.39	-0.11	-0.00	0.39	0.40	-0.25	0.46	0.38	0.26	0.33	0.08	0.07	0.70	0.80	0.51	0.40	0.46	0.43	0.28	0.24	0.59	0.66	1.00											
NC 24	Soy bean (production)	-0.46	-0.05	0.06	0.43	0.44	-0.25	0.53	0.45	0.27	0.34	-0.01	-0.02	0.71	0.83	0.57	0.40	0.56	0.53	0.36	0.33	0.56	0.65	0.98	1.00										
NC 25	Tobacco leaf (ha)	0.10	-0.03	-0.26	0.16	0.16	-0.04	0.02	-0.01	-0.16	-0.02	0.48	0.39	0.31	0.12	0.11	0.21	0.46	0.36	0.03	0.03	0.49	0.28	0.12	0.07	1.00									
NC 26	Tobacco leaf (production)	-0.23	0.15	0.06	0.33	0.33	0.20	0.30	0.33	0.12	0.18	0.05	-0.05	0.29	0.17	0.27	0.41	0.44	0.41	0.21	0.31	0.54	0.41	0.06	0.03	0.79	1.00								
NC 27	Sesame (ha)	-0.86	0.25	0.33	0.73	0.73	0.18	0.92	0.88	0.66	0.70	-0.35	-0.35	0.53	0.75	0.92	0.81	0.65	0.66	0.60	0.62	0.65	0.87	0.70	0.75	0.00	0.20	1.00							
NC 28	Sesame (production)	-0.89	0.32	0.39	0.79	0.79	0.26	0.95	0.91	0.70	0.73	-0.38	-0.39	0.47	0.68	0.95	0.85	0.70	0.71	0.61	0.65	0.65	0.86	0.61	0.66	0.07	0.28	0.98	1.00						
NC 29	Cow	-0.68	0.25	0.09	0.73	0.72	0.31	0.81	0.78	0.55	0.61	-0.01	-0.03	0.45	0.50	0.83	0.83	0.67	0.62	0.55	0.58	0.76	0.84	0.37	0.37	0.40	0.51	0.78	0.83	1.00					
NC 30	Buffalo	-0.16	-0.14	-0.48	0.33	0.33	-0.07	0.35	0.28	0.10	0.19	0.60	0.58	0.55	0.43	0.44	0.46	0.50	0.37	0.35	0.28	0.80	0.67	0.42	0.35	0.59	0.42	0.40	0.40	0.75	1.00				
NC 31	Pig	-0.30	-0.04	-0.33	0.46	0.46	0.03	0.49	0.43	0.22	0.34	0.44	0.42	0.56	0.47	0.55	0.57	0.57	0.46	0.49	0.45	0.83	0.75	0.42	0.37	0.58	0.49	0.52	0.54	0.85	0.97	1.00			
NC 32	Goat	-0.70	0.25	0.14	0.75	0.74	0.32	0.82	0.80	0.59	0.65	-0.05	-0.07	0.48	0.54	0.83	0.83	0.62	0.58	0.61	0.66	0.78	0.88	0.44	0.43	0.29	0.46	0.83	0.87	0.98	0.71	0.83	1.00		
NC 33	Poultry	-0.64	0.16	-0.03	0.67	0.67	0.20	0.78	0.73	0.50	0.55	0.09	0.07	0.51	0.55	0.82	0.82	0.69	0.63	0.54	0.56	0.82	0.88	0.46	0.45	0.43	0.51	0.77	0.81	0.98	0.83	0.90	0.96	1.00	
NC 34	Horse	-0.45	-0.31	-0.37	-0.05	-0.04	-0.32	0.37	0.33	0.43	0.26	-0.00	0.06	0.24	0.32	0.46	0.37	0.30	0.25	0.24	0.07	0.46	0.50	0.40	0.41	-0.22	-0.21	0.37	0.31	0.20	0.32	0.25	0.22	0.31	1

※表中の値が 1.0 に近い程、森林減少と正の相関が高い。表中の値が-1.0 に近いほど、森林減少と負の相関が高い。

2.3 参照レベル設定への社会経済因子の反映

参照レベルの策定にあたり、本業務では以下の4つの技術協力成果品を用いた。

1. 技術協力成果品「森林動態の解析結果」
2. 技術協力成果品「標本木調査の取りまとめ結果」
3. 技術協力成果品「森林プロット調査の取りまとめ結果」
4. 技術協力成果品「社会経済調査の取りまとめ結果」（本調査）

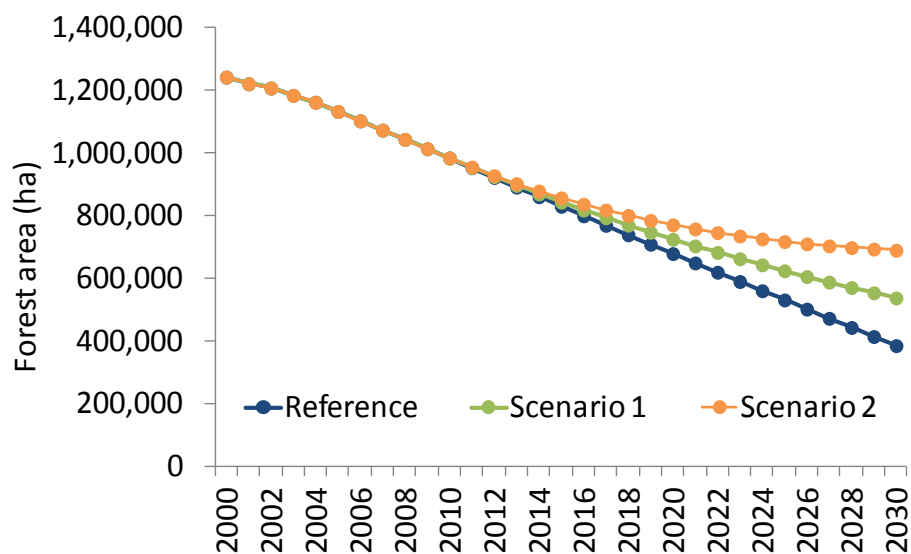
ラオスでは2014年7月末段階で参照レベルの設定にあたっての具体的な方向性を示しておらず、ここでは直近のUNFCCCにおける議論、そしてVCS等の動向に基づき、上記4つの技術協力成果品を用い、計量経済モデルを用いて参照レベルを設定した。

設定した参照レベルについては業務完了報告書に設定方法等を詳述したが、社会経済因子としては、人口、家畜（ここでは統計から入手可能なCowを適用）、そして焼畑移動耕作を代替する生計手段として水田面積を用い、以下のモデルにより構築した。

$$\begin{aligned}
 ForArea_t &= -0.0725 \times ForArea_{t-1} - 0.889 \times FA_t - 0.884 \times SBA_t + 1,708,039 \\
 FA_t &= 0.953 \times FA_{t-1} + 1.38 \times SBA_{t-1} - 65,867 \\
 SBA_t &= -0.577 \times SBA_{t-1} - 23.7 \times PF_t + 2.09 \times POP_t - 0.390 \times Cow_t - 560,942
 \end{aligned}
 \quad \text{..... モデル 1}$$

$ForArea_t$	Total forest area of Mixed Forest, Dry Dipterocarp Forest and Teak Plantation within the reference region at year t ; ha
FA_t	Area of Fallow at time t within the reference region; ha
SBA_t	Area of Slash-and-Burn at time t within the reference region; ha
PF_t	Area of Paddy Field at time t within the reference region; ha
POP_t	Population of within the reference region at time t
Cow_t	Number of Cow as livestock at time t within the reference region
t	1, 2, 3 ... t , a year of the proposed crediting period; dimensionless

なお、計量経済モデル（モデル1）を適用したルアンプラバン県における参照レベルにより、将来の森林面積は以下の通り推計された（図4）。



Note : Scenario “REL” means “Deforestation area is continuing to expand at the current rate. The area of Paddy field and the number of livestock (cow) remain constant until 2030”. Project scenario 1 means “REDD+ activities are implemented. The area of Paddy field and the number of livestock (cow) will increase by 10% over the next 20 years”. Project scenario 2 means “REDD+ activities are implemented intensively. The area of Paddy field and the number of livestock (cow) will increase by 20% over the next 20 years”.

図4 設定した参照レベルに基づく将来の森林面積

第3章 ポンサイ郡を対象とした取組

ポンサイ郡ホアイキン村落クラスターを対象にした取組ではプロジェクトベースの REDD プラス実施を想定した取組を進めた。REDD プラス事業（プロジェクト）を実施するにあたっては、事前に PD を作成することが求められ（技術協力成果品「REDD+事業の認証・登録に向けた調査報告書（認証機関に提出される申請書、並びに関連報告書含む）」を参照されたい）、その中で対象地における森林減少・劣化のドライバーを特定する必要がある。このため、郡が所有する SEDP、及び人口や農業に関する統計データを分析することから森林減少・劣化のドライバーを抽出・分析するとともに、平行して村落の住民を対象に調査票によるインタビューを実施することからドライバー抽出・分析を進めた。そして、分析結果に基づき森林減少・劣化を抑制するために効果的な対策を特定するため、対象地における Human Resources 及び Natural Resources を把握した上で、具体的な Project Activity を実施した場合の森林減少・劣化の抑制効果を定量的に把握するための Demonstration Activity の選定を行った（図 5）。

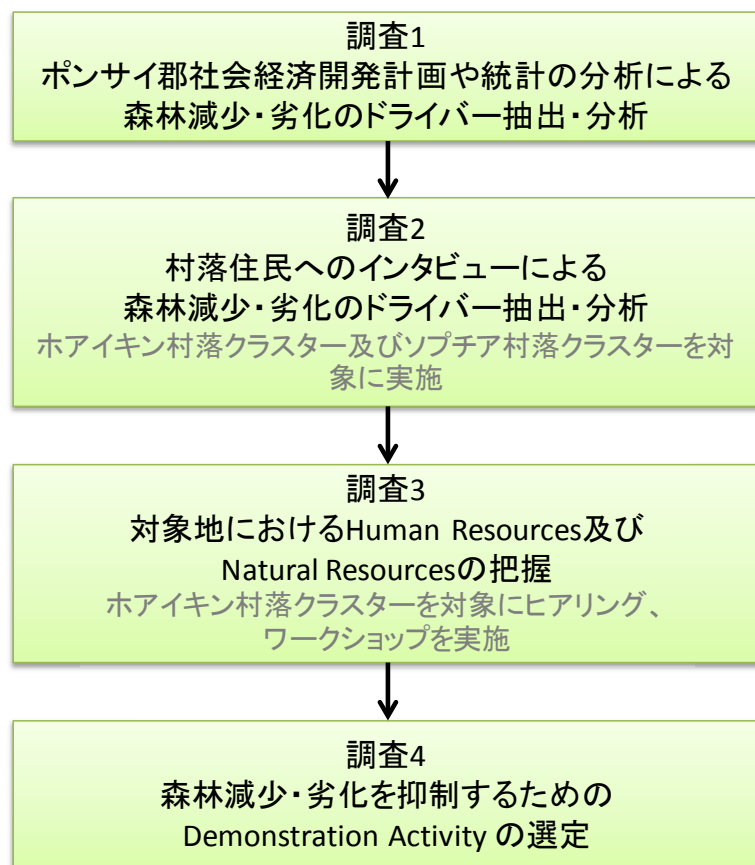


図 5 ポンサイ郡を対象にした社会経済調査の実施フロー

加えて、社会経済調査の結果はポンサイ郡を対象にした参照レベルの策定にあたっても反映した。すなわち、技術協力成果品「森林動態の解析結果」、技術協力成果品「標本木調査の取りまとめ結果」、そして技術協力成果品「森林プロット調査の取りまとめ結果」に基づきポンサイ郡における経年的な森林動態・炭素動態を明らかにするとともに、本成果物から得られるポンサイ郡の Regional Circumstances として反映した。

以上より、ポンサイ郡を対象にした社会経済調査では、以下の図 6 に示す通り参照レベルの設定（青線）を進めると同時に、プロジェクト実施によって得られる森林減少・劣化の抑制効果（赤線＝プロジェクトシナリオ）を推定することを目的とした。

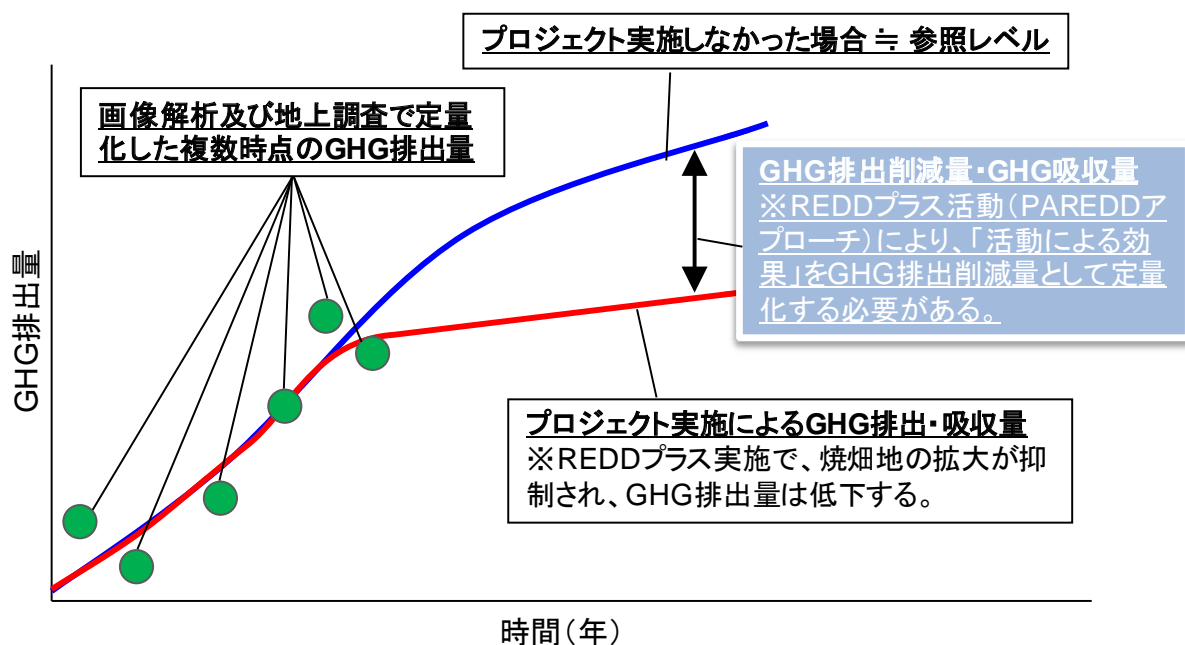


図 6 ポンサイ郡における参照レベル及びプロジェクトシナリオの考え方

次頁以降には、ポンサイ郡を対象にした社会経済調査（調査 1 から調査 4）を図 5 に示した作業フローに基づき詳述した。

調査 1 ポンサイ郡社会経済開発計画や統計の分析による森林減少・劣化のドライバー抽出・分析

本業務の対象地であるホアイキン村落クラスターでは、2000 年以降に著しい人口増加が進んでいた。この人口増加の原因としては、ホアイキン村落クラスターには焼畑地を拡大するポテンシャル（豊富な森林資源）が残っていることが挙げられたが、もう 1 つの理由として行政主導による村落移転等も考えられた。

ホアイキン村落クラスターでは 2002 年に行政主導で村の移転が行われ、6 つの村を統合して村落クラスターとなったが、こうした行政主導の村落移転はラオスでは珍しくなく、行政主導による人口集中化（過密化）という政策的な意味もあることが示唆された。したがって、参照レベルに反映するパラメータの 1 つとして人口増加を考えたとき、その動態は単に社会経済的な側面だけではなく行政主導という側面も考慮することが必要であり、社会経済調査及び参照レベルの策定にとって大きな課題だと考えられた。

なお、本事業では REDD プラス事業における参照エリアとしてはホアイキン村落クラスターを含めたポンサイ郡を設定したが、リーケージベルトとしてはホアイキン村落クラスターと隣接するソプチャ村落クラスター及びポントン村落クラスターを対象とした（図 7）。このことから、森林減少・劣化のドライバー抽出・分析にあたってはポンサイ郡全体を対象にした。

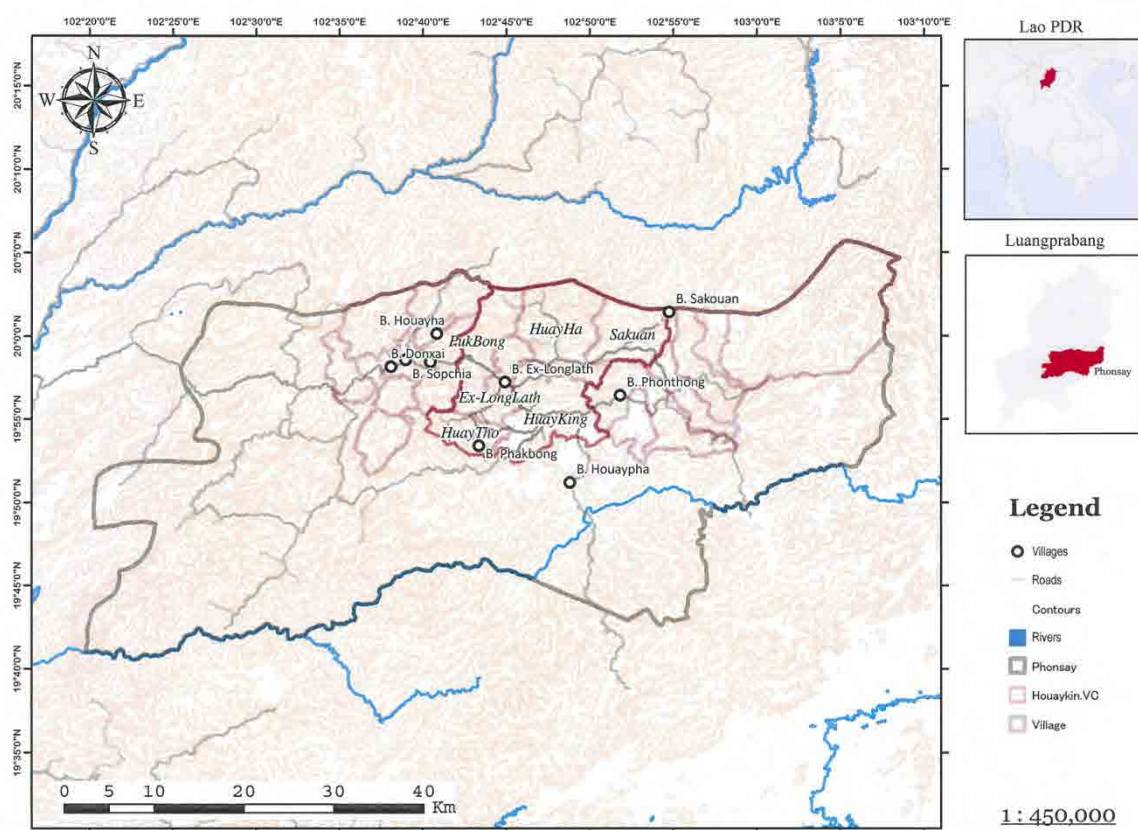


図 7 REDD プラス事業の対象としてホアイキン村落クラスター

1. 対象地の基礎情報

ホアイキン村落クラスターの西側に位置するソプチア村落クラスターでは、1990 年頃からルアンブ
ラバン市街までの道路アクセスが改善されたことにより市場への流通経路が確保され、それに伴い農
業生産や非木材生産物の利用が拡大した。道路整備等の社会インフラの整備や人口増加による森林利
用の増大が、森林被覆や農業・生物多様性を喪失させてきたという状況があり、ソプチア村落クラス
ターでは 1990 年代中頃から The Agrobiodiversity Initiative による農村開発支援が実施されてきた。一方、
ホアイキン村落クラスターでは 2000 年代から道路整備と村落の統合・移設が行われ、電話等の社会イ
ンフラも整備されつつあった（表 3）。

表 3 ホアイキン村落クラスターの道路整備状況

Year	History
2000–2001	Road construction from Sopchia VC (near Luang Prabang City) to HK-VC by manpower (passable only by motorbike)
2003	Road expansion from Sopchia VC to Phonthong VC by heavy machinery (passable by automobile)
2004	Road construction from the main road to Houayha and Sakuan villages
2005	Road construction from the main road to Houaytho village
2011–2012	Road expansion and bridge construction from Luang Prabang City to HK-VC

こうしたことから、今後はホアイキン村落クラスターではソプチア村落クラスター同様の社会経
済開発が進み、それに伴う森林減少・転用圧力の増加が予想された。なお、ホアイキン村落クラス
ターの人口及び村落の概要は

表 4 及び表 5 の通りだった。

表 4 ホアイキン村落クラスターの人口と民族構成

Village Name		Houaykhing	Phakbong	Houaytho	Houayha	Sakuan	Longlath
Number of households (HH)		210	82	59	55	138	81
Population (female)		1,479 (752)	467 (236)	354 (183)	396 (192)	910 (446)	464 (238)
Lao people	No. of HH	5	1	0	0	0	3
	Population (female)	23 (12)	1 (0)	0 (0)	0 (0)	0 (0)	9 (4)
Khmu people	No. of HH	122	81	35	6	464	118
	Population (female)	787 (394)	466 (236)	129 (77)	50 (22)	464 (238)	817 (398)
Hmong people	No. of HH	83	0	24	49	0	17
	Population (female)	669 (345)	0 (0)	225 (106)	346 (170)	0 (0)	85 (44)

表5 ホアイキン村落クラスターの概要

	Houaykhing	Phakbong	Longlath	Houaytho	Houayha	Sakuan
Distance from District Center	36 km	27 km	31 km	39 km	38 km	46 km
Land Area	7,425.8 ha	4,781.0 ha	<i>Work in progress under the PAREDD</i>	2,731.5 ha	7,497.8 ha	4,626.4 ha
Establishment of the Village	2003	2001	<i>Work in progress under the PAREDD</i>	70-100 years ago	Around 1970	Around 1960
Migrated from	Three villages merged into one village; villagers moved to roadside habitations	Phakbong Village was relocated to an area close to the current village area and finally settled to a roadside habitations following merge with Houaysoy Village	<i>Work in progress under the PAREDD</i>	Houaytho was known as Khmu Village at the current location; Hmong moved from Napieng Village located 8 km away in 2003	Houayha villagers were moved to an area close to the current village area, finally settling in the present area.	Hmong have lived at the current location for 50 years; Khmu people moved from the Phakseng District in 2002.
Reason for Migration	Government policy to merge small villages into bigger villages and to provide better road access to improved main road	Government policy to merge small villages into bigger villages and to provide better road access to improved main road	<i>Work in progress under the PAREDD</i>	Hmong moved to the village in 2003 due to government policy to merge small villages into bigger villages and to provide better road access	Need for arable land	Khum moved from Pakseng District in 2002 due to government policy to merge small villages into bigger villages and to provide better road access

2. ポンサイ郡における社会経済の特徴

ポンサイ郡のSEDP¹から、森林減少・劣化のドライバーを含む社会経済的な特徴を整理した。概要は以下の通りだった。

2.1 基礎情報

直近年（2004 年の統計）では、ポンサイ郡内には 55 村があり、合計 4,024 世帯があった。55 村のうち、ラオ族で構成された村は 8 村（535 世帯、人口 2,298 人（郡全体の 9.2%））、カム族が 36 村（2,581 世帯、人口 15,167 人（郡全体の 60.7%））、そしてモン族が 11 村（908 世帯、人口 7,521 人（郡全体の 30.1%））となっていた。郡全体の人口は 24,986 人、人口増加率は 1.7%/年、そして世帯あたりの構成員数は約 6 名となっていた。

ポンサイ郡はルアンプラバン県の中で最も貧しい郡として位置付けられており、2003～2004 年には 15 村（合計 2,318 世帯）が貧困状態と報告された。そうした中、ポンサイ郡の労働人口のうち 80%以上が焼畑移動耕作に従事しているため、ポンサイ郡の労働者の知識や技術は低水準であると報告されていた。また、様々な基礎的インフラ（水道等）が不足しており、清潔な水へのアクセスを持つ世帯は 32.9%、道路へのアクセスを持つ世帯は 59.4%、ヘルスケアサービスへのアクセスを持つ世帯は 73.5%にとどまっていた。そのため、政府は過疎地への教育ネットワークの開発、教員への研修、教育手法の改善、予防接種の接種率向上と過疎地へのヘルスケア支援、村に救急箱の設置、村の診療所の設置、安全な水へのアクセス向上等を最優先課題として支援を行っていた。

2.2 農業

ポンサイ郡は降水量も十分でかつ日射時間も長いことから、ハトムギ、ゴマ、メイズ等の野菜栽培に適した気候であるが、一方で大半が急斜面の山岳地であり、16～30%が低地、30～55%が高地と、水田が可能な平地は限定的となっていた。

郡の主要な産業は農業と家畜であり、世帯の主な職業は、82.7%が焼畑農業、2.7%がサービス業、14.6%が手工芸等を営み、自然に依存した生活を行っていた。水田を営む世帯は 202 世帯、水田と焼畑の両方を営む世帯は 67 世帯、焼畑を営む世帯が 3,330 世帯、サービス業を営む世帯は 107 世帯、そしてその他が 318 世帯となっていた。

2.3 森林保全への取組

ポンサイ郡の焼畑移動耕作の対象面積（統計情報）は 2004 年で約 3 千 ha と報告されていた。焼畑により森林が減少しただけではなく非木材生産物も減少しているため、ポンサイ郡では森林保全の取組が必要であるとされていたが、同時に焼畑移動耕作の代替となる持続可能な雇用の創出が重要だと指摘されていた。

2004 年には郡内の 3 村に居住する 167 世帯が試行的に焼畑移動耕作を止め、政府から資金支援（マイクロファイナンスの提供）を受けることで定住型の生計活動としての家畜の育成（牛、やぎ、豚、鶏）、植林等を行った。こうしたことから、焼畑移動耕作が森林減少・劣化のドライバーとして位置付けられていること、それへの対策が進められていることが分かった。

¹ 以下の記述は、PAFO（2004）Socioeconomic Development Plan Phonsay 2004-2005（ラオ語）より要約を作成した。

調査 2 村落住民へのインタビューによる森林減少・劣化のドライバー抽出・分析

対象地における村落住民を対象にしたインタビュー調査は、ポンサイ郡 DAFO の協力を得て行った。インタビュー先はホアイキン村落クラスター内の 5 つの村落（ホアイキン村、パクボン村、ホアイトー村、ホアイハ村、サクアン村）、隣接するソプチア村落クラスター内の 5 つの村落（ホアムアン村、パクホック村、タットン村、ホアイシア村、ホアイドン村）を対象に、各村落 30 世帯前後を無作為抽出によって抽出した。また、女性の意見を収集するためサンプリングで抽出した 30 世帯あるいは他の世帯の中から 10 世帯を対象に女性にもインタビューを実施した（表 6）。無作為抽出にあたっては Ms-Excel の乱数表を用い、村落の世帯リストから民族、職業（農耕様式）、経済レベル、農地面積等の情報に基づき、偏りなく様々な属性の住民を抽出できるように配慮した。

表 6 ホアイキン村落クラスター及びソプチア村落クラスターのサンプル世帯

Village cluster	Village (economic status)	Total no. of households	No. of sample households (HH, % of total)	No. of female samples (HH)
Houay Khing	Houay Khing (medium)	220	41 (19%)	10
	Sa Kuan (poor)	123	36 (29%)	9
	Houay Ha (poor)	56	37 (66%)	10
	Houay Tho (poor)	58	38 (66%)	8
	Phak Bong (poor)	82	35 (44%)	10
Sobchia	Pak Hok (medium)	95	36 (42%)	9
	Hua Meuang (better-off)	83	35 (44%)	10
	Tad Thong (poor)	82	35 (47%)	9
	Houay Si Yua (medium)	93	38 (41%)	11
	Houay Dong (poor)	85	32 (34%)	16
	TOTAL	977	363	102

なお、各村落でのインタビュー開始前には、ワークショップを開催して本調査の位置付けを説明した。そして、村落のリソースマップの作成、村落の基礎情報の収集を行った後、個別インタビューでは住民の土地利用変遷、村落会議への参画状況、森林利用の状況、焼畑を中心とする生計に関する状況等について 5 段階評価形式で調査を実施した（調査票は参考資料 2 を参照されたい）。

1. 森林減少・劣化のドライバー特定

とくに森林減少・劣化のドライバー特定に関係の深い、住民の土地利用、森林の利用状況、代替生計に関する回答結果、及び森林減少・劣化の抑制に向けて住民の能力（capability）を把握するため、村落会議における住民の意思決定への参画の状況、農業活動等における住民間の協働活動の状況、及び代替生計のニーズに関する回答結果を以下に示した（詳細は参考資料 2 及び別冊 1 を参照）。

1.1 土地利用

土地利用の変遷、現在の土地利用の状況、及び今後の農地拡大の可能性を明らかにするため、サンプル世帯に対して 2003 年以降（遡れる場合は 2003 年以前）の土地利用面積、農地利用箇所数、栽培作物等について聞き取りを行い、家庭内消費に必要な米の生産状況（年間の米の不足量）、生計維持に

必要な農地面積を調査した（調査結果は以下の通り）。

1.2 土地利用の変遷

2003 年以降のホアイキン村落クラスター及びソプチア村落クラスターのサンプル世帯の土地利用毎の利用面積は、図 8 及び図 9 の通りだった。

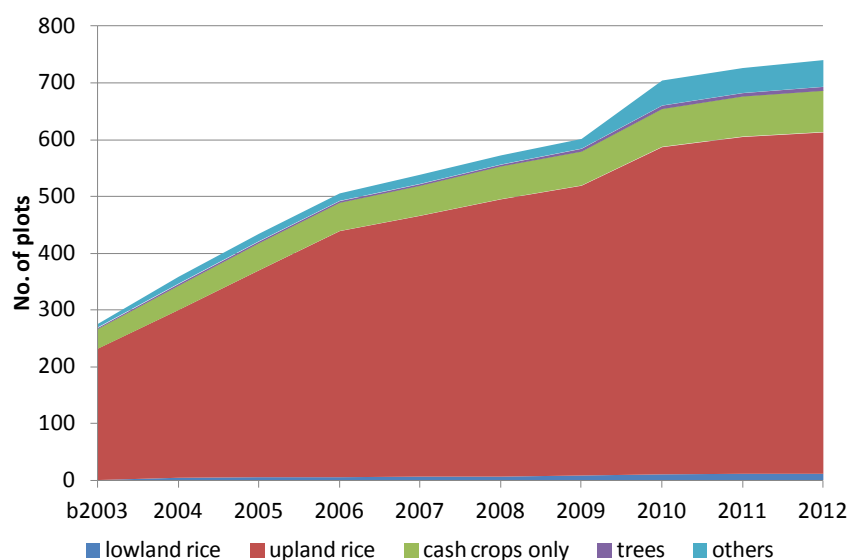


図 8 土地利用毎の農地利用箇所数の変遷（ホアイキン村落クラスターのサンプル世帯合計）

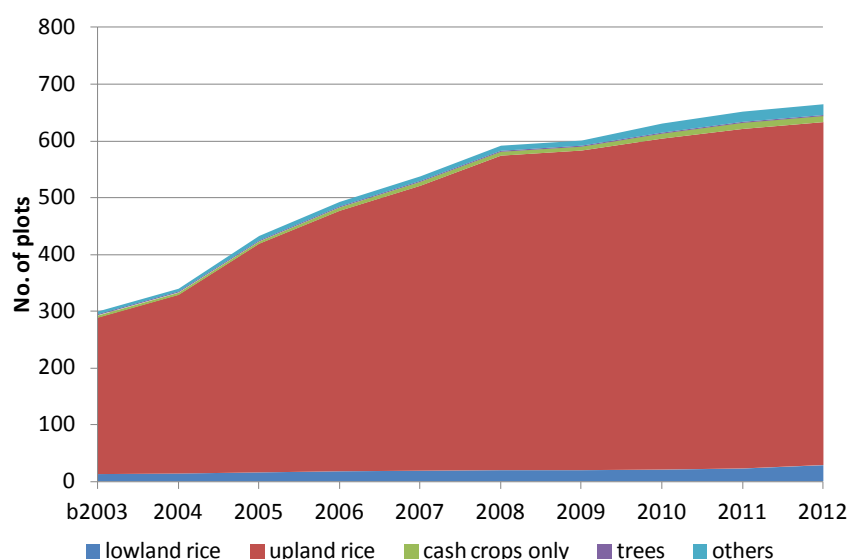


図 9 土地利用毎の農地利用箇所数の変遷（ソプチア村落クラスターのサンプル世帯合計）

注：図 8 及び図 9 の「lowland rice」は水田、「upland rice」は焼畑米のみの栽培若しくは換金作物との混作を行っている農地、「cash crop only」は換金作物のみを栽培する農地、「tree」は植林や果樹、「others」は休閑地を含むその他の土地利用を指す。

両村落クラスターでは、2003 年以降に焼畑地が増加傾向であり、その増加の速度は時期によって変化していた。ホアイキン村落クラスターでは、2005 年までの焼畑地の増加率が急でありその後はやや緩やかになっていた。その一方で、換金作物のみに利用する農地が 2006 年以降から増加しており、その理由としては 2005 年から 2007 年にかけて道路アクセスが改善されたことが要因だと考えられた。ソプチア村落クラスターでは、2008 年まで焼畑地は高い増加率を示していた。とくに 2004 年から 2008 年の焼畑地の増加率が大きかった。2004 年から 2008 年にかけて急速に焼畑地が増加した理由の 1 つとして、新たな村（タットン村）が設置されたこと、一部の地域で道路アクセスが改善されたことが挙げられた。その他のソプチア村落クラスターの特徴としては、ホアイキン村落クラスターのように焼畑米と換金作物栽培の農地を分けずに、1 つの焼畑地で米と換金作物を混作している点であった。ホアイキン村落クラスターとソプチア村落クラスターの土地利用の変遷の違いは、農業生産方法の違いが理由の 1 つであると考えられた。

1.3 現在の世帯あたりの農地所有面積と利用箇所数

サンプル世帯の世帯あたりの農地面積は平均で 4.47ha であった。農地面積は民族間で違いがあり、モン族の居住するホアイキン村落クラスター内の 4 村落（ホアイキン村、サクアン村、ホアイハ村、ホアイトー村）の結果では、モン族はカム族に比べて約 1.3~1.6 倍の大きさの農地を所有し耕作していることが明らかとなった。村落間の状況を比較すると、世帯あたりの農地面積が大きいホアイトー村、ホアムアン村、ホアイシア村では、農地の利用箇所数も多く、4 箇所以上を所有していた。その一方で、ホアイドン村、パクホック村、サクアン村の世帯の利用箇所数は他村落と比べて少なかった（図 10）。

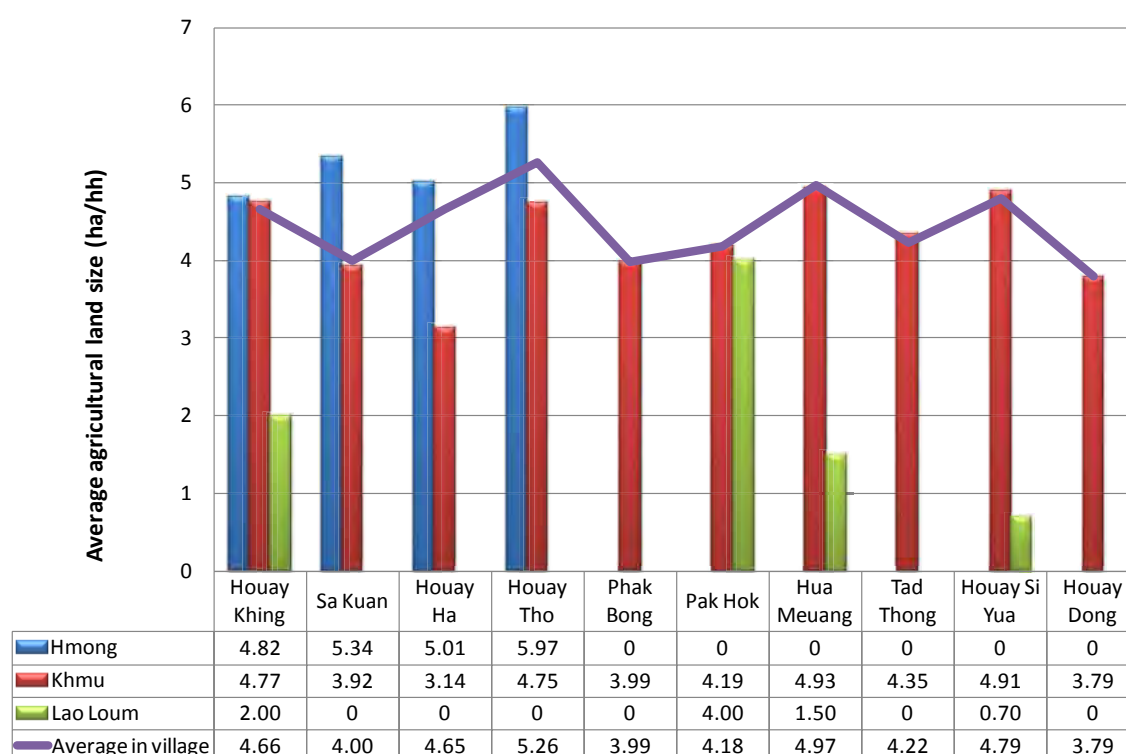


図 10 世帯あたりの農地面積平均（民族別及びサンプル世帯全体）

1.4 農地拡大の可能性

現在の所有面積と家庭内消費に必要な米の生産量を確保するために住民が追加で必要だと考える農地面積（Required land）の回答結果を図 11 に示した。

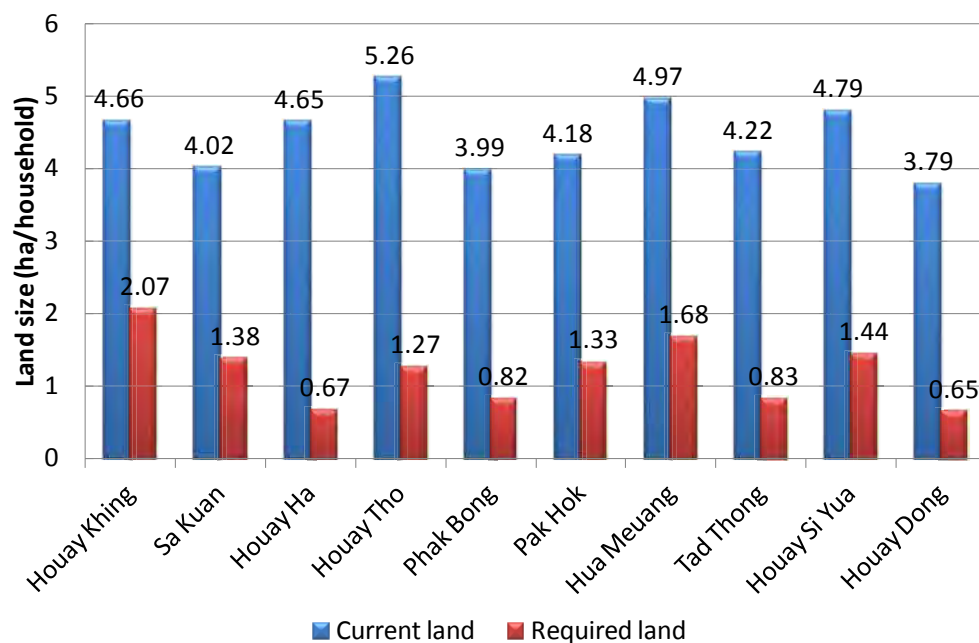


図 11 現在の農地面積とニーズ（サンプル世帯平均）

調査を実施した 10 村落のうち、ホアイキン村、サクアン村、ホアムアン村、ホアイシア村の住民は追加的な農地（焼畑地）が必要だと考える傾向が高く、農地面積のニーズも比較的大きかった。実際、これらの村落は他村落と比べて毎年米不足に陥る世帯の割合が高く、不足量も大きかった（図 12）。また、ホアイキン村、サクアン村、ホアイシア村については、世帯あたりの焼畑箇所数が 3 箇所もしくはそれ以下の世帯も多く、農地の休閑期間が短期化しており、十分な生産量確保が難しいことが明らかとなった（図 13）。

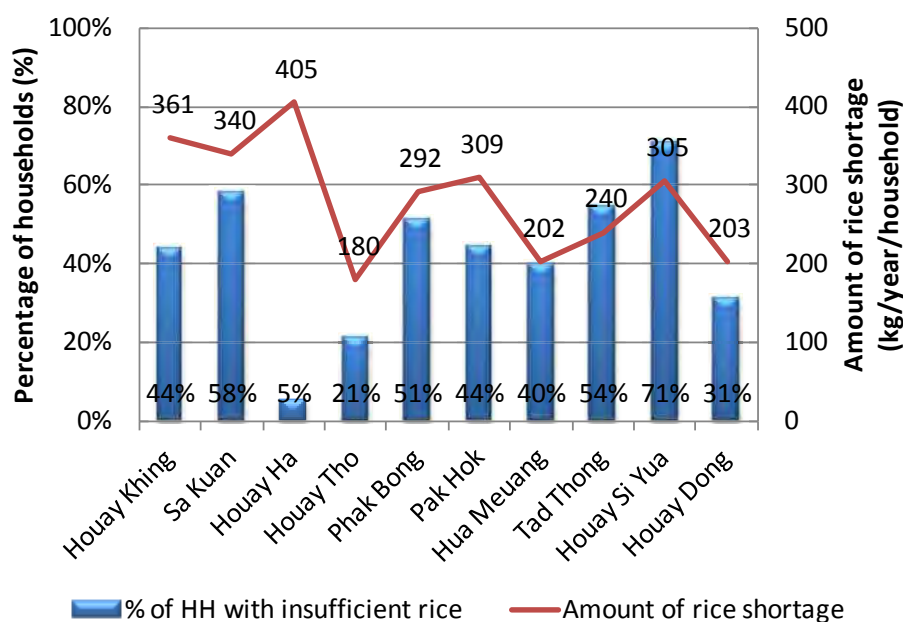


図 12 米不足の世帯の割合と米の不足期間（サンプル世帯）

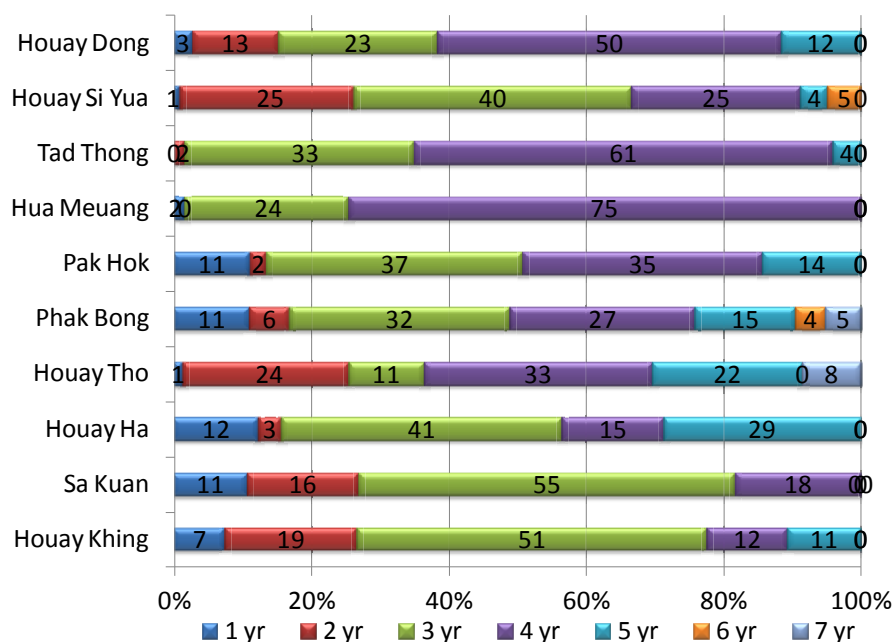


図 13 焼畑の休閑期間（サンプル世帯）

ポンサイ郡土地管理局の土地利用計画に関する統計を用い、各村落で農地及び農地予備地と区分されている土地の合計面積と各村落の全世帯数から世帯あたりの農地面積を算出し、各世帯に配分可能な農地面積を図 14 に示した。その結果、数値に幅はあるものの各村落で理論上は十分な農地を所有できることが分かった（最小はホアイキン村の 15ha/世帯、最大はホアイハ村の 74ha/世帯）。しかしながら、農地が遠い等のアクセスの難しさや労働力不足が原因で、実際には、農地に区分される全ての土地が開発・利用されているわけではなかった。インタビューにおいても、住民の多くは、生計向上のために農地を増やしたいが必要な労働力が不足していると回答した。

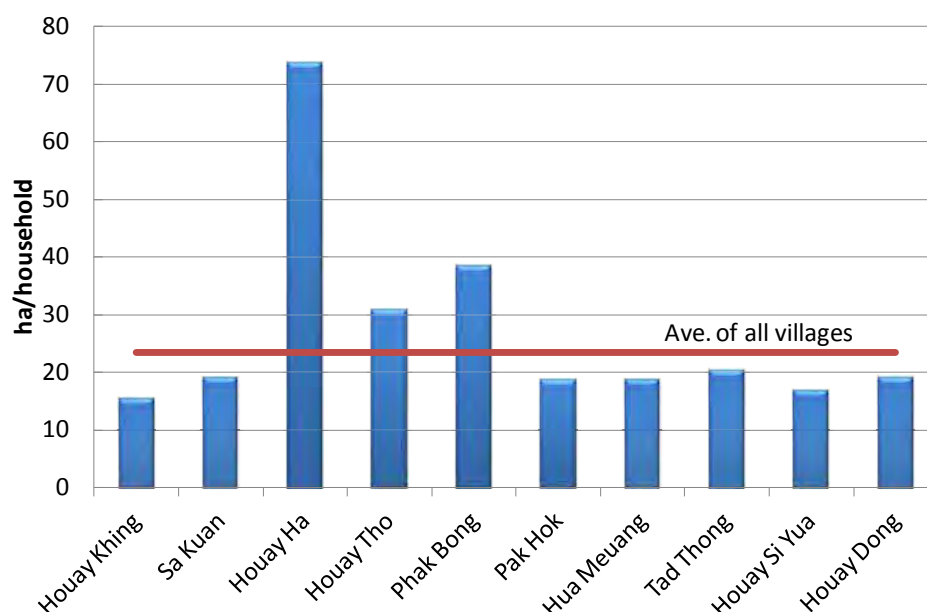


図 14 各村落の農地のポテンシャル（世帯あたりの利用可能な農地面積）

ただし、ホアイキン村、ホアムアン村、ホアイシア村、サクアン村では、世帯に十分な労働力があること、人を雇って労働力を確保すること等により労働力の確保が可能だと考えており、サンプル世帯が利用・所有する現在の農地面積の平均値が 4ha を超えているにもかかわらず、他村落と比べて追加で拡大を希望する農地面積が大きかった。さらに、人口規模に対する農地が比較的小さいホアイキン村、サクアン村、ホアムアン村等では、原始的な焼畑農業による農地拡大で土地利用への圧力が増しているため、住民グループを中心に適切な土地利用のモニタリングと管理をしていく必要があると考えられた。

2. 森林及び森林資源利用の状況

1 ヶ月あたりの薪炭材の利用、非木材製品の利用頻度、木材の利用頻度、放牧地として森林を利用する頻度を図 15 に示した。両村落クラスターで森林への依存度は強く、とくに薪炭材の利用頻度が高く、調理や暖房利用として住民に不可欠なエネルギーとなっていた。10 村落で最も利用量が多かったのは、ホアイハ村で、サンプル世帯の世帯あたりの平均利用量は 4,580kg/年で最も利用量の少ないホアイキン村（2,443kg/年）の約 1.9 倍であった。薪炭材に利用するのは 9 割以上が枯れ木や枯れ枝である。ソブチア村落クラスターでは居住地周辺で収集している世帯が多いのに対し、ホアイキン村落クラスターの住民は森林利用目的で村落内に割り当てているコミュニティ林で収集している傾向があった。

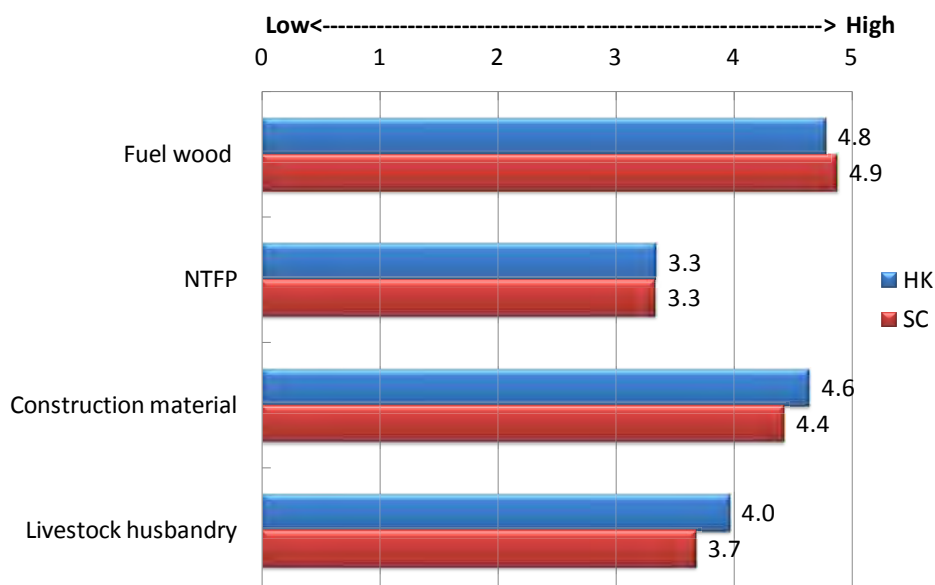


図 15 森林・森林資源の利用頻度（5段階評価の平均値）

家畜放牧の利用頻度も高かった。住民が放牧地としてどのような場所を利用しているかを図 16 に示した。約 40%の世帯が個別に林内放牧（Natural forest）をしており（主に牛や水牛）、約 35%が村落で決めた放牧用の共有地（Common land）を利用していた。共有地で放牧を行う場合、グループ単位で決められた土地を利用し、家畜の盗難防止等のために監視役を住民が交代で務めていた。十分な牧草を供給できないという理由から、焼畑の休閑地で放牧を行う割合は非常に低かった（Fallow land：ホアイキン村落クラスターで 4%、ソプチア村落クラスターで 1%）。

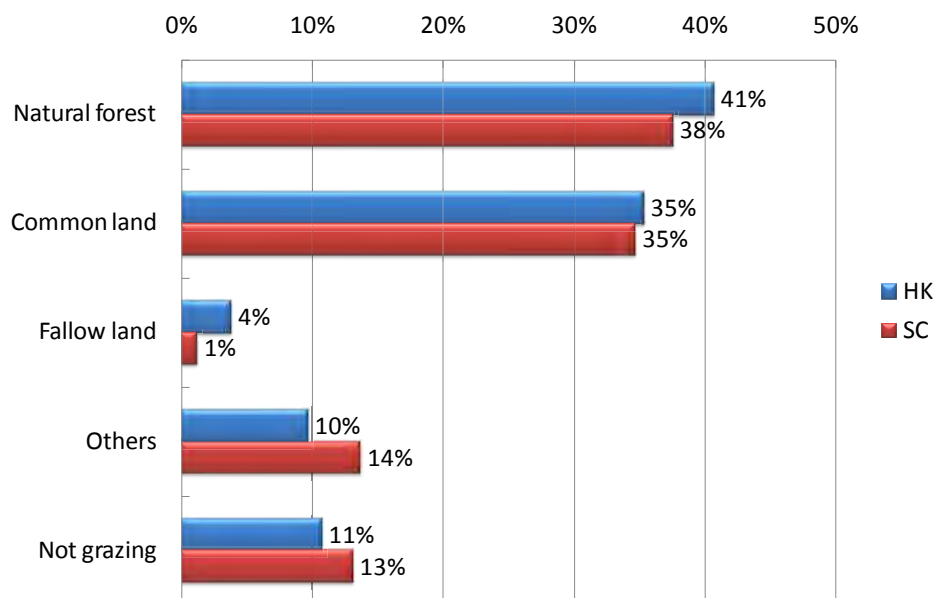


図 16 放牧地の利用場所（サンプル世帯に対する利用者の割合）

3. 生計維持に必要な能力の現状

対象地住民の生計向上の維持・改善に関する能力を明らかにするために、サンプル世帯に対し、生計向上に必要な技術や資源の状況が十分か、及びその満足度について 5 段階で評価し、住民の認識を整理した。評価項目は、世帯の資源（農地面積）、農業技術（生産技術）、食糧の確保（米の生産性）、資源へのアクセス（農業用水や農地）、経済性（収入）である（質問項目は参考資料 2 を参照）。

調査の結果、両村落クラスターで評価の平均が 3 以上であった項目は、農地面積（Agri land：ホアイキン村落クラスターで 3.7、ソプチア村落クラスターで 3.6）と米の生産性（Rice Production：ホアイキン村落クラスターで 3.5、ソプチア村落クラスターで 3.1）の 2 つであった。この結果は、耕作する農地を十分に有していることと食糧の確保に関係性があることを示しており、とくにホアイキン村落クラスターによく当てはまる傾向であった。農業技術（Production tech：ホアイキン村落クラスターで 3.1、ソプチア村落クラスターで 2.5）、農地へのアクセス（Access to farm：ホアイキン村落クラスターで 3.0、SC 2.6）、収入（Incomes：ホアイキン村落クラスターで 2.6、ソプチア村落クラスターで 2.3）に関する評価は中程度からやや低い評価を示したが、住民は改善を望んでいた。

ホアイキン村落クラスターのサンプル世帯は、ソプチア村落クラスターのサンプル世帯に比べて現在保有している農業技術の評価が高かったが（図 17）、両村落ともに慣習として天水を利用した原始的な農業を営んでおり、十分な技術を有しているわけではなかった。安定した生産量を確保し生計を維持していくためには、両村落ともに対策の必要な課題である。両村落クラスターで低い評価となった項目は農業用水へのアクセス（Agri water：ホアイキン村落クラスターで 1.1、ソプチア村落クラスターで 1.4）であり、農業用水の不足は各村落の農業で蔓延する問題であることを示していた。農業用水に関する課題は村落全体の課題であり、村落や住民グループで水管理を行うような技術や仕組みを Demonstration Activity として検討することは、持続的な森林管理を行う能力を向上していくためにも効果的だと考えられた。

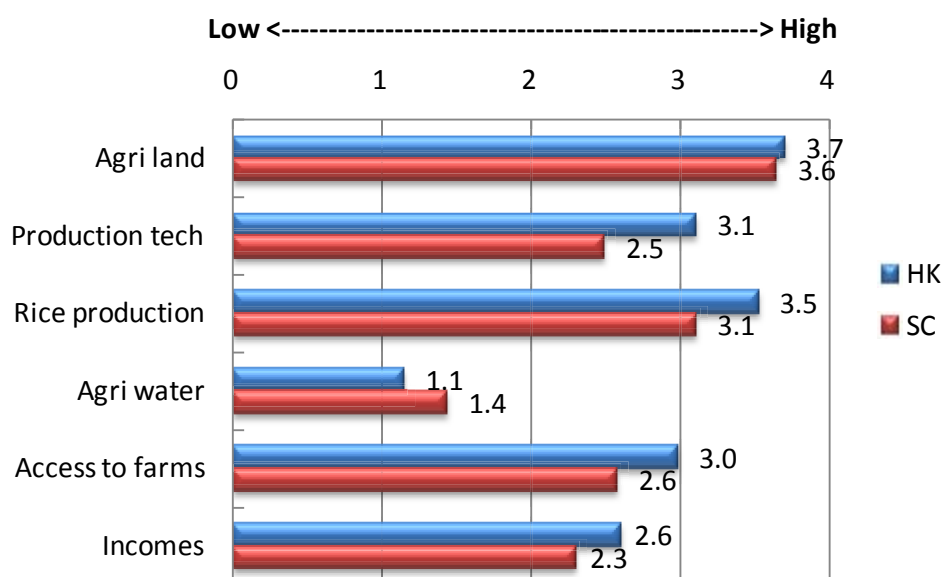


図 17 生計維持・向上に関する能力のサンプル世帯による評価（5 段階評価の平均値）

3.1 村落会議における意思決定の状況

持続的な森林管理を進めていくためには、参加型で土地利用計画を策定し、改善を加えながら実施していくことが重要であり、PAREDD アプローチの取組でも参加型の土地利用計画作成が進められている。住民のプロジェクト活動開始前の意思決定能力を明らかにするため、住民に身近な議論の場である村落会議への出席頻度、意思決定への参画状況（発言頻度）、参加型の意思決定プロセスへの関心や理解の程度について5段階評価で回答を得た（図18）。

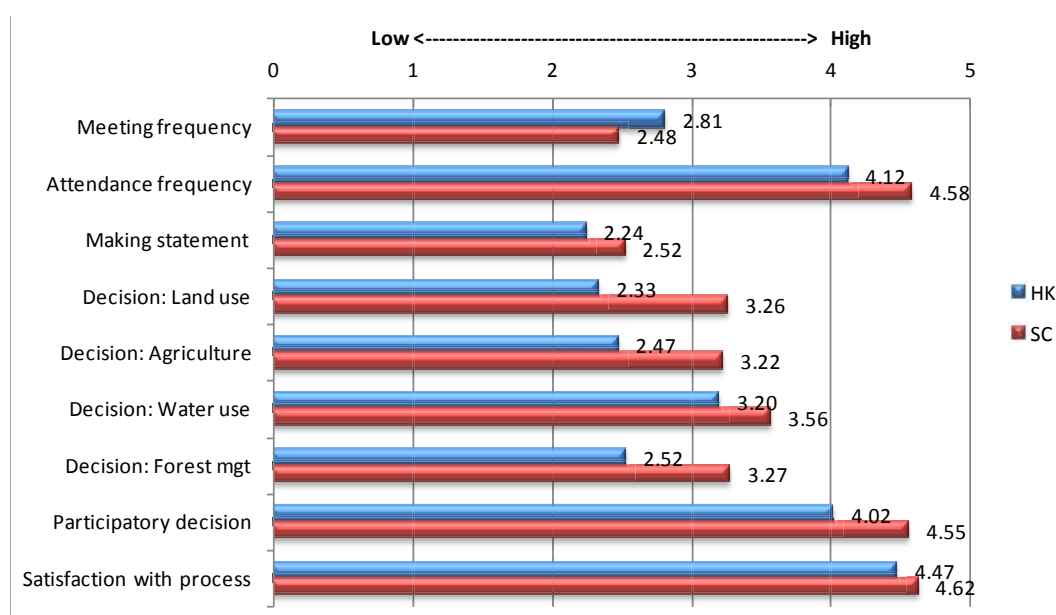


図18 村落会議への参加と発言頻度（5段階評価の平均値）

調査結果から、両村落では月に2~3回程度、村落会議を実施していた（Meeting frequency）。村落会議への出席頻度は、両村落クラスターともにほぼ毎回出席している世帯が多く、とくにソプチア村落クラスターの出席頻度は高い傾向があった（Attendance frequency：ホアイキン村落クラスター4.12、ソプチア村落クラスター4.58）。

しかしながら、村落会議中の発言頻度は低く、積極的な参加の状況は見られなかった（Making statement：ホアイキン村落クラスター2.24、ソプチア村落クラスター2.52）。特定の話題毎（土地利用（Decision：Land use）、農業（Decision：Agriculture）、水利用（Decision：Water use）、森林管理（Decision：Forest mgt））の発言状況を見ると、ソプチア村落クラスターの方が議論に参画することへの関心が高かった。また、土地利用計画の策定プロセスの在り方については、両村落クラスターともに参加型の土地利用計画が不可欠だと考えていた。ソプチア村落クラスターの方がホアイキン村落クラスターに比べ、より参加型プロセスの必要性に同意する結果となっていた（Participatory decision：ホアイキン村落クラスター4.02、ソプチア村落クラスター4.55）。

ソプチア村落クラスターの方が発言頻度は高く、参加型の意思決定プロセスへの関心や理解が高い理由は、ソプチア村落クラスターの方が早い段階で他ドナーの支援を受けて行政主導による土地利用計画が策定されており、その経験から参加型土地利用計画の重要性を認識していると考えられた。また、ソプチア村落クラスターは大半がカム族を占める単一民族の村である一方、ホアイキン村落クラスターはカム族とモン族という異なる民族が居住している。そのため、ホアイキン村落クラスターで

は、村落全体で同意を得るために村落委員や行政による支援を受ける必要性を感じる傾向が高いのだと考えられた。

3.2 村落活動における住民間の協働の状況

村落行事、焼畑耕作、水田耕作における住民間の協働活動の参加度合い、協働活動の実施から得られる便益の理解に関する回答結果は図 19 の通りだった。冠婚葬祭や清掃等の一般的な村落行事において住民同士が協働を行う頻度は両村落クラスターともに高かった（Frequency：ホアイキン村落クラスターで 4.40、ソプチア村落クラスターで 4.43）。焼畑作業や水田の灌漑作り等、特定の活動に限ると、ソプチア村落クラスターの方が協働活動を活発に行っていることが分かった（slush-and-burn：ホアイキン村落クラスターで 3.57、ソプチア村落クラスターで 4.25、irrigation：ホアイキン村落クラスターで 1.11、ソプチア村落クラスターで 1.56）。ソプチア村落クラスターには、労働力が必要な際にコミュニティ内の住民同士で助け合う習慣が強く残っていることが、協働活動が活発な理由の 1 つだと考えられた。一方、複数の民族が居住するホアイキン村落クラスターは、民族間の協力が限定的であるため、焼畑作業における協働活動の頻度が低いと考えられた。

一方で住民は、協働活動によってもたらされる便益（意思決定の強化、効率的な日常の課題解決）への理解は高いことが明らかとなった（Benefit: influence：ホアイキン村落クラスターで 4.20、ソプチア村落クラスターで 4.46、Effective prob solving：ホアイキン村落クラスターで 4.61、ソプチア村落クラスターで 4.69）。

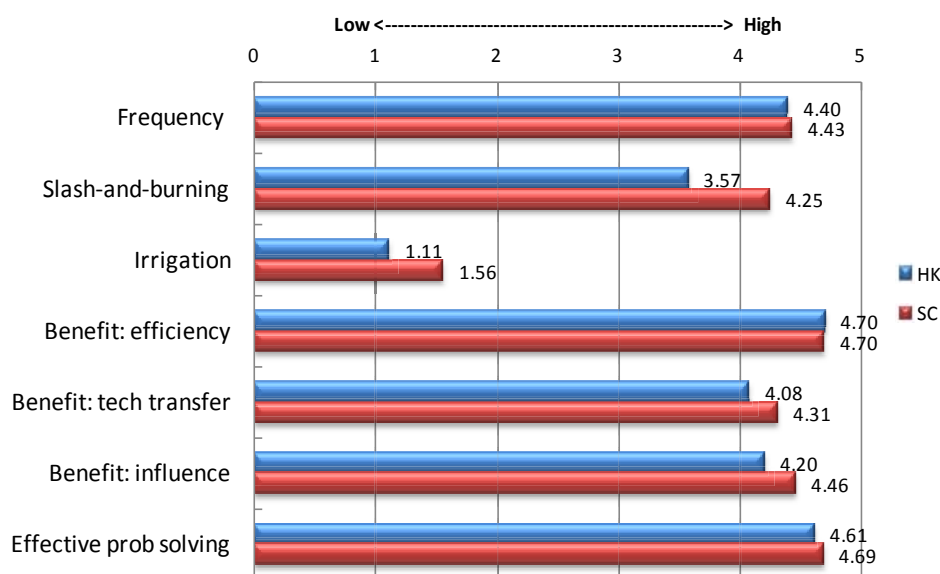


図 19 協働活動への参加（5段階評価の平均値）

3.3 代替生計のニーズ

調査票では、焼畑耕作に代わる代替生計のニーズも調査し、サンプル世帯が関心のある、もしくは既に従事している代替生計を示した（図 20）。両村落クラスターでは 40%以上の世帯が家畜飼育に関心を示し、約 30%以上の世帯が換金作物栽培に関心を示していた。ホアイキン村落クラスターは水田適地がホアイキン村のみに存在するため、ソプチア村落クラスターに比べて関心を示す割合が低かった。

また、様々な非木材生産物が存在するホアイキン村落クラスターでは、住民の食料や賃金収入として非木材生産物が重要な役割を担っているため、非木材生産物の活用を代替生計として挙げる世帯も存在した。

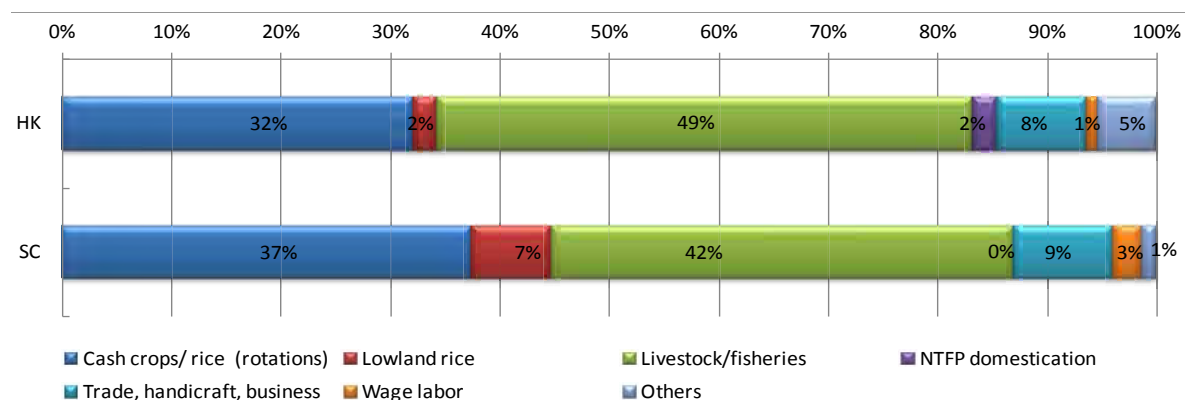


図 20 代替生計のニーズ（自由回答による集計結果）

家畜飼育が代替生計として最も高い関心がある理由は、家畜が住民の重要な資産であるだけでなく、ポンサイ郡では行政により主要産業の 1 つとして家畜飼育を推奨してきたことが挙げられた。近年では、ベトナムへの道路アクセスが改善し、ベトナムからの需要が急速に高まったことにより、家畜飼育はポンサイ郡で有望な産業となっていた。

調査 3 対象地における Human Resources 及び Natural Resources を把握

プロジェクトベースの REDD プラス事業対象地であるホアイキン村落クラスターにおいて、中でも典型的な土地利用を行っているホアイキン村を対象に、社会経済状況、Human Resources、及び Natural Resources を評価し、森林減少抑制のための具体的な活動（Project activity）を選定するための調査を実施した。調査では Capability Approach を適用して評価した。なお、評価は土地利用や土地の生産性等の潜在的な自然資源と生計に関する技術、知見、関心等の潜在的な人的資源に基づいて行った。

以上より、ホアイキン村落クラスターの森林減少・劣化のドライバー、及びそれに対する具体的な Project activity を示した（詳細は別冊 2 を参照）。

1. ホアイキン村落クラスターの現状

REDD プラスの対象地であるホアイキン村落クラスターでは、焼畑地の拡大、休閑期間の短期化、森林から農地への転用、放牧地の拡大等が森林減少の主要因であることが分かった。そして、灌漑設備の不足、不十分な土地管理の上に行う裏作による土地生産性の低下等の様々な状況が重なり、住民が焼畑に依存せざるを得ない状態にあることが問題であると考えられた。こうした社会経済状況の実態を理解するため、森林資源分野、農業分野、及び市場アクセスの 3 つの側面について現状を整理した。

1.1 森林資源分野の状況

村落には森林管理活動の機能はなく、非木材生産物や薪炭材の収集あるいは焼畑地の拡大については、とくに制限を設けず住民の自主性に基づいて行われていた。近年になり、土地のゾーニングや政府による土地利用規制が強化されたものの、住民の認識としては十分に浸透していなかった。また、森林内には様々な資源が存在し、中国、タイ、ベトナム等の販売市場も存在するため、住民は竹、蒟蒻いも（現地名 Doukdua）、キノコ、ラタンや薬草等の非木材生産物を採集し収入源としていた。非木材生産物を持続的で安定的に利用するため、農地等で栽培したいという意見もあったが、住民は栽培に関する知識や技術を有していなかった。

1.2 農業分野（焼畑、水田、家畜飼育）の状況

ホアイキン村落クラスターでは住民の大半は焼畑に従事していた。インタビューの回答からは政府による政策の建前上、各世帯が 1 箇所あたり 1ha で計 3 箇所の焼畑地を所有しているという結果を得たが、焼畑地の視察等から実際は 5 箇所以上の土地で耕作をしていることが容易に確認できた。5 箇所以上の土地で耕作をしている場合も、土地の管理や耕作技術が限定的であるために農業生産性は低かった。ホアイキン村の全世帯の状況を現地で確認した結果、年間に必要な米の生産ができていない世帯が村落全体で約 35%あり、カム族に限っては約 56%の世帯が年間の消費に必要な量の米を生産できておらず（表 7）、土地利用規制が厳しくなれば、十分な米の生産はさらに難しくなるものと考えられた。

表 7 ホアイキン村における民族別の所有農地の特徴

	Khmu	Hmong	Lao loum	Total
Total number of fallows (by each ethnic group)	352	294	15	661
Average number of fallows (by each ethnic group)	3	3	1.4	2.97
Number of paddy field owners	16	31	1	48
Total size of paddy fields	11 ha	24.1 ha	0.5ha	35.6 ha
Number of families with rice sufficiency (12 months or more)	51 (44%)	81 (84%)	8 (73%)	140
Number of families with rice deficiency	65 (56%)	8 (8.3%)	3 (28%)	76
Number of families with rice deficiency more than three months	47 (40%)	2 (2.1%)	1 (9%)	50

ホアイキン村では一部の世帯で水田耕作が営まれていた。水田面積は非常に小さく、0.3～2ha であった。水田耕作は、一旦灌漑設備や棚田が整備されれば、焼畑より少ない労力で十分な米の生産が見込めるが、水田の拡大や耕作に必要な技術、グループ農業の仕組みは現状では普及していなかった。次に、家畜は世帯の資産として重要な位置を占めており、約 43%の世帯が水牛や牛等の大型家畜、約 60%が豚やヤギ、80%以上の世帯が家禽類を飼育していた。しかしながら、飼育技術は乏しく粗放な林内放牧が行われるため、野生生物との接触による家畜の病気や森林劣化の要因となっていた。

1.3 市場アクセスの状況

ホアイキン村では、農業・森林生産物の市場システムが欠けていることが収入獲得の制約の 1 つであった。商業用の野菜、家畜、果樹、非木材生産物、及びその他多くの換金作物生産の潜在性があるが、それらの生産物を販売するための既存の市場システムが無い、若しくは直結していなかった。住民は生産物の販売を仲買人に依存し、需要量や価格は仲買人によって調整されていた。農業生産物や非木材生産物を市場へ売り出す仕組みがなく、買い手が見つからない、あるいは取引価格が安定しないといった課題があった。そのため、村落マーケットの実証活動をプロジェクトの取組の 1 つとすることを考えた。ただし、村落の農業や天然資源の状況について様々な課題はある一方で、住民は有用な様々な知識や経験を有していることも分かった。家庭内での消費目的で行われる伝統的な菜園技術の他、民族によっても非木材生産物に関する技術や能力に差異がみられた。カム族は竹細工や機織り、モン族は刺繍や鍛冶の技術を得意としていることが分かった。また、住民の中には、コーヒー栽培、伝統的な薬草作り、棚田等の知識を有していた。このような地域の知識は適切な普及教育によって地域内に促進・移転されると考えられる。そのため、織物生産システムが Demonstration Activity の 1 つになると考えられた。

2. 森林減少・劣化の課題分析と目的分析

以上の調査結果に基づき、村落での森林減少・劣化の抑制に向けた課題を Project Cycle Management 手法を用いて整理した。現地で住民と議論を進めた際には様々な課題が挙がり、非常に複雑な課題分析の結果を得たが、以下では、森林減少・劣化と関係の深い課題を抽出し再整理した結果を示している（詳細な分析結果は別冊 2 を参照）。森林の適切な管理に向けては、明確な土地所有システムを伴う科学的な土地の再ゾーニングが必要であり、市場システム開発や農業システム改善のための技術・資金支援、コミュニティの意識醸成が村落における生計向上及び森林減少・劣化の抑制に貢献すると考えられた。

2.1 課題分析

村落で生じている問題と森林減少・劣化との関係性を示している。焼畑地の拡大は新しい生計活動を実施する機会の不足、農地拡大による森林の転換、家畜管理技術の低さ（例えば、放牧地拡大による森林の転換）、市場へのアクセスが無いことが森林減少・劣化の主な原因であることが分かった（図 21）。

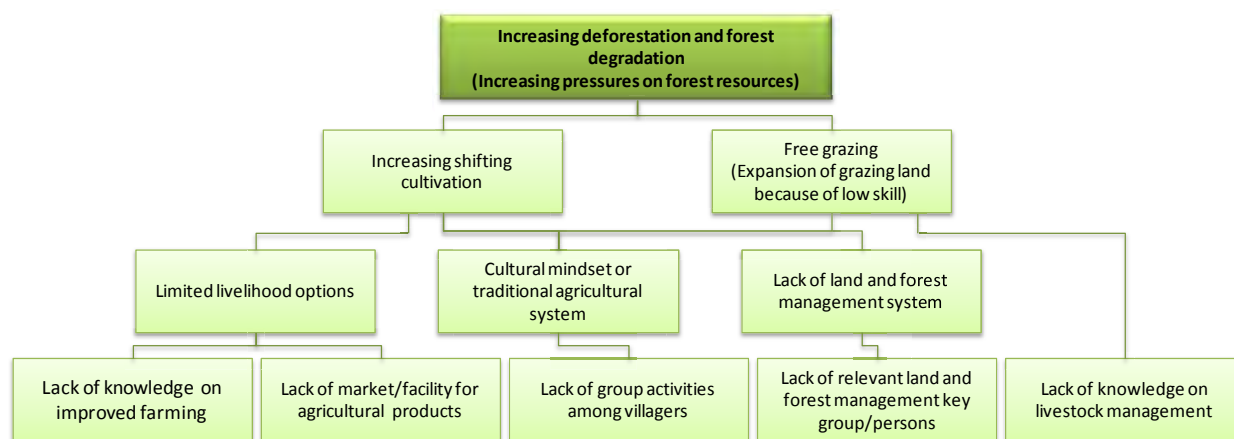


図 21 Project Cycle Management 手法に基づく課題分析の結果

焼畑耕作自体は森林減少・劣化の課題ではなく、村落が抱える複数の根本的課題が重なって森林減少・劣化が生じていることが明らかになった。焼畑の活動は住民が先祖から受け継いだ伝統的なアプローチや知識によって営まれている。したがって、住民の大半は、棚田式の常設の焼畑、混作、水田耕作や灌漑といった農業技術の経験がなかった。同様に、農業システムの改善に関する行政や NGO による支援も行われていなかった。住民は水資源あるいは灌漑機能の不足が焼畑に依存する原因であると述べていた。適切な土地管理を欠いた自給自足農業が土地の生産性を低下させ、毎年新しい土地で焼畑を行う結果を招いていた。さらに、住民は新しい技術を導入するリスクを負うことを恐れており、確実に便益を生み出すことが確認できるまで新しい技術を取り込めない状況があった。

住民の多くは家族単位で農業を営んでおり、労働力が限られることが、集約的な農業技術を導入する上で制約となっていた。そして、グループ農業や労働力の交換システムは伝統的な農業システムの中には組み込まれてこなかった。ホアイキン村はコミュニティが新しいため、グループ農業や労働力の交換システムは確立されていなかった。さらに、農家同士の農地の距離が遠く拡散しているため、互いの農地で労働力の交換を行う等の協力関係を築くことが難しい状況があった。

同様に、村落に農業生産物を販売する市場システムが無いことが商業目的の果樹、野菜等の作物を生産する意欲をそいでいた。住民の大半は生産物販売を仲買人に頼っていたが、住民は信頼できるシステムではないと考えていることが分かった。

家畜は村落の重要な収入源の 1 つであり、よい市場に恵まれていた。しかしながら、家畜飼育技術は非常に原始的で非科学的であった。住民は適切な管理をせずに林内で放牧し家畜を飼育していた。そのため、住民は家畜の糞尿を堆肥として有効利用できていないだけでなく、野生動物との接触により家畜が病気にかかりやすい状態になっていた。これまでも述べたように、住民は既に林内放牧により家畜の死亡率が増加することを経験していた。

2.2 目的分析

課題分析の結果を基に、森林減少・劣化を抑制するためにプロジェクトで実施する直接及び間接の活動を選定するための目的分析を行った。村落若しくは村落クラスターの状況を考慮し、以下に取り組むべき活動とその必要性を整理した（図 22）。

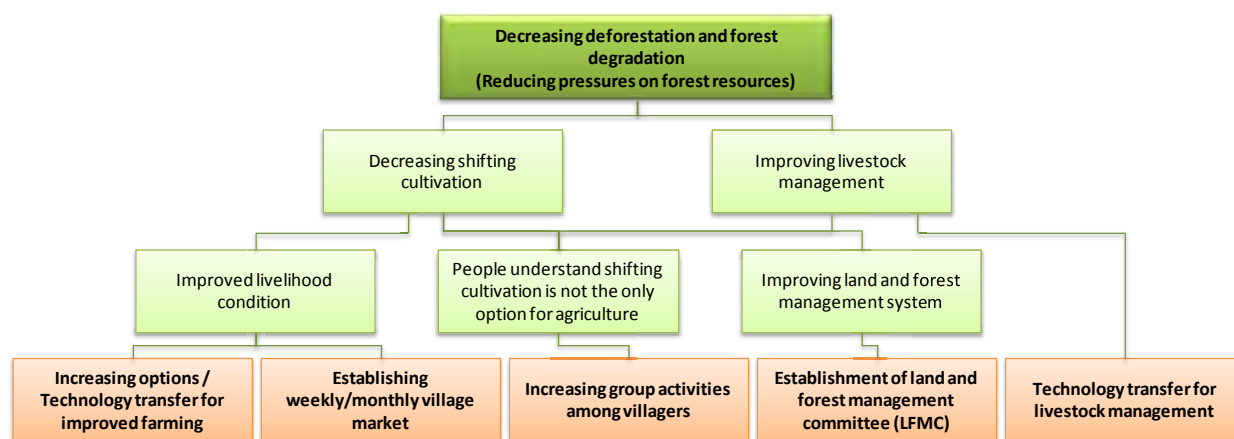


図 22 Project Cycle Management 手法に基づく目的分析の結果

2.2.1 協働活動の改善

図 22 の目的分析で示した住民グループによる協働活動については、促進することにより以下の効果が見込まれると考えられた。

- 生計活動やコミュニティの課題の多くは複雑であるため、解決には住民間の協力による努力が求められる。グループによる作業は住民の組織化を促し、コミュニティの課題を解決する能力を強化することになる。
- 村落の土地や森林資源は村落全体（共同体）の財産であり住民による管理は、本来コミュニティベース若しくは共同体の活動で実施されるものである。そのため、コミュニティ全体で管理されなければならない、管理メンバーは土地及び森林資源からの便益を平等に共有すべきである。
- グループによる作業はメンバーの資産や資源の流れをよくし、生計の改善や村落開発等、住民の共通の目的を達成するために効果的に用いることが可能である。
- 協働活動はプロジェクトで受け取る基金を管理し、村落基金を平等に利用するための住民への分配を行う効果的で持続的な組織形成につながる。プロジェクトの資金は限定的で同時に全ての住民を支援することができないため、このような基金の窓口を設けることは不可欠である。

2.2.2 土地・森林管理の改善（土地管理委員会（LFMC）の設置）

現在の土地・森林管理の規制は森林利用の規定が存在するのみで、森林管理に関する技術的側面が含まれていない。事前調査で明らかにした村落や村落クラスターの状況から、体系的な森林管理計画の策定と実施が不可欠なことは明らかである。そのため、対象地では、長期的な目標達成のため、PAREDD の取組によって土地及び森林の改善のために LFMC を設置して効果的に取組を進めていくことが重要だと考えられた。

2.2.3 生計の改善（選択肢の増加）

対象地における生計活動の選択肢は非常に乏しかった。多くの住民は代替の生計手段を有していないために焼畑に強く依存していた。図 22 に示した目的分析から、住民のニーズと能力を基に、苗はたの管理活動、家畜管理システム、機織り生産、及びその他の選択肢が有効であると考えられた。

2.2.4 週単位若しくは月単位の村落マーケットの設置

農業技術や新たな生計手段に必要な技術やシステムを改善するとともに、代替生計の選択肢を広げるためには村落マーケットの仕組みの構築が必要なプロジェクト活動として選択された。

2.3 課題分析及び目的分析の結果から示唆されたこと

上述した課題分析及び目的分析の結果を整理し、ワークショップや住民間の議論でその実施可能性について詳細を検討した（表 8）。その結果から住民は水田やコーヒープランテーション、とくに女性については機織りといった代替生計に関心が高く、こうした生計手段の導入は、村落での適用可能性及びルアンプラバン市街での市場確保の可能性も高いことが調査より明らかとなった。

表 8 各民族における各生計向上オプションへの関心

	Khmu	Hmong	Lao loum	Total
Interests in livestock				
Chicken/ducks	38	24	4	66
Pig and goats	40	13	2	55
Buffalo and cow	16	25	1	42
Introduction of improved livestock raising	6	8	0	14
Interests in improved agriculture				
Paddy field development (Terracing)	8	20	0	28
Development of irrigation system	8	9	0	17
Coffee plantation	16	17	0	33
Bamboo plantation	3	3	0	6
Corn cultivation	2	1	0	3
Cassava	3	1	0	4
Fruit tree plantation	8	6	0	14
Fisheries	0	2	0	2
Other interests				
Weaving	16	13	0	29
Construction training	3	1	0	4
Cooking training	1	0	0	1
Non-timber forest products promotion	3	2	1	6
Furniture business	3	0	0	3
Mechanical works	1	7	1	9
Business development	2	10	3	15
Iron works	0	1	0	1
Other	0	2	1	3

なお、表 8 で示された代替生計手段は、PAREDD の予算内で Project activity を実施することを考慮せず、住民とのワークショップやインタビューから幅広く収集した結果である。

調査 4 Demonstration Activity の選定

1. Demonstration Activity の選定

1.1 民族、ジェンダー等の多様性への配慮の必要性

上述した調査 1 から調査 3 の結果より、ホアイキン村落クラスターにはカム族とモン族の 2 つの民族が居住しており、それぞれの民族の有する習慣、知識、能力等に配慮して活動を実施することが重要だと考えられた。また、貧困世帯や女性等の社会的弱者への配慮も必要だと考えられた。そこで、民族毎の能力に基づいた Demonstration Activity を選定するため、基礎情報として世帯の家計、農業カレンダー、及び土地利用システムに関する一般的な情報の特定を行った。また、ホアイキン村落クラスターでは主要な代替生計の 1 つである水田の導入は世帯あたりの焼畑箇所の減少に貢献することが示されていたことから、民族毎の能力、村落住民の特徴、及び現状の生活様式や農業システム等の違いを分析した。調査はカム族及びモン族の双方を対象に、水田の保有状況等を踏まえて 41 世帯を対象に行ったインタビュー調査のデータを基に分析を行った。

1.2 土地利用及び代替生計の違い

第一に民族毎の慣習や土地利用の傾向を評価した。世帯の収入、農業カレンダー、及び土地利用システムの結果を基に、住民を次の 4 つのグループに分けて分析した (図 23)。4 つのグループは、カム族/焼畑農家 (現地名 Saohai)、カム族/水田農家 (現地名 Saonar)、モン族/焼畑農家、モン族/水田農家とした。

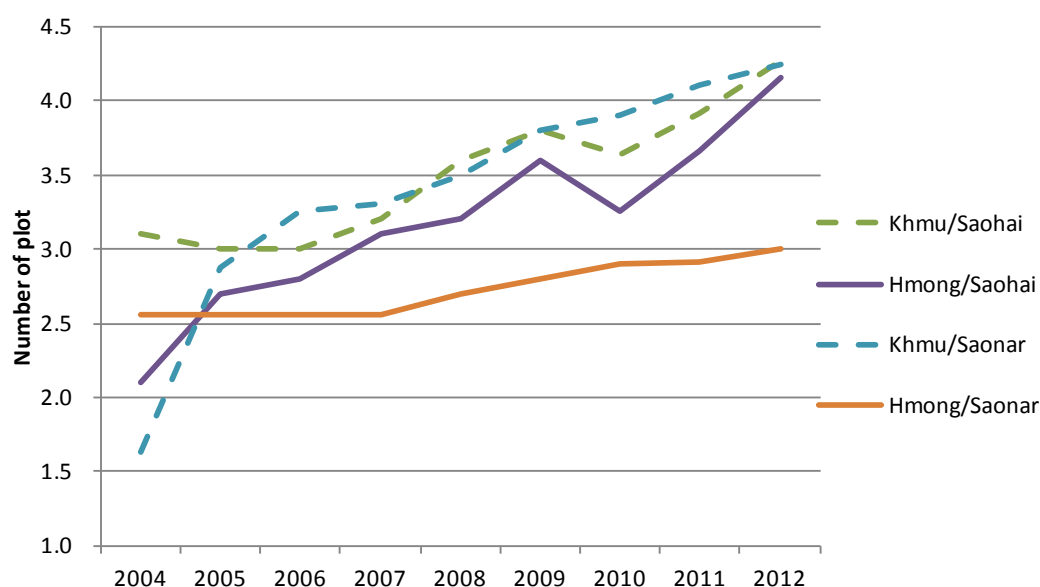


図 23 世帯あたり焼畑箇所の変遷 (サンプル世帯平均)

注： サンプルは村落の全世帯リストから民族と農耕形態が同数になるようにランダムに抽出した。サンプル世帯数は、カム族/焼畑農家 12 世帯、カム族/水田農家 12 世帯、モン族/焼畑農家 13 世帯、モン族/水田農家 12 世帯である。

図 23 より、世帯あたりの焼畑箇所は全グループとも増加しているが、グループ毎に傾向は異なっており、以下の特徴が挙げられた。

- ・ カム族は焼畑農家であるか水田農家であるかに関係なく、焼畑箇所は増加していた。
- ・ モン族/焼畑農家グループは焼畑箇所が増加していたが、利用箇所数はカム族に比べて小さかった。
- ・ モン族/水田農家グループは世帯あたりの焼畑箇所の増加率は他のグループに比べて低かった。

こうした特徴は、カム族の社会経済的な日常生活のレベルが貧しく、生計を維持・向上するために水田耕作へ移行することが難しいことを示唆していた。例えば、カム族とモン族を比較するとカム族は米不足に非常に苦しんでおり、米不足の量には統計的にも差がみられた ($p < 0.05$)。また、平均値では、カム族の米の不足期間は年間 2 ヶ月以上に及んでいた。一方、モン族の米の不足期間は年間 1 ヶ月未満であった。さらに、カム族は十分な生産量が確保できていないにもかかわらず、子供の教育費、治療費等の家計の急変に対応するために、米を販売する傾向があった。このような困窮の状況は、不十分な家計計画が原因の 1 つと考えられた。

モン族/焼畑農家とカム族/焼畑農家の年間の米の生産量を比較すると、モン族/焼畑農家の年間の生産量の方が高かった (図 24)。しかし、両グループの毎月の消費量に差はなかった。図 24 に示すように、カム族/水田農家は農耕技術の不足により水田から十分な生産量を得られていなかった。一方で、モン族/水田農家は水田から高い生産量を得ており、モン族/水田農家が焼畑箇所を抑制できた要因の 1 つだと考えられた。

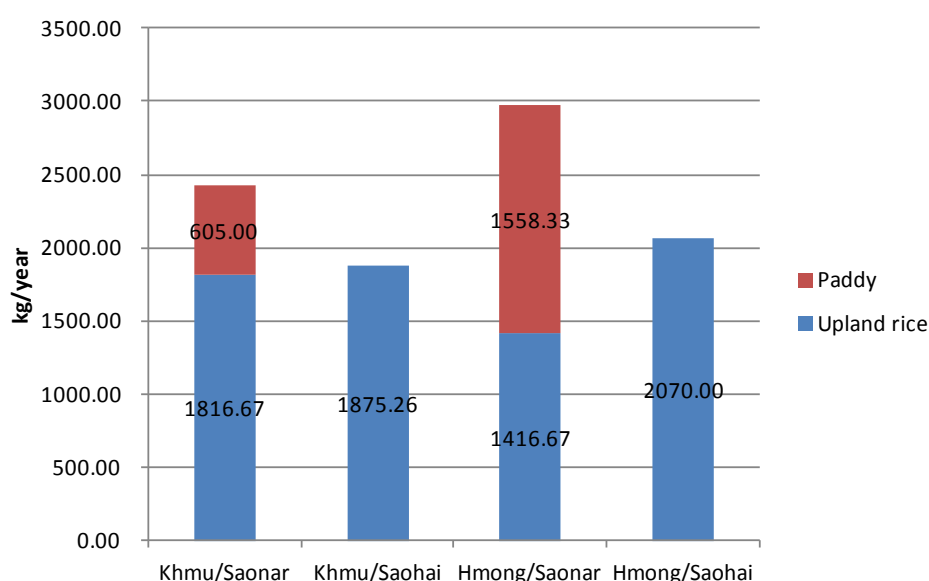


図 24 年間の生産量 (サンプル世帯平均)

1.3 民族グループによる能力の違い

民族による生活様式の違いは、生計に関する能力や機能によって説明することができた。カム族/焼畑農家は 4 つのグループで最も脆弱であり、日常生活を維持することが難しい状況にあった。モン族/水田農家は他のグループと比較して農業技術の向上や日常生活の改善がみられた。以上より、社会経済状況の分析を基に、各グループの生計の選択肢を整理した (表 9 及び表 10)。

表 9 カム族の生計に関する選択肢

	水田農家	焼畑農家
カム族	<p><日常生活の状況> 焼畑箇所を拡大している 水田耕作から余剰の生産量獲得ができない</p>	<p><日常生活の状況> 焼畑箇所を拡大している 焼畑から十分な生産量を獲得できず、生計維持のための他の手段に取り組む機会が不足している</p>
	<p><能力> ■水田耕作に関する資源：情報、理解、技術、資本、機械、及び労働力の不足 ● 現金を得るために政策銀行から融資を受たり、家畜を売却する世帯がいる ● 他の農家と協力して作業する経験や知識が不足している ■灌漑： ● 個別の農家で水源から水田までの水路を設けている ■家計計画が不十分</p>	<p><能力> ■気候に頼った原始的な農業技術 ■サンプル世帯の70%以上が家庭内消費に必要な米が不足（年間2~6ヵ月）（※1） ■生産性の低い土地が分配されている ■農業シーズンに除草作業等でモン族に雇われて働くため、自分の農地での農作業が完了しない ■政策銀行から融資を受けて家畜を購入したが、口蹄疫にかかりローンのみが残っている（※2） ■水田耕作の知識が不足している ■家計計画が不十分</p>

※1： インタビューによれば、各世帯は毎月120kgの米を消費していた。

※2： インタビューによれば、村落全体で、政策銀行から融資をうけた約90%の住民が同様の課題を抱えていた。

表 10 モン族の生計に関する選択肢

	水田農家	焼畑農家
モン族	<p><日常生活の状況> 焼畑箇所は一定若しくはやや増加している カム族/水田農家よりも水田からの生産量は大幅に多い</p>	<p><日常生活の状況> 焼畑箇所は拡大しているが相対的にカム族より利用箇所は小さい 家庭内消費に必要な米は生産できている</p>
	<p>■水田耕作に関する資源：モン族は慣習的に貯金する傾向があり、土地やトラクターの購入、労働力を雇う資金があった（規制前のケシ栽培から得た収入から水田を始めた世帯も存在した） ● 親戚とスタディツアーを計画し、村外で水田耕作を学んだ世帯も存在した ■技術の不足：稲藁を利用した堆肥利用や農業用水の貯水・管理技術は不足している ■灌漑： ● 周辺の水田農家と農業用水を共有する世帯がある ● 貯水ダムの材料などをグループで購入し、農業用水確保に取り組む世帯がある</p>	<p>■他の農家（多くはカム族）を雇い、予定通りの農作業を終えている（除草等の重労働は1度に約10人程度を雇用） ■余剰米から収入を得ている ■生産量と収入増加のための技術習得に意欲的である：現状は気候に左右される原始的な農耕様式である</p>

2. 住民特性に配慮した実施アプローチの分析

グループ毎のアプローチを検討するため、協働活動や村落での意思決定に関する慣習や能力に関するグループ間の違いを検証した。これらの能力は森林資源に依存する村落住民の持続的な森林管理にとって重要だと考えられた。

2.1 農耕様式と民族による協働活動の能力の違い

協働活動は生計改善及び REDD プラスの実施にとって重要な要素である。調査結果から、村落には農業、家畜飼育、あるいは森林のグループ管理の習慣はなかった。例えば、焼畑地での農地整備（除草等）や灌漑は住民にとって大変な重労働の1つである。しかしながら、住民はこれらの活動での協力の経験をあまり有していなかった。図 25 の (b) 及び (c) は、水田農家及び焼畑農家ともに協力の経験が少ないことを示していた。しかしながら、村落の一般的な活動（学校や村落会議室等の共有スペースの清掃、冠婚葬祭等）については、水田農家と焼畑農家では異なる結果を示しており（図 25 (a)）、水田農家は生活用水の管理等日常生活で協働する傾向が高かった（図 26）。

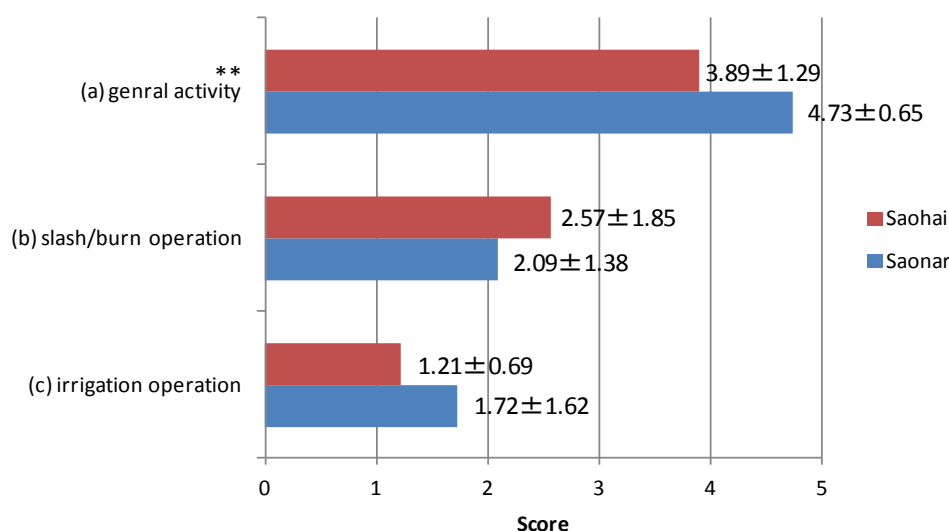


図 25 協働活動の経験

注：図は住民が5段階評価で次の質問に関する経験を評価した結果である。(a) 日常生活の改善のためにグループで協働活動を行う頻度、(b) 焼畑前の農地整備における協働活動の経験、(c) 水田の灌漑整備における協働活動の経験。一元配置による分散分析（有意水準 5%）によって焼畑農家と水田農家の回答結果の違いを分析した（** $p < 0.05$ ）。図の棒グラフはグループ毎の評価結果の平均、数値は標準偏差の値を示している。

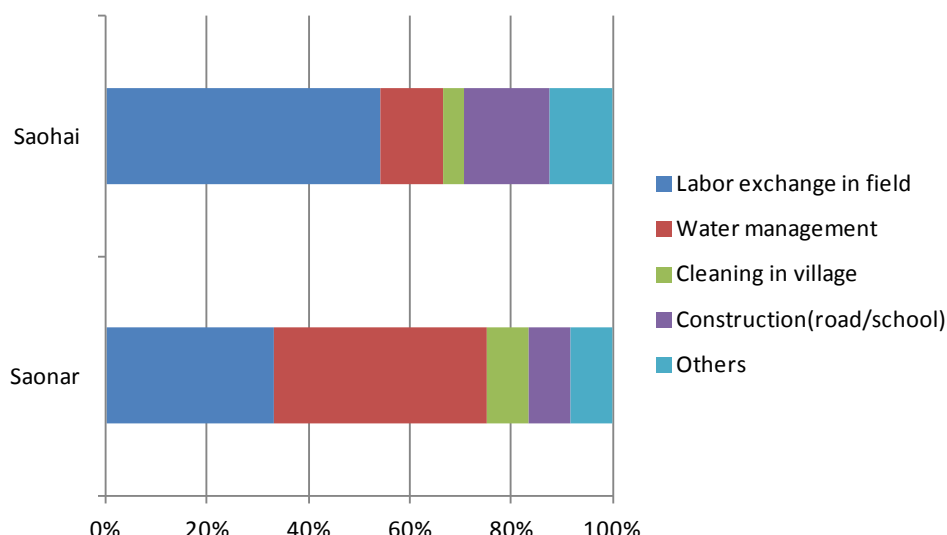


図 26 協働活動の内容

以上の特徴は全ての水田農家に見られる特徴ではなく、モン族/水田農家グループの中でもさらに一部の住民に限られた。協働活動の経験を有している住民（モン族/水田農家）の特徴は以下の通りである。

- 村落で優良農家として認識されている
- 独自に水田の農業用水管理グループを形成している
- 農業技術習得のためのスタディツアーを自主的に計画若しくは実施している
- 現在若しくは過去に村落委員を務めた経験を有する

一般的な住民は住民間の利害を調整することが難しいため、生活/農業用水の管理等の住民間で利害関係が生じる活動を協働で取り組むことは難しいと回答していた。利害調整の難しさが、村落で単純な労働力の交換しか行われていない理由の1つだと考えられた。

2.2 ジェンダーによる意思決定への参加と能力の違い

女性のエンパワーメントも重要である。女性は、農業活動だけでなく議論の場においても多くの課題に直面していた。図 27 に、村落会議における土地利用、農業、水管理、森林管理の4つの議論での発言経験の回答結果を示した。発言の状況は男女で大きな差があり、女性は男性に比べて意思決定の場で発言できていないことが明らかになった。村落の慣習だけでなく、ラオ語の理解力等も発言ができない要因の1つであった。女性は家畜の管理、薪炭材や非木材生産物の収集、生活用水の運搬等の日常生活の活動から村落内の土地や森林に関する多くの知識を有している。そのため、プロジェクト活動によって女性のエンパワーメントを促し、女性が日常生活から得ている知識を森林管理や保全に活用していくために、積極的な参加を求めていくことは重要である。

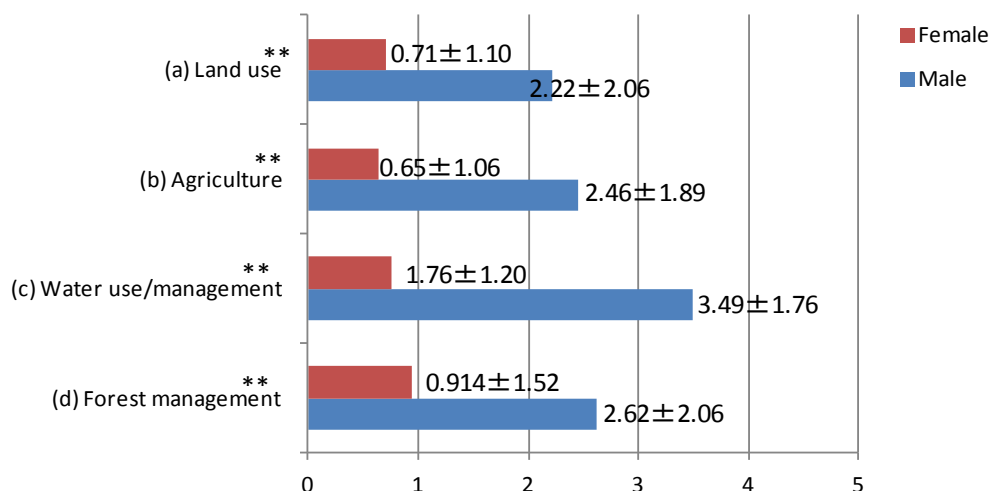


図 27 村落会議における発言の状況

注：上図は住民が 5 段階評価で村落会議での意思決定に関する次の質問の認識を評価した結果である。

(a) 土地利用の議論での発言経験、(b) 農業の議論での発言経験、(c) 水利用・管理の議論での発言経験、(d) 森林管理での発言経験。一元配置による分散分析（有意水準 5%）によって男女の回答結果の違いを分析した (** $p < 0.05$)。図の棒グラフはグループ毎の評価結果の平均、数値は標準偏差の値を示している。

調査の結果、モン族/水田農家のグループは焼畑抑制の優良事例を示しており（図 27）、彼らの生計維持に関する能力は他の 3 グループに比べて高かった（表 9、表 10）。例えば、モン族/水田農家は水田耕作に必要な資源を自ら獲得していた。そして、生計改善のための知識獲得に意欲的な世帯はスタディツアーを実施していた。水田耕作は農業用水を管理するためにグループを形成する要因となっていた。これまでの分析から、水田耕作の導入はホアイキン村においては、焼畑を抑制する代替生計の 1 つとなり得ると考えられた。また、民族、農業形態、及びジェンダーの違いに着目した場合、能力はグループ間で異なっていた。プロジェクト活動を実施するにあたり、カム族/焼畑農家や女性といった立場の弱いグループに配慮することが必要であると裏付けられた。

まとめ（プロジェクト活動の段階的な実施）

ポンサイ郡ホアイキン村落クラスターにおける REDD プラス事業の実施にあたり、上述した調査 1 から調査 4 の結果を踏まえ、プロジェクト計画書に記す Project Activity としては以下が適当だと考えられた。なお、本調査では、Demonstration Activity の試行は実施していない。プロジェクト活動のより詳細な実施計画の策定や効果を検証するための次の実施ステップとして、まずは Demonstration Activity の試行が望ましい。

Project Activity to be discripted in Project Description (PD)

Deforestation has occurred over many years in the target site due to pioneer shifting cultivation and forest resource use. This project seek to restrict the expansion of pioneer shifting cultivation (by clearing primary and secondary forest) and to promote longer fallow periods than before the project, thereby forest carbon stock should be kept or increased. These goals require additional efforts to develop alternatives to the rural people's dependence on forestry resources.

A preliminary socio-economic and natural and human resources surveys in the HK-VC undertaken in readiness phase confirmed the current land and forest use and the relationship between the lifestyles of the rural people and their dependence on forestry resources for their livelihood. These surveys also assessed natural resources in the village and human resources, and conduct problem and objective analysis to consider alternative livelihoods in the village. Based on the results of the preliminary surveys, the project developed a three-phase approach which adopts JICA's PAREDD Approach (Figure 1).



Figure 1 REDD+ activities adopting JICA PAREDD Approach

Readiness phase (preparatory phase) of REDD+ activities, focusing on capacity development; awareness of forest conservation and land use management and knowledge-sharing on global warming and the REDD+ strategy of central government of the Lao PDR. Capacity development had been undertaken based on the characteristics and circumstances of all types of rural people.

Based on the preparatory activities achieved under the readiness phase, the project tackled the next phase of the demonstration. Through demonstration activities based on the rural people's interests and needs, the project implemented several demonstration activities to assess their effectiveness as long term REDD+ activities (i.e. project activities). The demonstration activities helped encourage and motivate

rural people to participate in project plans and activities. Following demonstration activities, the project verify activity's results to identify suitable project activities. Verification was based on the capability approach to assess the capacity of the rural people to adapt new practices and their response to the outcomes of the demonstration activities.

Finally, the project moved to the long-term implementation phase of project activities. Based on the verification of demonstration activities, the project developed or revised long-term strategies with suitable project activities which are alternatives to shifting cultivation and the project has been implementing them in the target site.

Preparation Phase

Specific features of the phase: Readiness or preparation for REDD+ at the village level is required by UNFCCC decisions and conducting them were good practices in case of rural area development. As part of the readiness phase for REDD+ in Lao PDR, the project designed an approach for future REDD+ implementation at the village and village cluster levels for demonstration in the HK-VC, reflecting community-based/participatory-based land and forestry management approach efforts and readiness phase activities. Some features specific to this REDD+ demonstration are described below.

Setting of Institutional Structure: After village cluster orientation meeting and village meetings using some materials for awareness, to implement project activities at the village and village cluster level, the project set up a village land and forestry management committee (LFMC) in each village in the target site. Each LFMC is one of the proponents of the project and has task to play a central role in project management at the village level (Figure 2). In the readiness phase, based on human resources analysis, a LFMC was established with input from all stakeholders (e.g. villager of each ethnic group) to determine the specific rules and procedures for the LFMC.

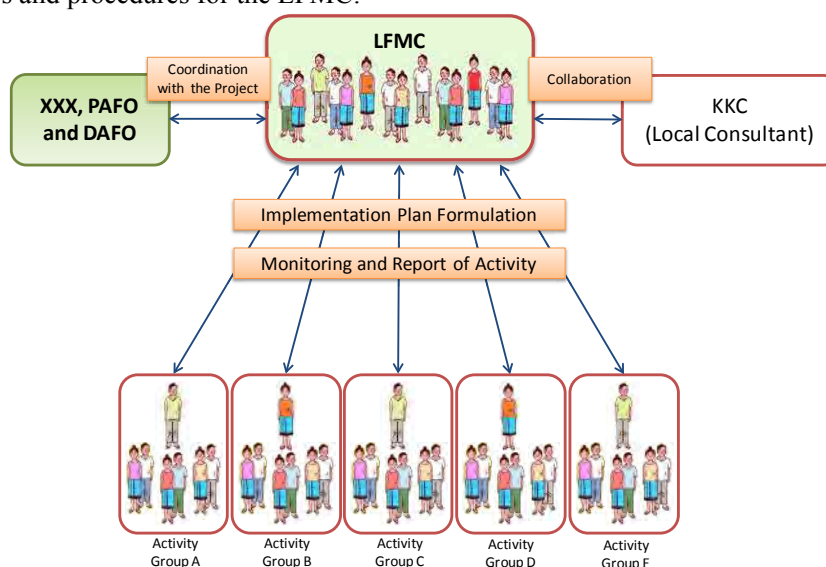


Figure 2 Structure of the LFMC

Planning of Project Activities: Rural people that rely on shifting cultivation in the village play a key role in successful REDD+ implementation. This is because deforestation has deep associations with local land and forest use and because local knowledge of natural resources is crucial to improving their lives. As part of the readiness phase for REDD+ at the village level, the project focused on capacity-building among both villagers and local authorities for village land and forest management. In particular, the project focused on the following aspects as capacity building: village land and forest management, including training of land zoning; alternative land use practices and income generation activities; and building awareness of forest conservation and the natural environment.



Village meeting



Village meeting

Moreover, according to the results of the problem and objective analysis in the preliminary survey, the project decided some demonstration activities as candidates of project activities and their Participants. After village meetings, following demonstration activities of Mitigation Activities are decided.

Demonstration Phase

Based on the results of above Readiness Phase (Preparation Phase) and rural people's interests (needs) and capacity or characteristics to plan and manage project activities, several demonstration activities were or are being implemented in order to verify their long term effectiveness as project activities (Figure 3).

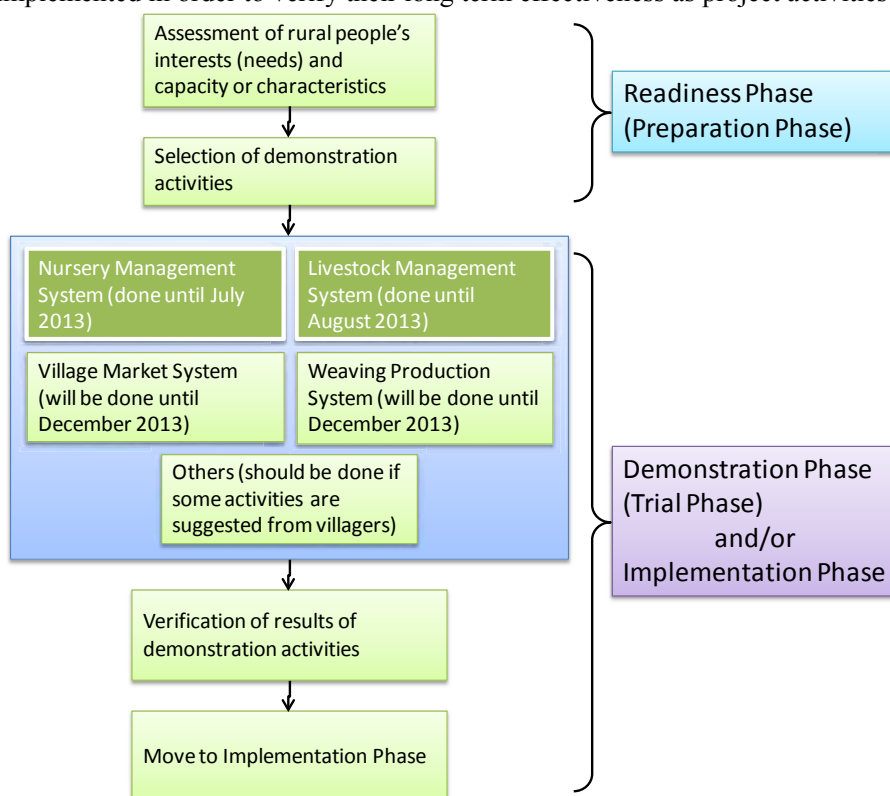


Figure 3 Procedure and status of demonstration activities in the project

Grouping activities as fundamental capability: Through nursery management activities, grouping activities are/were introduced to assess the effectiveness of group activities of rural people as a key feature of agricultural system in the village and to verify fundamental capability of rural people to implement some project activities. In addition, through the learning from activities, the specific capacity building activity was conducted to encourage group activity for increased labor efficiency in agricultural activities by initiated group farming or establishing cooperation for labor exchange. From results of difference of income and rice shortage periods between households with grouping activities and without grouping activities, it was clear that grouping activities are essential as fundamental livelihood system in the target site. Therefore, from verification of the demonstration, grouping activities must be effective as each project activities as bellow.

Nursery management system: Nursery Management System has already been successfully introduced

in other villages in Luang Prabang Province which would provide technical experience for the successful operating of the nursery in the village. Therefore, based on available natural resources, market potential and experiences from other villages, cash crop species were verified as alternative future livelihood sources. As a result of nursery management process, a Nursery Management Committee (NMC) was established under the LFMC. Similarly, a nursery management guideline was prepared with clear rules and procedures of NMC which was agreed by NMC and LFMC members and is going to be endorsed by village meeting. The rules and procedures developed for nursery management will provide guideline for other “grouping activities” such as Weaving Production System by woman group and village market system by villagers who have cropland (*see below*), with necessary modifications and adjustments. In demonstration activity of Nursery Management System, some actions (e.g. the coffee group) were trained on coffee plantation and pre-processing through NMC. In addition, activities of NMC encouraged and build up capacity on the cultivation of cash crops and non-timber forest products (NTFPs), and also encouraged necessary inputs and techniques such as seeds and fertilizer for the cultivation of such crops.



Meeting of Nursery Management Committee



Land preparation (grading)

Seedlings which produced from the nursery satisfied villager's interests (needs) of cash crop management. Also, from market analysis in Luang Prabang City, some kind of seedlings (coffee or dukduwa) had big potential of commodity for sale. Therefore, from verification of the demonstration, nursery management system must be effective as alternative livelihood in the village.

Livestock management system: The project encouraged the development of an improved livestock raising system (in sheds or confined areas). Based on market potential and experiences from other advanced villages, livestock management system was verified as alternative future livelihood sources. In this project, from problem analysis, it was clear that villager's livestock management method was quite a poor and is required additional technology transfer. Therefore, some training of breeding, feed utilization, vaccine administration and study tour to advanced village had been applied as trial. After them, the project verified effectiveness and continuity of livestock management system in target sites.



Pig management gage



After training and study tour, villager's livestock management practices were changed drastically and death rate of livestock decreased very much. Therefore, from results of verification of the demonstration, the project decided that livestock management system must be effective as alternative livelihood in the village.

Weaving production system: Weaving will be one of the integral cultural part of women life in northern Lao PDR. Many village women are skillful in weaving works. Initially many women showed interests in building their capacity on high quality weaving works and to develop cooperative weaving system under the Weaving Production Committee (WPC) which will be established in village as a part of alternative

livelihood. Weaving was chosen as one of the demonstration activity as it could have immense and immediate social impacts including women empowerment, their social role and positive impacts to the children. The women cooperative weaving would also enhance women group dynamics in the future to enhance group cooperation, social mobilization and support of implementing REDD+ activities.

Village market system: In the target villages, coffee, tobacco, mulberry, bamboo handicrafts and dukduwa pose potential market opportunities that can be boosted and preprocessed at the village level. Such alternative activities could provide employment opportunities for farmers. Entrepreneurs in Luang Prabang City took an interest in cooperating with villagers to promote such cash crops. The project plans to launch a weekly or monthly village market under the Market Management Committee (MMC) which will be established to promote markets for village products and to develop links to urban markets. Since this activity is consistent with district policies, the District Government will provide the necessary support (e.g., infrastructure and vehicles) to villages and villagers.

Others: From villager's interests and market situation, the project will apply other demonstration activities. The long term plan for next phase of the approach will be developed or revised based on evaluations and reports on the demonstration activities in this phase.

Implementation Phase

Based on the verification of demonstration activities in above phase, the long term strategy and action plan will be developed or revised and implemented to eliminate pioneer shifting cultivation practices and to increase fallow period in shifting cultivation area. In this project, following actions are scheduled to implement as project activities. From results of demonstration activities, some actions will be continued as implementation phase, which means demonstration activities are same as implementation phase.

Fundamental action of improvement of “Grouping Activities” to apply following actions: Once villagers learn improved agricultural practices and begin boosting land productivity through demonstration activities, they can be encouraged to put into place permanent agricultural systems. Initially, villagers may combine the practices of shifting cultivation and permanent agriculture (e.g., nursery management, livestock management and so on). Once assured that permanent agriculture is capable of sustaining their lives, the project can then move to discourage them from expansion of pioneer shifting cultivation. Additionally, both legal and incentive measures can be set in place to motivate farmers to improve and maintain the physical characteristics of the land. To supply the labor required for intensive farming, villagers can be encouraged to establish smaller groups based on interests, ethnicity, or other criteria to develop a system of cooperation for labor exchange or group farming, thereby solving the problem of labor requirements for initial farm preparations (e.g., terrace making) in the villages. The project promoted grouping activities and asked participating villagers to work in groups. Working in groups enables effective and equitable operation of project activities and produces various benefits for participating villagers.

Specific Activities: According to results of each demonstration activity mentioned in above, suitable actions as project activities should be implemented. Nursery management system and Livestock management system should be implemented as project activities and other activities will be implemented after verification and review.

参考資料 1 ルアンプラバン県各郡の社会経済開発計画要約

ルアンプラバン県の各郡（全 12 郡）では、SEDP が毎年作成されている。現地調査において入手できた直近年の SEDP の要約を以下に示す。

I. Luang Prabang District²

1. Location, Administration and Population

Luang Prabang District (LPQ-D) shares borders with 5 districts (Pak Ou, Nga, Xieng Nguen, Phonsay, and Chomphet). It is located between 247 and 1,425 meters above sea level. The highest temperature is 41°C.

LPQ-D had 118 villages administratively divided into 2 zones: (1) *khed thedsabaan* (municipal zone) that consisted of 64 villages and (2) a village cluster zone that consisted of 6 *kumban* with 54 villages. The number of household totaled 14,616. The population stood at 83,743 people of which 59,315 lived in *khed thedsabaan*. Lao Loum accounted for 72.52%, followed by Lao Theung 14.60% and Lao Soung 12.88% respectively. The population growth rate was 1.8% annually.

The majority of the population was engaged in tourism services, trade followed by agricultural and livestock activities.

2. Land and Forest

LPQ's land size is 774.06 square-km (or about 774,060 hectares). Reforestation taking place in the district was together carried out with industrial tree plantation activities such as teak (in 1,595 hectares), rubber trees (in 250 hectares), agraewood (in 10 hectares), etc. About 70 hectares of forest were expanded across the district. Reforestation was associated with activities pertaining to poverty reduction. Farmers or villagers primarily engaged in slash and burn farming were encouraged to do other cropping and livestock. The approach so-called “*song pouk neung liang*” or “grow 2 raise (animal) 1” was introduced such as to kumban kok waan, kumban xieng muak, kumban meung khai, kumban senkhalok, kumban phousouang, and kumban pakseang.

3. Poverty and Rural Development

In total there were reportedly 6 poor villages e.g. Houay Long, Houay Han, Houay Chia, Houay Siew, Bor Hae, and Long Lan, covering 300 households of 1,710 people.

Measures taken to address poverty in target villages and households included the commercial cropping and livestock and access to funding; and those practicing slash and burn rice farming (*hai*) were encouraged to do other activities by relocating them to settle down in the designated locations. As a result, 4 villages (Houay Chia, Houay Han, Houay Long and Houay Siew) were relocated.

² This information available in this profile is derived from the socioeconomic development plans (SEDP) implementation 2010-2011 and 2011-2012 SEDP of Luangprabang District. №120 date 12 December 2011.

4. Sectoral Development

The 3 main sectors are represented by agriculture, manufacturing-handicraft and service. The service sector accounted more than half of the economic output (61%), followed by agriculture (23%) and manufacturing-handicraft (16%) (2011). GDP per capita was about US\$1,632 (LAK7600/\$). The economic growth averaged 14% annually.

LPQ-D is the business center of the Province equipped with better facilities that attracts investments.

Agriculture and Livestock

Efforts have been made to transform the people's subsistence farming to commercial farming and production. As a result, the agriculture and forestry sector grew up to 13% annually. Clean vegetable production grouping was done in 4 villages as shown in following Table.

Table Villages Growing Clean Vegetables

Village	No. of Groups	No. of HHs
Ban Xieng Lom	6	79
Ban Pong Waan	1	18
Ban Na Deua	2	34
Ban Na Xay	2	38

The district as a whole could produce 10,707 tons of rice of which 9,360 tons were from *napii* in 2,294 hectares (4.2 tons/hectares), 682 tons was from *naxeng* in 110 hectares (6.2 tons/hectares), and 228 tons were from upland rice farming in 170 hectares (1.32 tons/hectares). Livestock subsector also expanded. There were 208,562 animals/poultry.

Together with rice production, other crops were promoted for commercial purposes as shown in following Table.

Table Some Crops Grown in LPQ-D (2011)

Crops	Area (ha)	Production (ton)	% ↓↑ (ha)
Sesame	236	401.2	↑ 76
Maize	832	1,778.6	↑ 18
Jobs tear	599	1,377.7	↑ 89
Vegetables/leaves	217	1,519	↑ 5
Soy bean	15	14	↓ 2
Peanut	275	330	↓ 5

Investments

The district registered 1,059 business units. 2011 alone saw 272 newly registered units (mostly trade and services).

5. Infrastructure

Roads

Compared to other districts in the Province LPQ-D has better transportation networks (air, land and river). The Mekong River and National Route №13, running through the district, are an important transport hub for transporting agricultural products and passengers.

Irrigation

The district had 217 irrigation facilities.

Schools

The district had 9 kindergartens, 39 pre-primary schools, 83 primary schools, 7 lower and 6 upper secondary schools.

Health

The district has 1 hospital, 7 dispensaries, 54 pharmacies, and a mobile medicine providing fund that covers 26 villages. 95% of women and children had vaccination. 42 villages were labeled “hygienic or clean”.

II. Xieng Nguen District³

1. Location, Administration and Population

Xieng Nguen is a 25-minute drive from Luangprabang district. It shares borders with 6 districts: Phonsay, Phou Khoun, Nan, Luangprabang, Chomphet, and Kasi of Vientiane Province.

As of 2011, Xieng Nguen had 68 villages of 5824 households. The population of the district was 32432 comprising Lao Theung (58.6%), Lao Loum (21.2%), Lao Soung (20.2%). The population of the district was engaged mainly with agriculture and services.

2. Land and Forest

The land size of the district is 1210 km² (121000 ha). Xieng Nguen is another mountain district of Luangprabang Province.

Reduction of slash and burn farming practices was carried out in association with poverty reduction. Xieng Nguen administration had tried to encourage farmers to be engaged in permanent farming practices through implementing projects like village resettlement (11 villages); land use titling completed in 9 villages (e.g. 24471 plots titled covering 21828.57 ha), 5371 plots measured covering 6365.61 ha. This helps reduce slash and burn farming land. As a result, shifting cultivation land was down to 552.9 ha in FY2009-2010 from 700 ha in FY2008-2009 and 10 villages stopped shifting cultivation practices. As of FY2009-2010 there were 43 villages still engaged in shifting cultivation.

3. Poverty and Rural Development

In association with the above section (land and forest) participatory consultation with farmers by

³ This information available in this profile is derived from the district's socioeconomic development plans (SEDP) 2009-2010 (5 March 2009).

authorities was carried out to do planning for production and livestock and to help poor families access to funding e.g. village development fund, rice bank, and so forth. As of FY2009-2010 the district had 121 poor households and 5 poor villages.

4. Sectoral Development

Xieng Nguen's economy was structured by agriculture accounting for 61.14%, followed by services 23.31% and manufacturing 15.55%. GDP per capita was LAK6.8 million.

The 2009-2010 saw Xieng Nguen's total rice production of 5326.5 tons in 2185 ha. Details are given in following Table.

Table Rice production

Rice	Production (ton)	Area (ha)	Productivity (ton/ha)
Napii (rain-fed)	2194.5	627	3.5
Naxeng (irrigated rice)	1032	258	4.0
Hai (shifting cultivation)	2100	1300	1.2

In addition, *khao ka kip dew* was also promoted and grown in 11 ha involving 16 households living in Na Thor, Na Kha, Houay Khang, Pholsavang, Phonsay, and Thin Keo.

Transforming shifting cultivation of rice into growing commercial crops was significant in part of the district in form of various projects. The following Table shows crops, plants and trees being promoted in the district.

Table Commercial Cropping and Tree Plantation

Crops/Plants/Trees	Production (ton)	Area (ha)	Location
<i>Short-life crops</i>			
Vegetables	864000.00	677.80	KB Suan Luang, some villages (Ban Yai)
Roots	5542.65	369.51	Ban Kua (Nam) Ming
Melons	1565.72	120.44	Ban Kew Ta Loun I
Corns (<i>salee, saloi</i>)	1117.00	583.82	KB Kew Ka Jam and Tad Ka Jam
Banana	465920.00	560.81	Ban Pholsavang, Kew Ta Loun I & II
Sesame	4322.00	454.95	KB Pak Bak, KB Nam Ming
Mungbean	714.38	357.19	KB Kew Ka Jam esp. Ban Phou Tha
Jobs tear	1570.00	713.64	KB Pak Bak and Kua Nam Ming
<i>Medium-life plants</i>			
Mulberry bark	1562.54	781.27	Ban Pholsavang, Kew Ta Loun II
Broom grass	1112.06	556.03	Ban Kew Mak Nao 2 (growing the most)
Coffee	-	130.7	Kumban Kew Ka Jam and Kew Yaa
Tea (<i>sha je</i>)	-	159.71	Kumban Kew Ka Jam and Kew Yaa
Oil tree (bio)	-	24.90	Kumban Kew Yaa
<i>Long-life trees</i>			
Teak	-	2127.97	6 kumban and Ban Yai
Rubber trees	-	760.32	Kumban Tad Ka Jam
Agrawood	-	65.49	Kumban Tad Ka Jam
Fruit trees	-	137.00	Kumban Suan Luang (esp. Ban Long Or)
Trees (quickly grown-up)	-	17.50	Kumban Kew Ya and Kew Ka Jam

Together with rice and crop production, livestock was another activity witnessing expansion in terms of numbers (188258 heads). The animals raised were cattle, buffalos, goats, pigs, poultry, etc.

5. Infrastructure

Roads

The national route №13 north cuts through the district. A number of roads between villages were being built and rehabilitated or improved. More than 90% of the villages can use the existing roads all year round.

Electricity

44 villages of 32099 households had access to electricity.

Irrigation

-

Schools

Xeing Nguen has 65 schools with 98% of children attending.

Health

97.5% of the population had access to clean water covering 30483 people. 61 villages used gravity-fed water facilities, 8 with water supply (*nampapa*).

III. Nan District⁴

1. Location, Administration and Population

With 80 km away from the Province's capital, Luangprabang, Nan is the southernmost district in the Province and shares borders with Luangprabang, Xieng Nguen, Vientiane Province (Mad, Phou Khoun and Kasi) and Sayabouly Province. It has 55 villages of 4022 households.⁵ Pak Xeng is administratively divided into 7 kumban⁶ and 11 villages put under the *thedsabaan* administration or district's capital. There are 54 villages (5491 households) in total in the district. The population was 28554 (2011). Lao Loum accounted for 57% of the total population, followed by Khmu (34%) and Hmong and Il Mian (9%).

2. Land and Forest

The land size of the district is 1516 km² (151600 ha). The district has 37600 ha of protection forest, 33800 ha of watershed protection forest, 1240 ha of district's Phou Sa Kaen, 1890 ha of regeneration forest (of Phou Jong area), 2450 ha of Pha Khon Long – Pha Dang Khuay protection forest, 2300 ha of Nam Pak protection forest, and 2790 ha of Pha Haen – Pha Nuan. 45 villages stopped slash and burn activities involving 5076 households. The shifting cultivation land was reduced to about 64 ha in 2011. The following is the land by type in the district.

Table Type of Land use

Type of Land	Size (ha)
Agriculture	48412.4
Cropping (<i>pouk fang</i>)	363.52
Land for security purpose	26.83
Forest	100457
Industry	4.65
Culture	118.87
Public work (transportation)	155.4
Watershed	2066.1

Other industrial trees such as oil trees, teak and rubber were planted in the total area of 162 ha. Rubber plantation accounted for more than 95%.

3. Poverty and Rural Development

The district had 9 poor villages covering 595 households (16.7%). Compared to the previous years

⁴ This information available in this profile is derived from the district's implementation of socioeconomic development plans (SEDP) 2010-2011 and plan for 2011-2012.

⁵ National Committee for Rural Development and Poverty Reduction, Prime Minister's Office, May 2011.

⁶ They are Kumban Sivilay (6 villages), kumban Thalee (6 villages), kumban Na Meuang (4 villages), Houay Hoy (7 villages), kumban Kok Toum (7 villages), kumban Pak Mone (6 villages) and Pak Nuen (7 villages)

the number of poor household was increased by 70.⁷ To address the issue, 8 village development funds were established. Two of the funds failed due to the management issue (e.g. in villages of Simoungkhoun).

4. Sectoral Development

Nan's economic growth stood at 8.2% (2011). The agriculture-forestry accounted for 63% of the growth, followed by services (20%), and manufacturing-handicraft (17%). GDP per capita was LAK6.2 million or \$779.

In 2011 the district could produce rice of 16179 tons of which 9.979 tons were grown from *napii* (paddy rice field) 2010 ha, *naxeng* 650 tons in 535 ha, rotational rice production 204 tons in 186 ha. Other than rice, other crops were also grown such as jobs tear (4219 ha, 12657 tons), maize (287 ha, 1128 tons), mungbean (82 ha, 183 tons), and so forth. Livestock was another activity supporting the rural livelihoods.

5. Infrastructure

Roads

The district's main is road №A4 connecting Sayabouly Province before joining national route №13 north. This road facilitates transportation of agricultural products of farmers.

Electricity

About 89.58% of the total households had electricity, covering 31 villages. Of which 3 villages (188 households) used solar panels and 13 villages (327 households) used water turbines and 35 households in 7 villages used generators.

Irrigation

The district had altogether 137 irrigation facilities that could water 181137 ha.

Schools

There were 47 primary schools with 99% of schooling kids, 6 lower secondary schools with 92.28% of student attendance, and 2 upper secondary schools with 42.30% of attendance.

Health

51 villages (99%) could access clean water. There were 1 hospital and 7 dispensaries. The district had 32 village-based first aid kits/services of which 22 were active.

IV. Pak Ou District⁸

1. Location, Administration and Population

Pak Ou shares borders with 5 districts of Nam Bak, Pak Xeng, Luangprabang, and Chomphet, and

⁷ The reason for the increase in number is due to redefinition of the national poverty line (Decree №285/PM).

⁸ This information available in this profile is derived from the 9-month implementation of the district's socioeconomic development plans (SEDP) 2012-2013 and the last 3 month plan.

Nga of Oudomxay. Pak Ou is administratively divided into 7 kumban with 49 villages and 5092 households. The population stood at 26019 in 2011.

2. Land and Forest

The size of the district is 720 km², the smallest district among the Province's 12 districts. The rice farmland is 1503.33 ha, including the newly cleared 68.61 ha. The shifting cultivation for rice covered 1025.31 ha and 185.21 ha were reduced as part of the government efforts to reduce the area of slash and burn cultivation. The land for commercial cropping was 1099.5 ha, including starchy crops (995.19 ha), fruit trees (601.8 ha) and vegetables (142.84 ha). Land use planning was carried out for 50 villages.

3. Poverty and Rural Development

15 villages were poor with 760 households.

4. Sectoral Development

(relevant info not available)

5. Infrastructure

Roads

32 villages had access to roads during both seasons (dry and rainy) and 15 could only use the roads during the dry season. 3 villages did not have road access.

Electricity

-

Irrigation

-

Schools

The district had 53 schools, including 3 secondary schools.

Health

18560 people in 38 villages (76%) had access to clean water. 32 mobile medicine funds were established across the district.

V. Nam Bak District⁹

1. Location, Administration and Population

Nam Bak District shares borders with 5 districts of Ngoi, Pak Ou (of Luangprabang), Nga, La (of

⁹ This information available in this profile is derived from the district's implementation of socioeconomic development plans (SEDP) 2012-2013.

Oudomxay), and Khao (of Phongsaly). It has 83 villages of 11666 households.¹⁰ Nam Bank is administratively divided into 9 kumban. The population was 64700 (2011). The majority of them was engaged in subsistence farming practices relying on forests and nature, and raising animals.

2. Land and Forest

The land size of the district is 1524 km² (152400 ha). The rain-fed rice farming (*napii*) land was 3097 ha in 2011, increased from 2911 ha in 2010; the irrigated production (*naxeng*) land was only 951 ha in 2011. The district had the permanent upland production (*hai khongthii*) land of 3500 ha (2013 planned) and the shifting cultivation land of 1000 ha (2013 planned). However, the *hai* area reported in 2011 was 6647 ha of which the district has aimed to reduce it to 4500 ha for FY2012-2013 covering 12 villages of 983 households.

The district aims to manage the forests in 3 types: conservation forest, protection forest and production forest. The shifting cultivation needs to be tackled in order to increase the forest coverage for the district.

3. Poverty and Rural Development

21 of 83 villages were considered poor, consisting of 1649 households.

4. Sectoral Development¹¹

Main commercial crops (short-cycle) being promoted included maize, jobs tear, sesame, melon, etc. Other plants (medium-cycle) included fruit trees (orange, coffee, mulberry bark, cardamom, and so forth). The long-cycle trees were rubber trees (150 ha), teak (100 ha)

5. Infrastructure

Roads

The national route №13 North and Road №1C become important routes for the villagers to transport their products and communication.

Electricity

More than 70% of all households had access to electricity (2011). The electricity network would be expanded to remote villages (e.g. Phou Kou, Thong Theung, Lao Lao, etc.)

Irrigation

-

Schools

-

Health

¹⁰ National Committee for Rural Development and Poverty Reduction, Prime Minister's Office, May 2011.

¹¹ The information here provides expected outputs for FY2012-2013.

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VI. Ngoi District¹²

1. Location, Administration and Population

Ngoi district is about 142 km far away from the Province's capital, Muang Luangprabang. It shares borders with 5 districts of Pak Ou, Pakseng, Viengkham, Nam Bak and Muang Mai of Phongsaly Province and also borders with Vietnam in the north. The district has Nam Ou (Ou River) running through it from north to south. It is 344 m above sea level.

Ngoi district had 105 villages comprising 6787 households and was administratively divided into 14 kumban before two of its kumban which comprised 24 villages (1299 households or 8739 people) were transferred to Phonthong district in November 2009. Phonthong was a newly established district in the Province.

As of January 2010 Ngoi had 10 kumban and 5 villages dependent to the district administration. In total there were 82 villages of 5603 households under the district. The population decreased to 30594 after the completion of the transfer. The population comprised 3 ethnic groups of Khmu, Lao Loum and Hmong. Khmu population accounted for 56% of the total population followed by 23% of Lao Loum and 21% of Hmong.

The population of the district was engaged mainly in subsistence agriculture, livestock, and services and relied on nature and forests.

2. Land and Forest

The land size of the district is 3492.4 km² (349240 ha) decreased by 1496.8 km² (or 149680 ha) after the abovementioned transfer. Of the total land, 91.35% was mountainous, followed by residential area (4.44%), tree plantation and production land (2.54%), and agricultural land (1.65%).

Ngoi is a mountain district with the total forest land of 810.23 ha of which protection forest accounted for 227.7 ha, 3.82 ha of conservation forest, 13.65 ha of regeneration forest, and 565.06 ha of industrial forest (planting rubber trees (45.15 ha), teak (478.32 ha), and agrowood (41.61 ha)), and 2 ha was pasture. Nam Ou is the main river with 15 tributaries allowing convenience for irrigation and transportation of goods and for tourism.

3. Poverty and Rural Development

Poverty remained 6.65% covering 21 villages. The villagers living in more rural remote areas were vulnerable and relied mostly on nature and forests and subsistence farming for livelihoods. Land use planning was done in 7 villages of 362 households in 7123 ha. The number of households practicing slash and burn farming was down to 2019 in 2010 from 4358 in 2004. Of which 435

¹² This information available in this profile is derived from the district's socioeconomic development plans (SEDP) 2010-2015 presented to the district's party congress IX between 7-8 Jan 2010.

households were engaged in paddy rice farming (*na*), 1346 in commercial cropping, 62 in raising animals and 176 in services. Compared to the 2004 numbers this was decreased by 46.33%.

4. Sectoral Development

The economic growth averaged 8% annually for the past 5 years until 2009. The agriculture and forestry contributed the most (83.89%) to the district's economy followed by services (14.15%) and manufacturing and handicraft (only 1.96%). GDP per capita was LAK3.9 million. 250 projects on socioeconomic development were launched for the past 5 years concentrating on food security, reduction of slash and burn farming practices, commercial production, and infrastructure development.

Between 2008 and 2009 the district could produce 8151.25 tons of rice of which paddy rice (*napii*) accounted for 3505.5 tons in 1001 ha, irrigated rice (*naxeng*) accounted for 709.65 tons in 157.7 ha and upland rice (*khao neun soung*) accounted for 3939.1 tons in 1165.68 ha. Ngoi had rice surplus for about 7 months.

Together with rice production, other crops were also promoted from commercial purposes. For instance, sesame production was increased in terms of land from 862.8 ha in 2004 up to 1112.8 ha in 2009; the same was for maize whose production land went up from 1339 ha in 2004 to 2659 ha. The most signification production taking place was in kumban Phou Thid Pheung. Pigeon pea also saw an increase from 334.1 ha in 2004 to 688.2 ha in 2009.

Livestock was another activity witnessing expansion in terms of numbers. The animals raised were cattle, buffalos, goats, etc.

5. Infrastructure

Roads

The district has №1 going through 12 villages. Many roads in other villages could be used during the dry season only making it difficult for farmers to transport their agricultural products.

Electricity

82 villages had access to electricity. Of which 1128 households used water turbines (*nam yord*) and 690 used generators. As a result, 3343 households could have an access to electricity, accounting for about 60% of the total households in the district.

Irrigation

Ngoi had 328 irrigation facilities including permanent and nonpermanent ones which could water 1157.7 ha of rice fields. Three water users' association or groups were established to manage the water use in kumban Sop Khan, kumban Sop Van and kumban Muang Seun.

Schools

Ngoi had 105 schools in total including primary and secondary schools with 9502 students. The number of children attending schools was 94%.

Health

The proportion of women and children reaching vaccination was 82% and 66 villages had gravity-fed water systems benefiting 26845 people (68.66% of the total population). Ngoi had 1 hospital, 5 dispensaries, 18 pharmacies, and the medicine fund covering 69 villages and those in remote areas.

VII. Pak Xeng District¹³

1. Location, Administration and Population

Pak Xeng shares borders with 5 districts of Luangprabang, Phonsay, Viengkham, Ngoi, Pak Ou. It has 55 villages of 4022 households.¹⁴ Pak Xeng is administratively divided into 8 kumban. The population was 23333 (2011). The majority of them were engaged in subsistence farming practices relying on forests and nature, and raising animals.

2. Land and Forest

The land size of the district is 1314 km² (131400 ha). The rain-fed rice farming (*napii*) land was about 223 ha in 2011, increased from 181 ha in 2010; the irrigated production (*naxeng*) land was less than 10 ha. However, the rotational cultivation land was 623 ha and the rotational cultivation land was increased from 643 in 2010 ha to 1187 ha in 2011.

3. Poverty and Rural Development

35 of 55 villages were considered poor, consisting of 600 households (2011). In 2012 the number of poor households went down to 576 and planned to make it 403 or 10.21% of the total households.

4. Sectoral Development

Like other districts in the Province, Pak Xeng is dominated by agriculture and forestry (more than 60%), followed by manufacturing (24%) and services (15%). GDP per capita was expected to be LAK6.2 million (FY2012-2013). Main commercial crops were maize, jobs tear and sesame with a combined total of over 3100 ha.

5. Infrastructure

Roads

The district relies mainly on road №2505 which needs to be rehabilitated. Other roads in the district have been planned for construction (e.g. Houay Phiang of Viengkham district – Houay Thong of Pak Xeng).

¹³ This information available in this profile is derived from the district's socioeconomic development plans (SEDP) 2012-2013.

¹⁴ National Committee for Rural Development and Poverty Reduction, Prime Minister's Office, May 2011.

Electricity

-

Irrigation

-

Schools

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Health

-

VIII. Phonsay District¹⁵

1. Location, Administration and Population

Located in the northwestern part of Luang Prabang (LPQ) Province and being 64 kilometers far away from the Province's capital, Phonsay District (PX) shares borders with 6 districts, namely Pak Seng and Viengkham (North), Phou Khoun (South), Viengthong of Huaphan Province and Phou Khud of Xieng Khuang Province (East) and LPQ and Xieng Ngeun (West). It is 1,800 meters above sea level.

There are 62 villages of 4,944 households in PX, an increase from 55 villages, 4,024 households in 2004. Administratively, PX is divided into 9 village clusters or “*kumban*” and 1 district municipality (*thedsabaan*). The total population stood at 32,480 in 2011. Khmu (Lao Theung) accounts for the majority of the population (64.53%, 3,316 HHs or 20,100 people). Followed is Hmong (Lao Soung) accounting for 26.16% (1,083 HHs or 8,154 people) in 2009.

The majority of the population was engaged in upland rice farming (*khao hai* or *khao neun soung*). The supportive livelihood activities were cropping, raising animals, and family trading. The people rely mainly on nature and forests for livelihoods. In 2004, 82.75 percent of the population practiced slash and burn farming (*hai*) whereas 14.6 percent made handicraft and the remaining was in the family business in services.¹⁶

2. Land and Forest

PX's land size is 24,437.4 square-km (or about 244,374 hectares) and 93.28 percent is mountainous making it difficult for paddy field expansions. In 2004 the district had a total agricultural land of 7,322.14 hectares (following Table).

¹⁵ This information available in this profile is derived from the socioeconomic development plans (SEDP) 2004-2005 (published in June 2004 by the district office for statistics and planning) and SEDP 2010-2015.

¹⁶ PX SEDP 2004-2005.

Table Land Use (2004)

No	Detail	2004 (ha)
	<i>Napii</i> – paddy land	190.3
	<i>Naseng</i> – irrigated land	19.65
	Rotation farming land	3,011
	Dry-season cropping land	364.90
	Wet-season industrial cropping land	3,736.29
	Total	7,322.14
	Residential land	1,161.63
	Forest (appx.)	4,209.08
	Road	530.4
	Fish pond	2.95
	Pasture	3,000
	River and stream	71,318.87
	Others	112,554.93
	Total	192,777.86

Source: PX-SEDP 2004-2005.

The majority of the land area of the district is the conservation forest (*pa sa nguan*), watershed forest (*pa yod houay*), and regeneration forest (*pa feun fou*). According to PX SEDP 2010-2015, in 2009 a total forest area covered 26,924 hectares whereas the conservation forest area was 5,114 hectares, the regeneration forest area was 4,490 hectares, the protection forest area was 24,440 hectares and 212.33 hectares went to pasture or livestock.

Reforestation was expanded in 254.16 hectares. In addition, industrial trees were planted like Agra wood (45.63 hectares), teak (140.45 hectares), rubber trees (156.45 hectares), and *mai zui per mu* (128 hectares).

Non-timber forest products such as mulberry bark trees (134.5 hectares) and broom grass (185.25 hectares) were domesticated.

The main rivers and streams are Nam Pa, Nam Vee, Nam Therr, Nam Bak, Nam Pha, Nam Khan and other streams with potential sources for irrigation.

3. Poverty and Rural Development

The poverty rate stood at 40% covering 47 villages or 75.8% of the total villages. In other words, there were 1,373 poor households.

Measures were taken to tackle the poverty issue of the villagers. The government staff was dispatched to work with grass-root levels. Thirty two funds for instance were created to help the poor access the funding for commercial cropping and raising animals.

Together villagers were encouraged not to practice slash and burn activities and provided with new opportunities by relocating the villages to appropriate locations. For example, 8 villagers were relocated and they were Mok Jok, Kew Ya, Mok Trang, Phol, Kew Mee, Long Laet, Kew Peng, Houay Xieng, Phol Ngam, and Pak Vee.

The land use planning (LUP) was completed in 5 villages of 322 households. The completed LUP

covered 3,864 hectares and 3 villages with 1,757 households were announced “not-slash-and-burn-farming villages”. Of 12 households were engaged in practicing paddy farming, 1301 in cropping, 324 in raising animals, 110 in services and about 10 engaged in other activities. As a result, the slash and burn farming land was down by 205.14 hectares.

4. Sectoral Development

The district’s economic growth was 7.5% during 2004-2009. The sectoral growth was that agriculture accounted for 70%, followed by services for 25% and 5% for manufacturing and handicraft. The gross domestic product (GDP) per capita was LAK4575000.

In the 5 years (2004-2009) 5,600.5 tons of rice was produced of which 1,034.92 tons were from *napii* (rain-fed paddy) in 246.41 hectares (4.2 tons/hectare), 99 tons from *naseng* (irrigated) in 18 hectares (5.5 tons/hectare), 3,198 tons from upland rice in 2,805.86 hectares (1.14 tons/hectare). The average paddy rice was 139 kilograms/person/year.

Other crops were also promoted. For instance, sesame was grown in 1,129 hectares producing 628.15 tons. Compared with the 2004 figure it went up to 25.64%. The major sesame producing kumban were Don Kham, Phol Thong and Nam Bor.

Maize was another most grown crop in the district with 1,388 hectares producing 3,399.25 tons increased by 15% compared to the 2004 outputs. The major maize producing kumban were Sobchia, and Nam Bor.

Jobs tear was grown in 603 hectares producing 929.38 tons with an increase of 30.83% compared to the 2004 figures. There were other crops as shown in following Table.

Table Main Crops

Crops	Area (ha)	Outputs (ton)	Increase (%)	Location (kumban)
Sesame	1129	628.15	25.64	Don Kham, Phol Thong, Nam Bor
Maize	1388	3399.25	15	Sobchia, Nam Bor
Jobs tear	603	929.38	30.83	-
Bean	187	187.24	-	-
Thua hae	377.18	302.24	-	-
Cabbage	10.93	90.16	-	-
Tomato	12.6	123	-	-
Garlic and onion	15.94	14.37	-	-

Source: PX SEDP 2010-2015.

The district witnessed the increase in the number of livestock in the past year (2004-2009) as shown in following Table.

Table Livestock (2009)

Animals	No of heads	% ↓↑ compared to 2004
Cattle	10,196	↑ 11.25
Buffalo	5,485	↑ 14.97
Goat	12,152	↑ 12.7
Pig	15,862	↑ 17.9
Poultry	105,356	↓ 7.0

Source: PX SEDP 2010-2015.

There were 148,051 animals of which 10,196 were cattle (an 11.25% increase), 5485 buffalos (a 14.97% increase), 12,152 goats (a 12.7% increase).

Regarding the manufacturing and handicraft sector, most businesses are small-sized. 230 businesses were registered witnessing a 74% increase in numbers when compared to 2004.

5. Infrastructure

Roads

The district has a main road (№5204) heading to Xieng Khuang Province. During the dry season, 95.23% of the existing road is accessible in all villages. The development of road networks to remote areas or villages are made depending on the funding. 28 road development projects with 231.4 kilometers were implemented.

Irrigation

There are 122 weirs (*fai am loun*) including 3 permanent ones (e.g. Houay Loung, Houay Nga, and Nam Therr).

Schools

There are vocational training center, secondary schools and primary schools in each village. There were 69 schools (e.g. 1 kindergarten with 40 children, 15 pre-primary schools with 579 children, 66 primary schools with 6,713 pupils, 3 lower secondary schools with 1,144 pupils and 1 upper secondary school with 310. 95.41% of children attended schools.

Health

The district has 1 hospital, 8 dispensaries, 6 pharmacies, and a mobile medicine providing fund that covers 48 villages. 99% of women and children had vaccination. 23 villages were labeled “hygienic or clean”. 57 villages had gravity-fed water system (*namlin*) accounting for 91% of the total population.

Energy

1,614 households had access to electricity of which 11 villages covering 891 households used power grid networks, 8 villages covering 357 households used solar panels, 313 households used (homemade) water turbine (*fai fah nam yod*), 53 households used generators. This saw a 19% increase in household electricity use.

IX. Chomphet District¹⁷

1. Location, Administration and Population

Chomphet District shares borders with Pak Ou, Luangprabang, and Hongsa of Sayabouly (East) and Nga district of Oudomxay (North), Xayabouly (South).

It had 67 villages of 5,143 households, administratively divided into 9 *kumbans*. Three of them were “focal” development village clusters aimed to become small towns. 20 were Lao Loum, consisting of 2,276 households; another 20 were Lao Theung of 2,157 households; and 7 were Lao Soung with 710 households. And 20 villages were ethnically mixed villages. The population totaled 28,872 of which 12,031 were Khmu, 11,702 were Lao Loum, and 5,139 were Hmong.

The majority of the population was engaged in rice farming and *hai* or shifting cultivation, followed by raising livestock, weaving, pottery, etc.

2. Land and Forest

Chomphet’s land size is 1,241.1 square kilometers (or 124,110 hectares). 1,618.11 hectares were rice field (or *na*); 569.24 hectares were used of shifting cultivation fields (*hai*) of which 328 hectares were for rotation cultivation having 849 households involved; 9,584 hectares were for cropping cultivation field; 9,428 hectares were used for pasture; 790 hectares were for residential and the rest was mountainous and forest. 46 villages or 1646 households were engaged in shifting and rotation cultivation activities.

Non-timber forest products included *mak tao* (sugar palm fruits), wild orchids, broom grass, mulberry bark, bamboo shoots, etc.

3. Poverty and Rural Development

As of 2008 the district had 195 poor households (or 1,029 people) in 30 villages. Of which 115 were Lao Theung households in 13 villages, followed by 55 Lao Soung in 7 villages and 25 Lao Loum households in 1 village.

Measures taken to address poverty in the villages and households included the commercial cropping and tree plantation (e.g. pigeon pea, mulberry bark, agra-wood, rubber trees) and livestock. Land use planning was completed for 57 villages, accounting for 85% of the total villages in the district. In 2008, 137.26 hectares of shifting cultivation land (*hai*) were eradicated and 158 households shifted from *hai* cultivation practices into other occupations; and 569.24 hectares of shifting cultivation land remained.

The district has the village development fund already covering 36 villages (54% of the total villages) with 1,675 members.

¹⁷ This information available in this profile is derived from the socioeconomic development plans (SEDP) 2008-2009.

4. Sectoral Development

To the economic outputs, the agriculture-forestry accounted for 78.60% whereas the service stood at 12.23% and 9.05% went to manufacturing. FY2007-2008 witnessed 70% and 44% growth in tourism-driven services and manufacturing respectively, and agriculture-forestry saw only a 13% growth. The district's annual economic growth was 8% and GDP per capita was about US\$601.

In agriculture the district had concentrated on the *napii* production (or rain-fed rice production) in 8 flat lands with a total area of 1,617 hectares and a 4.2 ton-per-hectare output. The *naxeng* rice farm land (or irrigated rice) covered 285 hectares with a 4.5-ton-per-hectare output. Shifting cultivation fields covered about 569 hectares with a 1.5-ton-per-hectare output. In 2008 the district could produce 8,930 tons (or equivalent to 309 Kg of paddy rice per person) and the district faced the rice shortage for about 2 months, equivalent to 1,175 tons.

In addition, other crops were promoted and grown in 20 hectares. Livestock and fishery for commercial purposes were also promoted. Following Table is a list of some crops grown in the district.

Table Some crops grown in Chomphet (2008)

Crops	Area (ha)	Production (ton)
Sesame	713.36	1,070.04
Maize	383.75	1,036.12
Pigeon pea (<i>thua hae</i>) for sticklac production	276.14	-
Roots	187.98	1691.82
Vegetables/leaves	181	539.6
Peanut	133.41	106.72
Chilly, egg plants	115.3	334.37
Mung bean	66.15	39.69
Jobs tear	70.06	189.16
Sugarcane	71.67	310.01

Other fruit trees and hard wood trees were planted. Following Table shows main tree planted in the district. Significantly, rubber tree plantation was increased by 200.4 hectares (or a 56% increase) from previous years.

Table Fruit trees and hard wood

Trees	Area (ha)
Teak	444.64
Rubber trees	357.4
Mulberry bark	110.53
Fruit trees	52.84
Agrawood	11.65

The development of tourism in the district has gained momentum attracting more number of tourists (4420 tourists recorded). The tourism sites include cultural, natural and historical attraction

such as Xieng Ngeun Temple, Chomphet Temple, Ethnic Village, and pottery village.

5. Infrastructure

Albert its location next to Luangprabang district, Chomphet's infrastructure situation is relatively underdeveloped. It was reported that a new city would be built in Chomphet a bridge over the Mekong River linking the two districts of Luangprabang and Chomphet was planned. Thus, the infrastructure development projects were planned.

Roads

A number of road construction and rehabilitation projects were proposed and implemented e.g. Xiengman-Hongsa road rehabilitation. The survey work of 6 roads were carried out (Ban Muang Kham – Ban Buam Lao (14km), Xieng Man – Ban Chan (8km), Pak Leung – Song Tai (24km), Pak Hang – Nam Hang (15km), Houay Miang – Kengken (19km) Buam Lao – Houay Tham (14.4km). The roads in the district can be used all year round and the Mekong River is the district's main transportation of agricultural goods and passengers.

Electricity

In 2008 16 villages or 1,048 households had access to state electricity (23.88%). 395 households used water turbines (*nam yord*), 52 used generators and 20 used solar panels.

Irrigation

There are 16 streams providing irrigation. The streams are Nam Houay Hang, Houay Khan, Houay Song, Houay Kaen, Houay Leum, Houay Leung, Houay Chan, Houay Tan, Houay Hong, Houay Yok, Houay Kaen, Houay Ving, Houay Sin, Houay Kohn, and Houay Hang.

Schools

The district had 71 primary schools and 4 secondary

Health

The district has 1 hospital and 6 dispensaries, and about 77% of the villages have access to gravity-fed water systems.

X. Viengkham District¹⁸

1. Location, Administration and Population

Viengkham is located in the northeast of and about 200 Km from the Province's capital, Muang Luangprabang. It shares borders with 5 districts of Phonthong, Pakseng, Phonsay, Ngoi, and Huaphanh's Viengthong.

Viengkkham had 69 villages of 4925 households administratively divided into 9 kumbans and 1 large village or district's capital. The population of the district was 29031 of which 76.1% was Khmu, followed by Lao Loum (14.3%) and Hmong (13.1%) respectively.

¹⁸ This information available in this profile is derived from the district's socioeconomic development plans (SEDP) 2010-2011 and Planned 2011-2012 SEDP.

The majority of the population was engaged mainly in upland rice farming, followed by cropping, raising animals, etc. respectively.

2. Land and Forest

The land size of the district is 2143.67 km² (214,367 ha). It is a mountain district with rough terrain covering about 78% of the total land. The district had 9455 ha for raising animals. The industrial plantation was promoted to grow agra-wood (77 ha), rubber trees (74 ha) and teak (277 ha). The agricultural production in the district relied mainly on shifting cultivation practices and the people continued to exploit natural forests resulting to a significant decrease in forests and natural resources. The agricultural land was 5200 ha, including 176.4 ha of paddy rice field, 1932.6 ha of shifting cultivation land (*hai*), 3091 ha of cropping land (maize, jobs tear, sesame, etc.)

3. Poverty and Rural Development

Viengkham is one of 4 poor districts in Luangprabang Province. The district's poverty was reportedly 29.17% covering 35 villages covering 1437 households. They relied on subsistence farming techniques and forests for living. The village development fund was established in 61 villages valuing LAK2.52 billion.

4. Sectoral Development

The economic growth stood at 8.7% in 2011 which was represented by agriculture and forestry (64.7%), services (32.4%), and manufacturing (2.9%). GDP per capita was US\$738. In the same year 40 investment projects were approved focusing on agriculture and forestry (11 projects) and a few each for other subsectors.

The main export products were rice, agriculture products and non-timber forest products being traded with the Chinese and Vietnamese. In 2011 22 development projects were implemented mostly concentrating on agriculture-forestry instanced by the 150-ha paddy rice field in 6 kumban, agricultural land allocation, and so forth.

5. Infrastructure

Roads

As a mountain district, 8 villages did not have road access, especially kumban Vang Bong and few others. Many of the existing roads were rough and could be used in one season – the dry season.

Electricity

Electricity and telecommunication were limited to remote areas and villages in the district. 89.37% of the total households had access to electricity accounting for 12 villages. 21 villages spreading across 9 kumbans resorted to other sources of energy such as water turbine (*nam yord*).

Irrigation

-

Schools

The district had 3 secondary schools, 35 primary schools, and 32 pre-primary schools or *mulapathoum*.

Health

About 87% of the population could access gravity-fed water system accounting for 60 villages.

XI. Phou Khoun District¹⁹

1. Location, Administration and Population

Phou Khoun shares borders with 5 districts of Phonsay, Xieng Nguen, Xiengkhuang's Phou Khout, Vientiane's Kasi and Vangvieng. As of 2011 it had 39 villages of 3468 households. The population was 21332, an increase of 8% compared with the 2006 number. The 2006 report indicated that Lao Theung accounted for almost 67% of the total households, followed by Loum Soung, 28% and Lao Loum, 4%. It is administratively divided into 7 kumban.²⁰ The population was engaged mainly in subsistence farming, shifting cultivation and raising livestock.

2. Land and Forest

The land size of the district is 979 km² (97900 ha). In 2006 the district had 1491 ha of shifting cultivation fields, 1146 ha of rotation farming (fallow with rotation), 345.09 ha of paddy fields, and 345 ha of permanent *hai*. It was reported in 2006 that the district had rice shortage for 6 months (or about 3250 tons). Reduction of shifting cultivation was concentrated on the villages e.g. Na Nan, Tang Ou, Pha Keng Yai, Phonsay, and Sen Sii. Land allocation was done in 10 villages: Pha Wai, Chim, Phou Lang Jang, Phou Vieng Noi, Phou Vieng Yai, Phon Kham, Long Miang, Phou Soung, Phou Yang, and Sam Yaek.

3. Poverty and Rural Development

In 2006 there were 1164 poor households in the district. According to the 2011 report, the number of poor households remained 290 households spreading in 17 villages.²¹

4. Sectoral Development

The economic growth of the district reportedly stood at 7% and GDP per capita was LAK1.7 million (\$172). The 2006 economic structure was that 67% was contributed by agriculture and

¹⁹ This information available in this profile is derived from the 6-month implementation of district's socioeconomic development plans (SEDP) 2006.

²⁰ They were kumban Thedsabaan consisting of 6 villages, kumban Long Phod (5 villages), kumban Pha Keng Noi (6 villages), Phou Leuy (7 villages), kumban Phou Soung (7 villages), kumban Phou Vieng Noi (7 villages) and Buam Phor (6 villages).

²¹ National Committee for Rural Development and Poverty Reduction, Prime Minister's Office, May 2011.

forestry, followed by services (19%), and manufacturing (14%). The crops grown for commercial purposes in the district were shown in the following table.

The crops grown for commercial purposes in the district were shown in the following Table.

Table Some crops grown in Phou Khoun (2008)

Crops/Plants/Trees	Production (ton)	Area (ha)
Maize	1661.15	664.46
Sweet corn	410.52	171.05
Sesame	364	182
Peanut	520.8	173.6
Soybean	85.1	42.55
Roots	1770.8	178.86
Ginger	715.27	310.99
Cassava	3527.16	396.31
Chilly	208.95	139.3
Vegetables	1663.39	178.86

Together with cropping, livestock was also promoted, including cattle, pig, poultry, etc. Livestock kumban were Chim, Phou Vieng Noi, Phou Soung, Thedsabaan, and Pha Kieng Noi. Poultry villages included Jang Euan, Phou Leoy, and Houay Sa Taep.

5. Infrastructure

Roads

The national route №13 North passes through part of the districts (10 villages) and Road №7 cuts through the district (linking 7 villages in the district) and connects with Route №13 to Xieng Khuang Province. There were about 17 villages located in remote areas with difficult road access.

Electricity

70% of all households had access to electricity (2011)

Irrigation

-

Schools

Phoukhoun had 39 schools. 36 were primary ones and the rest were secondary ones. These 39 schools accommodated 5167 students. Non-formal education was also offered to illiterate people. With this 1712 people in 24 villages could read and write.

Health

-

XII. Phonthong District²²

1. Location, Administration and Population

Phonthong was established in 2009. Two kumban of Ngoi district comprising 24 villages (1299 households or 8739 people) were put under the newly established Phonthong administration. Phonthong district shares borders with 4 districts: Ngoi and Viengkham (Luangprabang), Mai (Phongsaly), Viengthong (Huaphan) and Vietnam. Phonthong had 38 villages of 2589 households and administratively divided into 5 kumbans. The population totaled 18,920 represented by Hmong (33.67%), Khmu (33.05%) and Lao Loum (33.26%). The majority of the population was engaged in subsistence rice farming and *hai* or shifting cultivation, followed by raising livestock, weaving, pottery, etc.

2. Land and Forest

The size of the district is about 2089 km². The district's forest coverage is 120235 ha, followed by agriculture land of 86499 ha, residence 696 ha and so forth (following Table).

Table Type of Land use

Land Types	Size (ha)
Forest	120,234.76
Agriculture	86,498.79
Residence	696.21
Culture	392.64
Roads	202.35
Manufacturing	195.98
National defense and security	61.23

Land allocation was still ongoing. For instance, the residential land of 17 hectares was assigned for 7 villages (e.g. Nam Luang, Pak Tha, Houay Tha, Na Vat, Vang Xieng, Pong Bor, and Houay En). The agricultural land was also measured for the 3 villages of 314 households to manage and use covering 550 hectares. Together the land use planning was done at the village and kumban levels across the district. The total rice field area was 609.37 hectares and 23.5 hectares were cleared for rice farming.

3. Poverty and Rural Development

Phonthong is one of the 4 poorest districts in the Province.²³ 30 out of 38 villages were categorized “poor”.

²² This information available in this profile is derived from the 6-month implementation of the district's socioeconomic development plans (SEDP) 2011-2012 and the last 6 month plan (March 7, 2012).

²³ The other three poorest districts were Phonsay, Pak Xeng, and Viengkham (according to the implementation report of the agriculture and forestry development sector of the province (№537 of June 28, 2012).

4. Sectoral Development

(info not available)

5. Infrastructure

Phonthong is a relatively new district of the Province. Infrastructure like public facilities / offices (e.g. schools, DAFO office, Health office...) were being planned and constructed.

Roads

An important road of the district is road № 2508 of 55 Km, connecting Phou Thid Pheung to Vietnamese border.

Electricity

-

Irrigation

-

Schools

The district had 54 schools (1 secondary school, 18 primary schools, and 22 *mulapathoum*) with 4101 students in total. FY2011-2012 aimed to reach 99% of the schooling age in the district.

Health

The district has 1 hospital and 2 dispensaries. 18 villages (11245 people) have access to gravity-fed water systems or equivalent to 61.13% of the total population. 34 villages had 76 health volunteers stationed in the village.

参考資料 2 社会経済調査の質問票

Date_____

Name of Interviewer_____

Questionnaire sheet in Phonsay District
Study on consciousness of villager to land use change

1. Basic information

- 1) Kumban and village names:_____
- 2) Interviewee_____

Age_____ Ethnic_____ Sex_____ Relationship with Household head:_____
- 3) Household head_____ Age_____ Ethnic_____ Sex_____ (☐ same person as above)
- 4) Family member: _____, Women: _____, Labor: _____, Children(under15): _____, Absentee*: _____

*“Absentee” means he / she lives in other places more than six months a year.)_____
- 5) Occupation of HH head & Interviewee

5.1. Occupation of HH	Choose [Yes/No]	Monthly Earning (Kip)	From Month to Month
[On-farm (including livestock)]			
a) <input type="checkbox"/> <i>Sauna</i>	Yes / No		
<input type="checkbox"/> Farming on own land	Yes / No		
<input type="checkbox"/> Farming on rented land	Yes / No		
<input type="checkbox"/> Others _____	Yes / No		
b) <input type="checkbox"/> <i>Saohai</i>	Yes / No		
<input type="checkbox"/> Farming on own land	Yes / No		
<input type="checkbox"/> Farming on rented land	Yes / No		
<input type="checkbox"/> Others _____	Yes / No		
[Off-farm]			
c) <input type="checkbox"/> Civil servant / teacher / army	Yes / No		
d) <input type="checkbox"/> Wage Labor (short-term employed labor)	Yes / No		
e) <input type="checkbox"/> Self-employed business / vender	Yes / No		
f) <input type="checkbox"/> Others _____	Yes / No		

5.2. Occupation of Interviewee	Choose [Yes/No]	Monthly Earning (Kip)	From Month to Month
[On-farm (including livestock)]			

<i>livestock</i>)			
a) <input type="checkbox"/> <i>Sauna</i>	Yes / No		
<input type="checkbox"/> Farming on own land	Yes / No		
<input type="checkbox"/> Farming on rented land	Yes / No		
<input type="checkbox"/> Others _____	Yes / No		
b) <input type="checkbox"/> <i>Saohai</i>	Yes / No		
<input type="checkbox"/> Farming on own land	Yes / No		
<input type="checkbox"/> Farming on rented land	Yes / No		
<input type="checkbox"/> Others _____	Yes / No		
<i>[Off-farm]</i>			
c) <input type="checkbox"/> Civil servant / teacher / army	Yes / No		
d) <input type="checkbox"/> Wage Labor (short-term employed labor)	Yes / No		
e) <input type="checkbox"/> Self-employed business / vender	Yes / No		
f) <input type="checkbox"/> Others _____	Yes / No		

6) Migrated year of Household: _____ Year

Move from _____ village in _____ reason; _____ / Born here

7) Education Level of Household head

	Primary	Lower secondary	Upper secondary	Post secondary
graduate/dropout	1 2 3 4 5	1 2 3 4	1 2 3	1 2 3 4 5 6 7

8) Household head has never attended schools _____

9) Household head attended training relating to farming improvement, etc. _____

2. Current land use & land use change: draw resource map & fill in blank

	Information of land	Before 2003	2003	2004	2005	2006	2007	2008	2009	2010	2011
e x.	Crop's name: <u>upland rice</u> [1]ha [0.5]t [3]plots(rotation, use no.1-3) Fallow: <u>3 yrs</u> Place/Dist.: <u>beside --- stream / 30min by walk</u> Acquisition process: <input type="checkbox"/> <u>Gov. provide,</u> <input type="checkbox"/> Others() Occupation: <u>Own</u> /common/borrow/lend land						Change upland rice to job's tear		Gov. took		
1	Crop's name: _____[]ha []t []plots Fallow: _____ Place/Dist.: _____ Acquisition process: <input type="checkbox"/> <u>Gov. provide,</u> <input type="checkbox"/> Others() Occupation: <u>Own</u> /common/borrow/lend land										
2	Crop's name: _____[]ha []t []plots Fallow: _____ Place/Dist.: _____ Acquisition process: <input type="checkbox"/> <u>Gov. provide,</u> <input type="checkbox"/> Others() Occupation: <u>Own</u> /common/borrow/lend land										
3	Crop's name: _____[]ha []t []plots Fallow: _____ Place/Dist.: _____ Acquisition process: <input type="checkbox"/> <u>Gov. provide,</u> <input type="checkbox"/> Others() Occupation: <u>Own</u> /common/borrow/lend land										
4	Crop's name: _____[]ha []t []plots Fallow: _____ Place/Dist.: _____ Acquisition process: <input type="checkbox"/> <u>Gov. provide,</u> <input type="checkbox"/> Others() Occupation: <u>Own</u> /common/borrow/lend land										

	Acquisition process: <input type="checkbox"/> Gov. provide, <input type="checkbox"/> Others() Occupation: <u>Own/common/borrow/lend</u> land																		
5	Crop's name: _____[]ha []t []plots Fallow: _____ Place/Dist.: _____ _____ Acquisition process: <input type="checkbox"/> Gov. provide, <input type="checkbox"/> Others() Occupation: <u>Own/common/borrow/lend</u> land																		
6	Crop's name: _____[]ha []t []plots Fallow: _____ Place/Dist.: _____ _____ Acquisition process: <input type="checkbox"/> Gov. provide, <input type="checkbox"/> Others() Occupation: <u>Own/common/borrow/lend</u> land																		
	NTFP: _____ _____ Place: _____ _____																		

Check sheet for Interviewee

Please check the lists below, after you got information about interviewee's land use trend.

- ☐ Total land size (current). / Divide shifting cultivation and paddy.
- ☐ Total plot size of shifting cultivation (current).
- ☐ Process of getting land
 - ☐ When did they start the farming in this village?
 - ☐ Who gave the land? : Ex. Government, village head, parents, other villager, by himself and so on.
 - ☐ What is the former land use? : Did they develop the forest or fallow land of others?
- ☐ Farming style:

- ☐ Rotation or Pioneer
 - ☐ Fallow year / Continuously used period
- ☐ How many plot does interviewee use in a year (farming season)?
- ☐ Land occupation
- ☐ Past utilization : (If interviewee can answer, please check.)
In case of interviewee changed or abandoned farming land
 - ☐ Reason
 - ☐ Former utilization : Ex. Change from shifting cultivation to paddy

Please answer 5 step assessments.

3. Consciousness of Decision making in village

<u>Purpose: To clarify the villager's bottom-up participation in village meeting</u>	Level of appreciation 1-Never 2-Seldom 3-Middle 4-Often 5-Everytime	Remarks
Q1. How often village meeting is held at one month?	_____ times per month	
Q2. How often do you attend the meeting to discuss village policy and activities or village rule (regular meeting)	1 2 3 4 5	
Q3. How often do you make a statement in the village meeting?	1 2 3 4 5	
	Level of appreciation 0-Never 1-Low 2-Middle Low 3-Middle 4-Middle High 5-High	
Q4. Have you participated in any discussion to decide land use in a village?	0 1 2 3 4 5	
Q5. Have you participated in any discussion to decide agricultural topic?	0 1 2 3 4 5	
Q6. Have you participated in any discussion of using water sources (water spring, well)?	0 1 2 3 4 5	
Q7. Have you participated in any discussion to decide rules for forest management/operation?	0 1 2 3 4 5	
Q8. How do you think it is necessary to make a decision by all villagers to decide village land use plan?	1 2 3 4 5	
Q9. Who should decide the village land plan for better land use in the future?	<input type="checkbox"/> Government, <input type="checkbox"/> Village head(include village committee), <input type="checkbox"/> Yourself or family, <input type="checkbox"/> Ordinary villager, <input type="checkbox"/> Others()	
Q10. Are you satisfied with a process of decision making in the village meeting?	1 2 3 4 5	

4. Consciousness of Group activity

<u>Purpose: To clarify villager's recognition or behaviour of cooperation activities as group</u>	Level of appreciation 1-Low 2-Middle Low 3-Middle 4-Middle High 5-High	Remarks
Q11. How often do you join the group activity to cooperate with each other for improving your daily life?	1 2 3 4 5	
And what kind of cooperation?		
Q12. Have you cooperated with others to implement slash/burn operation for farming land?	1 2 3 4 5	

Q13. Have you cooperated with others to implement irrigation operations for paddy field?	1	2	3	4	5	
How do you think these are benefits of group activity or not?						
Q14. Making products efficiency	1	2	3	4	5	
Q15. Transferring technique or knowledge among villager (farmer to farmer)	1	2	3	4	5	
Q16. Enforcing insistence of group among village	1	2	3	4	5	
Q17. How do you think group is better than individual to resolve your problem such as improving productivity, earning much money?	1	2	3	4	5	

5. Consciousness of forest

<u>Purpose: To clarify the impact of deforestation and forest degradation by villager's forest utilization.</u>	Level of appreciation 1-Low 2-Middle Low 3-Middle 4-Middle High 5-High					Remarks
Q18. How often do you use the forest for collecting fuel wood? <i>If the interviewee buys it, please note at Remarks.</i>	1	2	3	4	5	
Q19. How much fuel wood do you collect?	_____/week or month or year Total: _____ kg/year					
Q20. What kind of wood do you collect for fuel wood?	<input type="checkbox"/> Cutting living wood, <input type="checkbox"/> Dead wood					
Q21. Where do you get the fuel wood?	<input type="checkbox"/> Natural forest, <input type="checkbox"/> Plantation					
Q22. How often do you collect the NTFP in the forest?	1	2	3	4	5	
Q23. How often do you use the forest to get timber for construction?	1	2	3	4	5	
Q24. How much timber do you collect? And What kind of wood do you collect?	_____/week or month or year _____					
Q25. How often do you use the forest for livestock grazing?	1	2	3	4	5	
Q26. Where do you use for grazing? If they use common land, ask place and number of household using it.	<input type="checkbox"/> Natural Forest <input type="checkbox"/> Common land, place: _____, ____ HH <input type="checkbox"/> Fallow land, <input type="checkbox"/> Others(_____)					
How do you think about the benefit (value) of forest?	Level of appreciation 1-Low 2-Middle Low 3-Middle 4-Middle High 5-High					Remarks
Q27. Getting firewood	1	2	3	4	5	
Q28. Getting NTFP	1	2	3	4	5	
Q29. Getting timber	1	2	3	4	5	
Q30. Getting compost materials	1	2	3	4	5	
Q31. Role of reserve area for farming	1	2	3	4	5	
Q32. Providing fertile into soil	1	2	3	4	5	
Q33. Keeping water source	1	2	3	4	5	
Q34. Protecting land slide	1	2	3	4	5	

6. Capacity of maintaining livelihoods

<u>Purpose: To clarify villager's capacity to maintain their livelihood.</u>	Level of appreciation(satisfaction) 1-Low 2-Middle Low 3-Middle 4-Middle High 5-High	Remarks
Q35. Do you have enough land size for farming? If you lack the farming land, how much land do you want?	1 2 3 4 5 Current: _____ ha, Need: _____ ha	
Q36. Do you have enough knowledge or techniques to get necessary products for a living?	1 2 3 4 5	
Q37. Can you get enough rice production for family?	1 2 3 4 5	
Q38. How much rice do your family consume per month?	_____ Kg/month	
<i>If interviewee suffers the food shortage, ask Q38 & Q39.</i>		
Q39. Food shortage period and shortage amount	from _____ to _____; _____ kg	
Q40. The way of getting food <i>If they have to pay some money or interest, please note at Remarks.</i>	<input type="checkbox"/> buying at market, <input type="checkbox"/> borrow from rice bank, <input type="checkbox"/> borrow from relative, <input type="checkbox"/> consume other food like cassava or taro, <input type="checkbox"/> Others(_____)	
Q41. Do you satisfy the situation of water for farming?	1 2 3 4 5	
Q42. Accessibility to farming places	1 2 3 4 5	
Q43. Do you satisfy your income?	1 2 3 4 5	

7. Options of daily life

How do you feel the satisfaction about these situations?	Level of appreciation 1-Low 2-Middle Low 3-Middle 4-Middle High 5-High	Remarks
Q44. Situation of water for daily life use	1 2 3 4 5	
Q45. Situation of health service And ask the reason of interviewee's answer	1 2 3 4 5	
Q46. Situation of education for your family And ask the reason of interviewee's answer	1 2 3 4 5	
Q47. Situation of transportation	1 2 3 4 5	
Q48. How often do you go outside village?	1 2 3 4 5	
Q49. What is your purpose going outside? If interviewee has several options, please ask top three.	<input type="checkbox"/> Selling products at _____, <input type="checkbox"/> Buying products at _____, <input type="checkbox"/> Go to hospital, <input type="checkbox"/> Go to day work at _____, <input type="checkbox"/> Others(_____)	
Q50. How do you go to outside village? If interviewee has several options, please ask top three.	<input type="checkbox"/> By bike, <input type="checkbox"/> By bicycle, <input type="checkbox"/> By public vehicle, <input type="checkbox"/> By walk, <input type="checkbox"/> Others(_____)	

8. What kind of alternative livelihoods do you want instead of slash & burn farming?

9. Please rank (1-14) the following alternative livelihoods you think the most suitable to help reduce or stop slash and burn farming.

Alternative Activities	Ranking (1-14)
• Commercial cropping	
• Rice farming	
• Trading	
• Raising small livestock	
• Raising large livestock	
• Shifting cultivation	
• Labouring	
• Planting fruit trees	
• Weaving (silk, cotton)	
• Weaving bamboo, rattan, etc.	
• Planting industrial trees: teaks..	
• Planting industrial trees: rubber trees.	
• Fishing	
• Others: _____	

参考資料 3 社会経済調査の様子（写真）

2012年10月12日～11月13日 ポンサイ郡ホアイキン村落クラスターでのフィールド調査



村長との打合せ
(2012年10月12日 ホアイキン村)



集落
(2012年10月12日 ホアイキン村)



村落の様子
(2012年10月12日 ホアイキン村)



村落の様子
(2012年10月12日 ホアイキン村)



事前ワークショップ
(2012年10月13日 ホアイハ村)



事前ワークショップ
(2012年10月13日 ホアイハ村)



住民インタビュー調査
(2012年10月13日 ホアイハ村)



住民インタビュー調査
(2012年10月13日 ホアイハ村)



住民インタビュー調査
(2012年10月15日 ホアイキン村)



畑周辺の果樹栽培
(2012年10月26日 ホアイキン村)



水田 (ホアイミアンエリア)
(2012年10月26日 ホアイキン村)



水田の水確保用の個人ダム
(2012年10月26日 ホアイキン村)



簡易水路
(2012年10月26日 ホアイキン村)



水田の水源
(2012年10月26日 ホアイキン村)



水田横の焼畑
(2012年10月26日 ホアイキン村)



脱穀作業
(2012年10月26日 ホアイキン村)



焼畑地周辺
(2102年10月27日 ホアイキン村)



焼畑地周辺
(2012年10月27日 ホアイキン村)



焼畑地周辺
(2012年10月27日 ホアイキン村)



焼畑地周辺
(2012年10月27日 ホアイキン村)



住民インタビュー調査
(2012年10月27日 ホアイキン村)



住民インタビュー調査
(2012年10月27日 ホアイキン村)



焼畑地出作り小屋
(2012年10月27日 ホアイキン村)



焼畑地出作り小屋
(2012年10月27日 ホアイキン村)



住民インタビュー調査
(2012年11月10日 ホアイトー村)



住居（竹作り）
(2012年11月10日 ホアイトー村)



家庭菜園内のコーヒー
(2012年11月10日 ホアイトー村)



住居横の家庭菜園
(2012年11月10日 ホアイトー村)



家畜の共同飼育地
(2012年11月10日 ホアイトー村)



家畜の共同飼育地
(2012年11月10日 ホアイトー村)

2013 年 4 月 ポンサイ郡ホアイキン村落クラスターでのフィールド調査



苗はた小屋 (TABI による支援)
(2013 年 4 月 24 日 パクボン村)



苗はた
(2013 年 4 月 24 日 パクボン村)



苗はた
(2013 年 4 月 24 日 パクボン村)



苗はた
(2013 年 4 月 24 日 パクボン村)



苗はた
(2013 年 4 月 24 日 パクボン村)



蒔蒾いも
(2013 年 4 月 24 日 パクボン村)



TABI の支援によるコーヒーの苗はた
(2013 年 4 月 25 日 ホアイキン村周辺)



TABI の支援によるコーヒーの苗はた
(2013 年 4 月 25 日 ホアイキン村周辺)



中国人の仲買による村落マーケット
(2013 年 4 月 25 日 ホアイキン村周辺)



鶏小屋
(2013 年 4 月 25 日 ホアイキン村周辺)



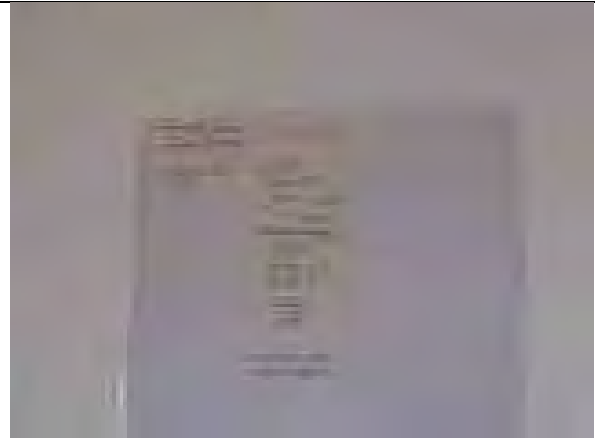
実証活動に向けた住民グループの議論
(2013 年 4 月 26 日 ホアイキン村)



実証活動に向けた住民グループの議論
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実証活動に向けた住民グループの議論
(2013 年 4 月 26 日 ホアイキン村)



苗はた活動候補地
(2013 年 4 月 26 日 ホアイキン村)



対象地の景観
(2013 年 4 月 26 日 ホアイキン村)



**Socio-economic Survey and Analysis to Identify Drivers of Forest Changes
in Houay Khing and Sop Chia Village Clusters,
Phonxay District, Luang Prabang**

January 2012

Vientiane, Lao PDR

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Abbreviation and Acronyms

CESVI	Cooperazione e Sviluppo (Cooperation and Development)
DAFO	District Agriculture and Forestry Office
GDP	Growth Domestic Product
GoL	Government of Lao PDR
GPARG	Governance and Public Administration Reforms
HH	Household
HK	Houay Khing
JICA	Japan International Cooperation Agency
MAF	Ministry of Agriculture and Forestry
MI	Mekong Institute (Thailand)
MoIC	Ministry of Industry and Commerce
MURC	Mitsubishi UFJ Research & Consulting
NGPES	National Growth and Poverty Eradication
NTFP	Non-Timber Forest Product
PADETC	Participatory Development Training Centre
PAFO	Provincial Agriculture and Forestry Office
PAREDD	Participatory Land and Forest Management Project for Reducing Deforestation
PDR	Peoples' Democratic Republic (Lao)
PICO	Provincial Industry and Commerce Office
REDD+	Reducing Emissions from Deforestation and Forest Degradation Plus
SC	Sop Chia
TABI	The Agrobiodiversity Initiative
ToR	Terms of Reference
UNESCO	United Nations Educational, Scientific and Cultural Organization
VCA	Value Chain Analysis

Table of Contents

Abbreviation and Acronyms	i
Chapter 1 Scope of the Survey	1
1.1. Background	1
1.2. Objectives	2
1.3. Data and Methodology	2
1.4. Study Area: Houay Khing and Sop Chia Village Clusters	4
1.4.1. Land and People	4
1.4.2. Livelihoods	6
1.4.3. Road Access and Wage-labor	6
Chapter 2 Household Samples and Survey Results	8
2.1. Characteristics of Interviewed Households/Members	8
2.2. Education	9
2.3. Occupation	9
2.4. Migration	10
Chapter 3 Agricultural Land Use	12
3.1. Historical Change in Land Size	12
3.2. Land Size	13
3.3. Rotational Periods of Upland Agricultural Plots	16
3.4. Acquisition and Ownership of Agricultural Land	18
3.5. Purposes of Agricultural Land Use	19
3.6. Access to Agricultural Land	21
Chapter 4 People's Perceptions about Livelihoods and Land and Forest Use	22
4.1 Perception about Participation in Decisions on Land and Forest Uses	22
4.2 Perception about Participation in Group Activities	24
4.3 Perception About Forests and Forest Resource Use	25
4.4. Perception About Values of Forest and Forest Resources	27
4.5. Perception About Livelihoods	28
4.6. Perception about Quality of Life	31
4.7. Alternative Livelihood Options	32
Chapter 5 Drivers of Deforestation and Forest Degradation	35
5.1. Socio-economic Situations	35
5.2. Land Use	35
5.3. Perceptions about Collective Actions, Forest Resources and Livelihoods	36
5.4. Potential Drivers of Deforestation and Forest Degradation	37
5.4.1. Shifting cultivation/livelihood options	37
5.4.2. Demographic changes	38
5.4.3. Market forces	39

Chapter 6 Conclusions	41
APPENDIXES	46

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Chapter 1 Scope of the Survey

1.1. Background

This study is part of the efforts of Japan International Cooperation Agency (JICA) to validate and register “Project on REDD+ through Participatory Land and Forest Management for Avoiding Deforestation in Lao PDR.

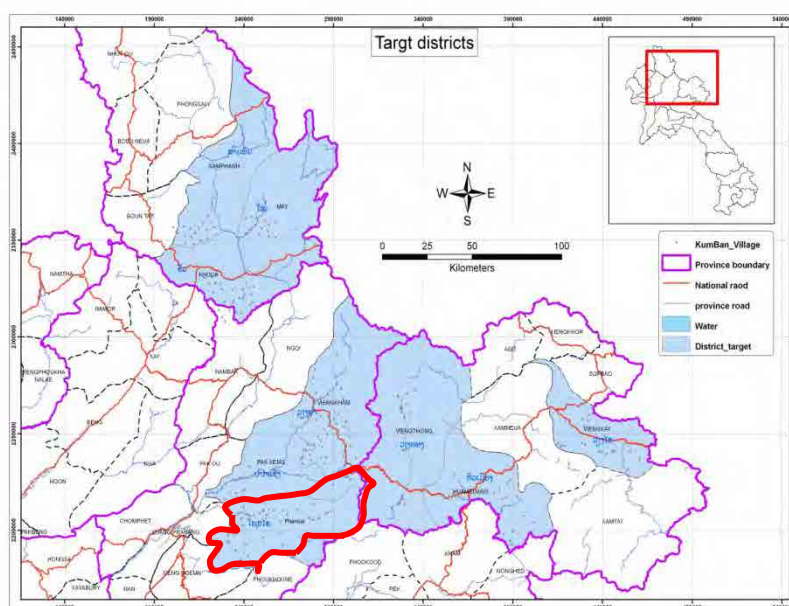
Lao People’s Democratic Republic (Lao PDR) established a REDD taskforce in 2008 under the assistance of JICA and other organizations to initiate an approach to addressing potential and technical challenges towards implementing REDD+ (or Reducing Emissions from Deforestation and Forest Degradation Plus). REDD+, if effectively implemented in Lao PDR, it is expected not only to work as a global warming mitigation scheme but also to contribute to establishing a forest management system in the country’s villages, and eventually to reducing poverty and conserving environment on a global scale.

To promote REDD+, JICA has been conducting a project called “Participatory Land and Forest Management Project for Reducing Deforestation” or “PAREDD” since 2009 and the Validation and Registration of REDD+ Project (called PAREDD+) is to have the Houay Khing Village Cluster (called “*kumban*” in Lao language) in Phonxay district of Lao PDR’s Luang Prabang province validated and registered as a target area of the REDD+ project.¹

The field surveys of PAREDD+ has just began in February 2012 and social-economic surveys in five villages of Houay Khing village cluster, and around five villages of Sop Chia village cluster as a Reference Area are to be implemented by an independent Subcontractor, Mitsubishi UFJ Research & Consulting (herein after referred to as “MURC”) appointed by JICA, in tandem with a local partner, NewEra+, (herein after referred to as “Subcontractor”) to identify the drivers of deforestation and forest degradation and develop suitable REDD+ activities by the methods of

rural people participation. Furthermore, application for validation and registration as a REDD+ project will be prepared using data developed through the project.

Figure 1 Location of Phonxay Disatrick, Luang Prabang Province



Source: National Geographic Department

¹ Phonxay district is one of the 4 poorest districts in Luang Prabang province and one of the ten priority poorest districts in the whole country. It shares borders with Pakseng district in the north, Phoukhoun and Xieng Ngeun district, Viengthong (Huaphan province) and Phoukood (Xiengkuan province) in the east, Luang Prabang town and Pak Ou district in the west.

1.2. Objectives

The main objective of this survey is to conduct the socio-economic survey and analysis to contribute to the efforts in identifying drivers of deforestation and forest degradation, and developing suitable REDD+ activities of rural people participation.

1.3. Data and Methodology

The analysis presented in this report is based on primary data collected between October and December 2012 through a variety of methods. The secondary data, figures, and reports were collected and reviewed. Following a half-day orientation meeting organized at the district, the survey started from HK cluster of five target villages. Attending the orientation meeting were district officials from the agriculture and forestry, planning, commerce², the heads of Houay Khing (HK) and Sop Chia (SC) village clusters, target village chiefs and PAREDD project staff. The meeting also heard from the participants sharing the information about the socio-economic situation, problems, seasonal difficulties, and coping strategies of villagers.

The household interviews started by having an orientation meeting with the villagers and village authorities first³. The target and non-target household members were also present. This village-level meeting allowed the participating villagers to share their views about their seasonal livelihood patterns such as cropping, collecting forest products, and participating in other livelihood activities. The village's map of the natural resources and customary land use were also drawn, including the forest and land use activities that might suggest any indicative forest changes. The villagers also shared main challenges they were encountering and proposed alternative livelihoods believed to help eliminate slash and burn farming (See Annexes 1 and 2)

The surveys were conducted from 9 until 28 October 2012⁴. An additional survey was carried out between 4 and 24 December 2012 for the mapping of the agricultural plots of between 7 - 8 households in each of the target villages by using the GPS (Global Positioning System). Altogether, 359 plots of 77 households were GPS-mapped and recorded with the data including latitude, longitude and elevation or height above sea level. The satellite imagery will be evaluated by MURC's remote sensing team.

The household samples in HK cluster were the same samples used in the previous household survey conducted by PAREDD in early 2012. The selection criteria looked at the groups of ethnicity, gender, wealth ranking, etc. In consultation with MURC, the sample households in the Reference Area, or SC cluster, were selected from TABI's household data collected in July 2010, using the selection criteria similar to that of HK cluster. Five out of 8 villages in SC cluster were selected in consultation with MURC.

Agreed by MURC, three types of villages to be included in the study were one better-off village, two general or middle level and two poor villages⁵. This composition would help compare the pattern of the livelihoods and the way of living of the people in those three types of villages. The inclusion of the better-off village would be a reference for the middle and poor villages to learn from. The reference area villages are Hua Meuang as better-off, Phak Hok and Houay Si Yua as medium in terms of easy access when compared with the villages in Sop Chia cluster itself, and Tad Thong and

² The meeting was held on the 9th October 2012 and chaired by the District Governor of Phonxay. At the meeting a list of households to be interviewed was provided to each of the village chief to review and inform those households

³ The village meeting was led by three village cluster officers and facilitated by the survey team.

⁴ The survey began from the villages in Houay Khing Village Cluster first between 9 and 12 October 2012, and moved to Sop Chia Village Cluster from 13 until 28 October 2012. The Household Survey Questionnaire Form was designed by MURC and revised by the consultant in consultation with MURC.

⁵ Based on the email exchange titled "Sop Chia Survey" dated on the 20th October 2012".

Houay Dong as very poor. The village cluster head provided necessary information to select the villages. By the Lao definition, ranking better off, medium, or poor villages is done based on the access to roads, food security (mainly rice), access to electricity, education (e.g. access to school), access to health service facilities, revenue of the village, and number of poor HHs (that is more than 50% of total households). With such a definition, Phak Hok, Houay Si Yua, Tad Thong and Houay Dong are regarded as poor villages and this claim is also indicatively supported by a report of the National Committee for Rural Development and Poverty Reduction (2011)⁶.

Prior to the kickoff of the Household Survey, a Household Sample Questionnaires were tested at a village in Luang Prabang district. The household interview also included some female interviewees in each target village. Table 1 shows the household samples by clusters and villages.

Table 1 Sample Households in Houay Khing and Sop Chia Village Clusters

Village cluster	Village code	Village (economic status)	Total no. of households	No. of sample households (HH, % of total)	No. of female samples (HH)
1. Houay Khing	1-1	Houay Khing (medium)	220	41 (19%)	10
	1-2	Sa Kuan (poor)	123	36 (29%)	9
	1-3	Houay Ha (poor)	56	37 (66%)	10
	1-4	Houay Tho (poor)	58	38 (66%)	8
	1-5	Phak Bong (poor)	82	35 (44%)	10
2. Sop Chia	2-1	Pakhok (medium)	95	36 (42%)	9
	2-2	Hua Meuang (better-off)	83	35 (44%)	10
	2-3	Tad Thong (poor)	82	35 (47%)	9
	2-4	Houay Si Yua (medium)	93	38 (41%)	11
	2-5	Houay Dong (poor)	85	32 (34%)	16
TOTAL			977	363	102

Source: Survey team

⁶ National Committee for Rural Development and Poverty Reduction (2011). Review and Evaluation of Poverty and Development based on Decree No. 285/PM, reported by Provinces and Districts.

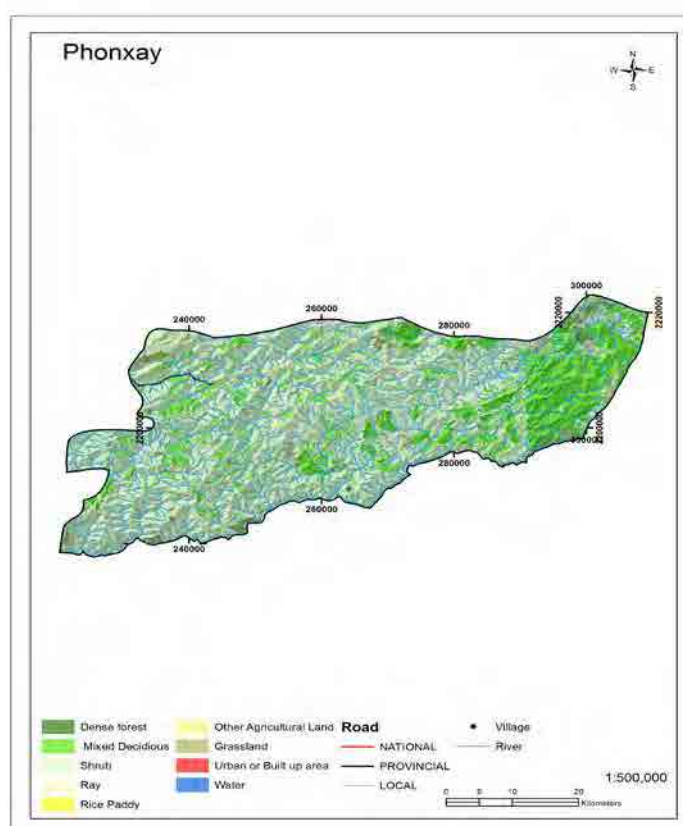
1.4. Study Area: Houay Khing and Sop Chia Village Clusters

1.4.1. Land and People

Houay Khing (HK) and Sop Chia (SC) village clusters share the borders with each other⁷. The combined total area of these clusters is 50,871 ha⁸, accounting for 20.15% of the total land area in the district and generally characterized by rough terrains owing to the presence of mountains.

HK cluster has a total land of 29,974 ha, of which 26,551 ha (89%) lies in the 5 target villages. Sop Chia village cluster has 20,896 ha, of which 16,166 ha (77%) belongs to another 5 target villages in SC cluster. Table 2 shows a breakdown of land types completed by the Phonxay District Land Management Office (2012)⁹. The land of the village clusters in question was classified into 8 types: (i) residential/housing area, (ii) forests, (iii) agriculture/production area, (iv) water, (v) public work, (vi) industrial area, (vii) cultural area and (viii) security area. In addition to the above-mentioned types of land, each village also has a “subtype” of lands or zones identified based on the village’s geographic characteristics. For instance, they allocate areas for grazing activities (e.g. grazing land) and the forest type can be further demarcated into production, conservation, and protection forests (Annexes 1 and 2).

Figure 2 Map of Phonxay District



Source: National Geographic Department

⁷ Phonxay district has 10 village clusters including 1 central village served as the district capital. They are Phon Thong, Ka Tang Sa Leung, Nam Bo, Jom Jiang, Don Kham, Houay Khing, Sop Chia, Tha Khamh, Neun Soung, and Ban Yai (district capital).

⁸ The breakdown of land areas by cluster and by village available from this report is sourced from the land management office of Phonxay District that was surveyed in the middle of 2012.

⁹ The land use planning survey was conducted between May and June 2012 covering all 61 villages in Phonxay district.

Table 2 Land Areas in Survey Areas by Village

No	Village Cluster	Type of Land (ha)					Total Area
		Residential / Housing	Forests	Agriculture / Production	Water	Others	
Houay Khing							
1-1	Ban Houay Khing	21	3,968	3,384	20	34	7,426
1-2	Ban Sa Kuan	8	1,722	2,332	15	38	4,115
1-3	Ban Houay Ha	4	3,362	4,128	-	3	7,498
1-4	Ban Houay Tho	8	936	1,779	-	9	2,732
1-5	Ban Phak Bong	3	1,620	3,146	-	12	4,781
Total (A)		44	11,608	14,768	35	96	26,551
Sop Chia							
2-1	Ban Phak Hok	7	1,797	1,763	-	20	3,586
2-2	Ban Hua Meuang	4	180	1,550	13	16	1,763
2-3	Ban Tad Thong	3	1,636	1,667	9	9	3,325
2-4	Ban Houay Si Yua	5	3,343	1,564	9	2	4,922
2-5	Ban Houay Dong	6	905	1,624	20	14	2,569
Total (B)		24	7,862	8,168	52	60	16,166
Total (A+B)		67	19,469	22,937	87	157	42,717
District Total Area		424	147,250	102,077	1,672	1,033	252,457

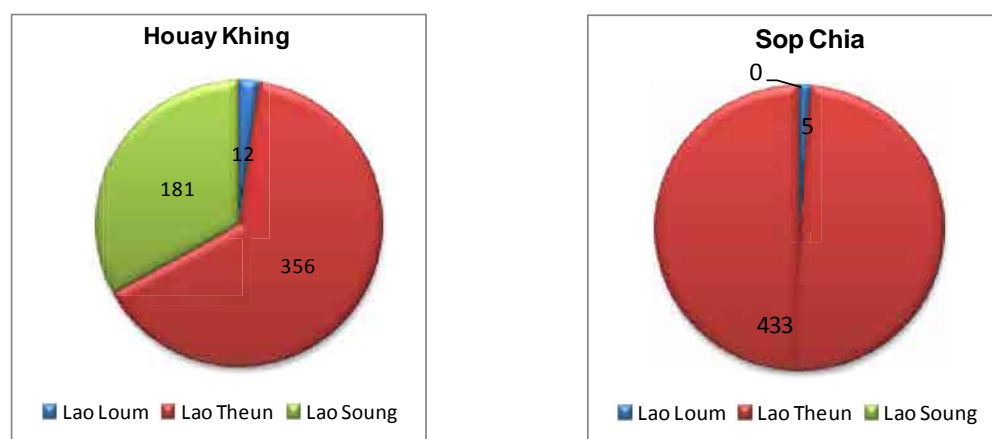
Source: Phonxay District Land Management Office, 2012.

At the time of the survey, the total population of the ten villages in the study area (five villages in each cluster of HK and SC) is 6,275 people (977 households), mostly Lao Theung (e.g. Khmu) and Lao Soung (e.g. Hmong). Lao Loum makes up the least proportion of the population in each village cluster. The majority of these people are engaged in subsistence upland agriculture usually associated with slash and burn farming and livestock as their supportive income generating activity.

In HK cluster, the total number of households in the five target villages is 539 (3,525 people). Khmu (Lao Theung) dominates the population in the HK cluster, which accounts for 65%, followed by Hmong (33%) and Lao Loum (2%) respectively. Following the government's policy on merging smaller villagers to larger ones, Ban Long Lath of HK cluster is subject to the mergence with other villages with better infrastructure and public service delivery. At the time of the survey, Long Lath had 42 households. It was reported that two clusters, namely Houay Khing and Phon Thong, would be new homes for Long Lath people. In HK cluster, Phak Bong and Houay Khing are targeted for the people to move in. However, discussions are ongoing as of this reporting.

In SC cluster, the total number of households in five target villages stands at 438 (2,677 people). SC cluster is dominated by Khmu population that accounts for 99% and the rest is Lao Loum. Figure 3 breaks down the population by ethnicity in 2 target clusters.

Figure 3 Number of Households in Target Village Clusters by Ethnicity



Source: Survey team

1.4.2. Livelihoods

The majority of the population is mainly engaged in upland rice farming (*khao hai* or *khao nuen soung*) usually associated with slash and burn activities. Cash-cropping and raising animals are the supportive activities. In general, people are dependent mainly to nature and forests for livelihoods. Figure 4 shows generic seasonal farming activities taking place at certain months in the two target clusters. As growing upland rice (*khao hai*) is widely observed in the areas, the villager also grow other crops such maize and cassava for animal feeds during the wet seasons.

Figure 4 Seasonal Farming in 2 Clusters

	Month											
System	1	2	3	4	5	6	7	8	9	10	11	12
Season	Dry Season				Wet Season						Dry Season	
Upland Farming		Slash, Burn, Fence, Hut			Plant					Harvest		
Rainfed Farming										Harvest		

Source: Survey team

Farmers normally start clearing bushes/land in February and leave bushes dried until March before burning and removing obstacles, making fence and huts. By late May farmers begin to plant rice and some other crops. The first weeding is in July, the second is in September (the gap only one month). It is said that three years swidden fallow is two times of weeding for one production cycle, if swidden fallow is shorter than three years, the weeding would be 4-5 times and also the production is lower, this could be one reason that some farmers are tempted to clear big bushes and trees which is considered illegal. The harvesting starts from October to December. Basically later December of the year is a rice or crop transportation season from *hai* fields or locally called “*sanam*” to the village. All work requires intensive labor forces which farmers always have to rely on labors exchange in order to complete work on time. If *sanam* is a 2-3 hour walk farmers stay for a certain period of time in order to save time of traveling.

The use of forest mainly associated with the collection of non-timber forest products (NTFPs) is seen year round depending on forest products. Forest products are an important source of income for rural people and also ensure food security. Usually farmers collect forest products from forests near their *sanam* with a distance between 1 and 3 hour walking. The common forest products are for instance broom grass or *khem* (February-April), mulberry bark or *posa* (May-June), bamboo shoots (June-September or during the rainy season), *dou deua* roots (July-October), bamboo worm or *mae* (September-October), *peuak meuak* bark (all year), wild edible leaves, and so forth. The collection season of these forest products have not changed but are reported declining due to population growth associated with people seeking for more farming land by practicing slash and burn cultivation (also refer to Annex 4).

1.4.3. Road Access and Wage-labor

Generally roads can be accessed during the dry season to all target villages but, in the rainy season, can be extremely difficult or impossible to travel. This is instanced by Sa Kuan, Houay Ha, Houay Tho, Tad Thong and Houay Dong. Located on the main road, Ban Houay Khing is better equipped with health center, school (including the primary and secondary levels), gravity-fed water system (*nam lin*) and so forth, and also considered as the central entry to and the largest village of HK cluster in terms of the number of population, accounting for nearly 40% of the total population in 5 target villages. Sop Chia cluster, located closer to the district center, relies on public facilities available from the center. However, Houay Dong and Tat Thong with an 18-25 km distance from the district’s center are more vulnerable and can be accessed in the dry season only.

Waged labors are uncommon and hardly seen in rural areas. In most cases, villagers exchange labors for farming activities such as bush clearance, planting rice, weeding, harvesting and so forth. They also help each other to build houses, the host is supposed to take care of his or her helper with food and drink. As a new house style introduced and built with cement and roofed with tile or zinc materials in recent years, labor is traded and waged for work done. Waged labor tends to be increasing as such a new house style construction has been widely observed for the past recent years. As a result, local workers or contractors have emerged and the pay or wage is made in form of cash, rice, cattle, or poultry.

Chapter 2 Household Samples and Survey Results

2.1. Characteristics of Interviewed Households/Members

A total of 363 households in 10 villages of 2 clusters were interviewed, 187 in HK cluster and 176 SC cluster. Additionally 102 wives of the interviewed household heads were included for interviews, making a total of 464 people interviewed.

The majority of the ethnicity people in the two clusters are Khmu ranging from over 60% to almost 100% (as shown in Tables 3 and 4). Of 363, 283 were Khmu households (110 in HK and 173 in SC) followed by 75 Hmong and 5 Lao Loum. In other words, HK cluster is the Khmu-Hmong community whereas SC cluster is the Khmu-dominated community.

Table 3 Characteristics of Samples in Houay Khing Cluster

	Houay Khing	Sa Kuan	Houay Ha	Houay Tho	Phak Bong
No. of samples	41 of 220 HHs	36 of 123 HHs	37 of 56 HHs	38 of 58 HHs	35 of 82 HH
Gender	10 Female	9 Female	10 Female	8 Female	10 Female
Ethnicity	M35 : F16	M 25: F 20	M 28: F 19	M 27: F 19	M 22: F 23
Main agri. activity	L3 : K24 : H24	L0 : K34: H11	L0 : K10 :H37	L0 :K26 :H20	L0 :K45 :H0
Land ownership	Upland	Upland	Upland	Upland	Upland
	Lowland		Lowland		
	<i>samano theedin</i> is issued to individual households to certify their possession and use ¹⁰	<i>samano theedin</i> is issued to individual households to certify their possession and use	<i>samano theedin</i> is issued to individual households to certify their possession and use	<i>samano theedin</i> is issued to individual households to certify their possession and use	<i>samano theedin</i> is issued to individual households to certify their possession and use
Main source of income	Rice (upland / lowland)	Rice (upland)	Rice (upland / lowland)	Rice (upland)	Rice (upland)
	Livestock	Livestock	Livestock	Livestock	Livestock
Economic status	Medium	Poor	Medium	Medium	Poor
Resettlement	4 villages (Houay Khing, Paed, Houay Tha & Houay Saak)	3 villages (Somboun Noi, Sa Kuan Noi, & Sa Kuan Yai)	2 villages (Houay Ha & Long Euang)	2 villages (Houay Tho & Jom Bang)	Only Phak Bong

Source: Survey team

Table 4 Characteristics of Samples in Sop Chia Cluster

	Phak Hok	Hua Meuang	Tad Thong	Houay Si Yua	Houay Dong
No. of samples	36 of 93 HHs	35 of 83 HHs	35 of 82 HHs	38 of 93 HHs	32 of 85 HHs
Gender	9 Female	10 Female	9 Female	11 Female	16 Female
Ethnicity	M 34: F11	M35 : F 10	M34: F 10	M34 : F15	M32 : F16
Main agri. activity	L1 :K44 :H0	L1 :K44:H0	L2:K42:H0	L2:K47:H0	L0 :K 48:H0
Land ownership	Upland	Upland	Upland	Upland	Upland
	Lowland	Lowland	Lowland	Lowland	Lowland
	<i>samano theedin</i> is issued to individual households to certify their possession and use	<i>samano theedin</i> is issued to individual households to certify their possession and use	<i>samano theedin</i> is issued to individual households to certify their possession and use	<i>samano theedin</i> is issued to individual households to certify their possession and use	<i>samano theedin</i> is issued to individual households to certify their possession and use
Main source of income	Rice (upland)	Rice (upland)	Rice (upland / lowland)	Rice (upland)	Rice (upland / lowland)
	Livestock	Livestock	Livestock	Livestock	Livestock
Economic status	Poor ¹¹	Medium ¹²	Poor ¹³	Poor ¹⁴	Poor ¹⁵
Resettlement	2 villages (Houay Sooi & Phak Hok)	1 villages (Houay Meuang)	3 villages (Ban Phol, Tad Neua, & Tad Thong)	3 villages (Houay Si Yua, Houay Poo, Tad Thong)	2 villages (Houay Dong & Houay Kao)

Source: Survey team

¹⁰ A book is issued to individual households to certify that they possess and use the plots. This logbook is called *samano theedin* and not considered land titling.

¹¹ Poor economically but medium in terms of infrastructure

¹² Medium economically and infrastructure

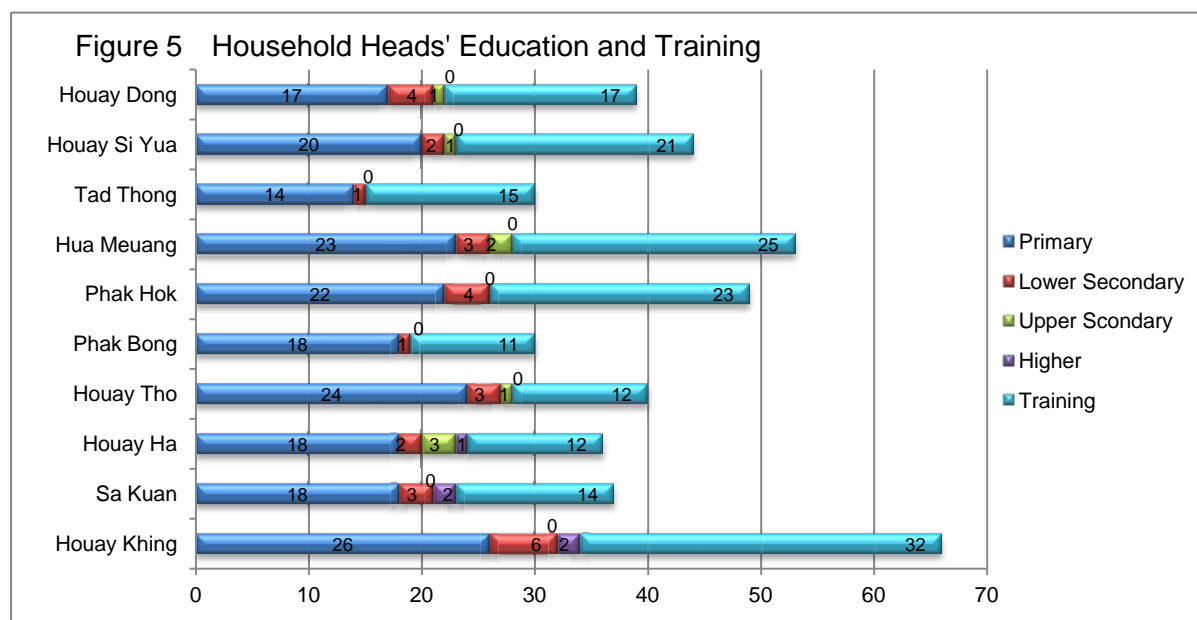
¹³ Poor economically and infrastructure

¹⁴ Poor economically but medium in terms of infrastructure

¹⁵ Poor economically and infrastructure

2.2. Education

130 of 187 households interviewed in HK cluster went to schools, mostly primary education level whereas 114 of 176 did in SC cluster (Figure 5). Roughly between 1% and 5% of the household head samples continued the secondary education level in both clusters. The training provision was also reported focusing more on improved techniques of cropping and raising livestock. Other trainings such as health, village management, and so forth were also reported.



Source: Survey team

Table 5 shows the labor structure, members under 15 years of age and members not living with the family. An average size of the household is about 7 persons in both clusters of which children under 15 years of age account for about a half. In every 133 working members there are 16-17 who left their own villages for reasons like studies, work, marriage, and so forth. The main reason the family members left the villages are studies, followed by work, marriage, and so forth respectively.

Table 5 Household Labor Force

Village	Family members	Female	Labor force	Children	Absentees
Houay Khing	294	144	163	124	22
Sa Kuan	255	127	122	117	9
Houay Ha	276	139	130	138	31
Houay Tho	260	125	130	118	20
Phak Bong	203	96	114	84	3
Total	1,288	631	659	581	85
%		0.49	0.51	0.45	0.07
Phak Hok	239	122	132	106	17
Hua Meuang	213	102	132	77	18
Tad Thong	222	113	125	94	17
Houay Si Yua	264	119	153	97	15
Houay Dong	218	106	123	89	13
Total	1,156	562	665	463	80
%		0.49	0.58	0.40	0.07
Grand Total	1,156	562	666	463	80

Source: Survey Team

2.3. Occupation

Table 6 shows the number of the sample households engaged in on-farm activities. The families living in the target villages are mainly engaged in subsistence upland farming associated with slash and burn practices. The similarity that both clusters share is that they have a majority of *saohai* or upland

farmers. In HK cluster, 86 % of 187 interviewed households are engaged in upland farming and another 5 %, all in Houay Khing village, are engaged in both upland farming and lowland rice farming. In SC cluster, 80 % of 176 households are engaged in upland rice farming only and another 14 %, mainly in Hua Meuang, Tad Thong and Houay Dong, are engaged in both upland and lowland rice farming. In other words, more than 90 % of interviewed households are engaged in some sorts of upland farming in both clusters. It should be noted that Lao farmers usually avoid economic risks by diversifying their income sources; therefore, many household heads are engaged in off-farm activities in addition to on-farm activities for additional incomes as discussed below.

Table 6 suggests that almost all upland and lowland paddy farmers grow crops on their own land. It was reported that farmers renting land were new members of the village where farming land is not available or if it is located too far and / or less fertile.

Those not engaged in on-farm activities at all are only 7 % in HK and 2 % in SC clusters.

The development or expansion of lowland paddy fields depends on water sources and necessary resources available to deliver water to the farming land. Compared with HK cluster, SC cluster has more water resources available from all the target villages. This creates enabling conditions or environments for developed and expanded lowland rice farming and farmers with lowland farms are able to grow rice in the dry season.

Table 6 Occupation (On-farm) of Household Heads

On-farm activities	HK (187 HH)		SC (176 HH)	
	HH	%	HH	%
<u>a) On-farm: lowland paddy only</u>				
Farming on own land	2	1	6	3
Farming on rented land	0	0	0	0
<u>b) On-farm: upland farming only</u>				
Farming on own land	160	86	140	80
Farming on rented land	2	1	2	1
<u>c) Both a)lowland and b)upland farming</u>				
Farming on own land	10	5	25	14
d) Not engaged in on-farm activities	13	7	3	2

Table 7 Occupation (off-farm) of Household Heads

Off-farm occupations (*multiple choice)	HK (187 HH)	SC (176 HH)
Civil servant/teachers/etc	7	11
Short-term waged labor	26	49
Self-employed business	9	17
Others	133	151

**Some households hold multiple occupations and thus made more than one choice.*

Source: Survey team

Apart from on-farm activities, the sample households are engaged in various off-farm activities or occupations. Table 7 summarizes all the off-farm activities the heads of sample households are engaged to earn incomes (some households hold multiple occupations). SC cluster is located closer to the district center and thus has better access to off-farm work opportunities available in town and even in Luang Prabang city. As a result, it has more households engaged in government work, wage labor, trading, and small shops than those in HK cluster. Those who chose “others” (i.e. 133 HH in HK cluster, 151 HH in SC cluster) mainly rely on forests for a living by collecting and selling forest resources. This suggests that the forests remain very important to rural those people.

2.4. Migration

The implementation of the government’s policy on transforming small villages into large ones was significant between 2001 and 2005. Among 363 sample households interviewed, 65% were not born in the village but migrated to settle down in their current villages with various reasons ranging from marriage, fleeing diseases outbreaks, seeking fertile land for agriculture to village relocation or merger. The most recorded reason is the merger of multiple villages in both clusters.

Table 8 summarizes the migration based on the interviews with sample household heads in both clusters. Of 238 migrants, 136 are in SC cluster, mostly Khmu, and 102 in HK cluster with the slightly higher number of Khmu than Hmong. Migration due to village relocation or merger ranks first in HK cluster, followed by the availability of agricultural land, access to better infrastructure (e.g. health service center, school, road, etc.), marriage and so forth. All the 5 villages in HK cluster witnessed the migration or population movement caused by

village relocation or merger. The target villages of SC cluster witnessed a significantly high number of migration due to village relocation or merger at 105 cases out of 136, and about 97% were Khmu.

Table 9 shows some of the villages which immigrating households moved from during the past decade. Not only did the two clusters experience the intra-cluster movement of people—merge of several villages into one, but also experienced the movement or migration of people from villages of other district(s) like Pak Seng.

Table 9 Villages from which immigrants came from

Village cluster	Current village	Villages that immigrants came from
Houay Khing	Houay Khing	(old) Houay Khing, Pak, Tha Phaa, Khok Hin
	Sa Kuan	Houay Pheung, (old) Sa Kuan (Pak Seng district), Sa Kuan Yai
	Houay Ha	Houay Ta Mang, Sa Kuan, Long Euang, Lang Kon (Pak Seng district), Mai Soung
	Houay Tho	Jom Piang, Sa Kuan
	Phak Bong	Houay Soi
Sop Chia	Phak Hok	Houay Soi, Mok La Hang, Mok Jong
	Hua Meuang	Mok La Hang
	Tad Thong	Long Euang, Tan Neua, Ngiew, Lang Kon (Pak Seng district)
	Houay Si Yua	(old) Houay Si Yua, Mok La Hang, Houay Phod
	Houay Dong	Houay Tao, Phak Xai, Houay Hoi, (old) Houay Dong, Jom Jiang

Table 8 Migration of Interviewed Households

Village	Ethnicity			Migrants	Reasons					
	K	H	L		VM	MG	OB	LA	AI	OT
Houay Khing	14	12	2	28	10	4	1	6	7	4
Sa Kuan	17	4	0	21	3	3	0	8	9	5
Houay Ha	6	15	0	21	11	4	0	3	3	2
Houay Tho	8	14	0	22	12	2	7	2	0	1
Phak Bong	10	0	0	10	6	2	0	0	0	2
Total	55	45	2	102	42	15	8	19	19	14
Phak Hok	25	0	1	26	16	5	0	0	3	2
Hua Meuang	13	0	1	14	3	6	0	0	0	6
Tad Thong	31	0	1	32	27	1	0	2	2	1
Houay Si Yua	32	0	1	33	32	0	0	0	0	1
Houay Dong	31	0	0	31	27	2	0	1	0	1
Total	132	0	4	136	105	14	0	3	5	11
Grand Total	187	45	6	238	147	29	8	22	24	25

Notes: K=Khmu, H=Hmong, Lao=Lao Loum, VM=village merger, MG=marriage

OB=outbreaks, LA=land availability, AI=access/infrastructure, OT=others

Source: Survey Team

Chapter 3 Agricultural Land Use

This chapter looks at the land use in Houay Khing (HK) and Sop Chia (SC) clusters by focusing on agricultural land¹⁶ of 363 sample households.

3.1. Historical Change in Land Size

The following figures (Figure 6 and 7) show the land use change in two clusters since 2003. Upland rice fields here include both upland fields planted with only rice and those with rice and other cash crops. “Others” include fallow land.

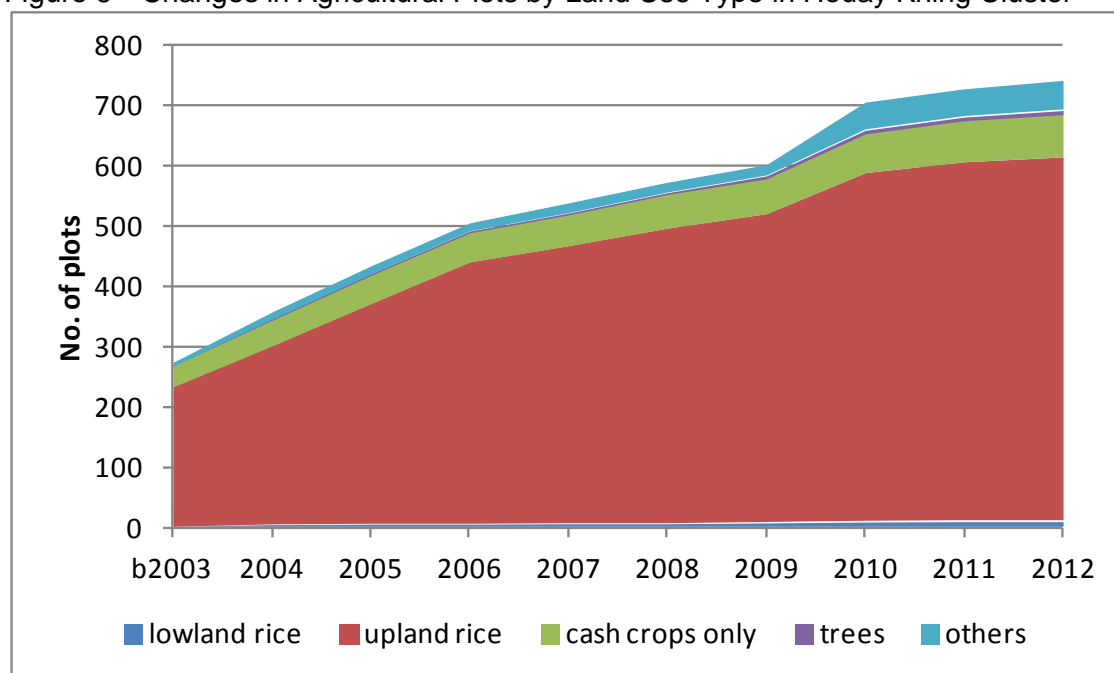
In both HK and SC clusters, upland rice fields have been on the constant rise since 2003 but the pace of increase varies. In HK cluster, the rate of increase is rather high up to 2006 and becomes moderate afterward. Instead, the cash-crops-only fields start to increase in 2006 onward. This increase in cash crop production may be due to the improvement of the road access to and from the district in 2005-2007.

On the other hand, SC cluster shows a high rate of increase in upland fields (rice and cash crops) up to 2008. The rate of increase in upland fields accelerated especially from 2004 to 2008. The rapid increase in upland fields in 2004-2008 can be explained partly by the newly settled village (Tad Thong) and partly by the improved road access. Another distinctive feature of SC cluster is that the cash-crops-only fields have not seen a significant increase yet unlike HK cluster. The difference may come from the fact that households in HK cluster grow cash crops in separate fields from upland rice fields, while households in SC cluster tend to grow cash crops on the same fields as upland rice (inter cropping with rice).

Another visible difference is that SC cluster has had more than 10 lowland rice fields in 2003 while there was none in HK cluster in 2003. The number of lowland rice fields has doubled in SC cluster since 2003 thanks to the availability of irrigation.

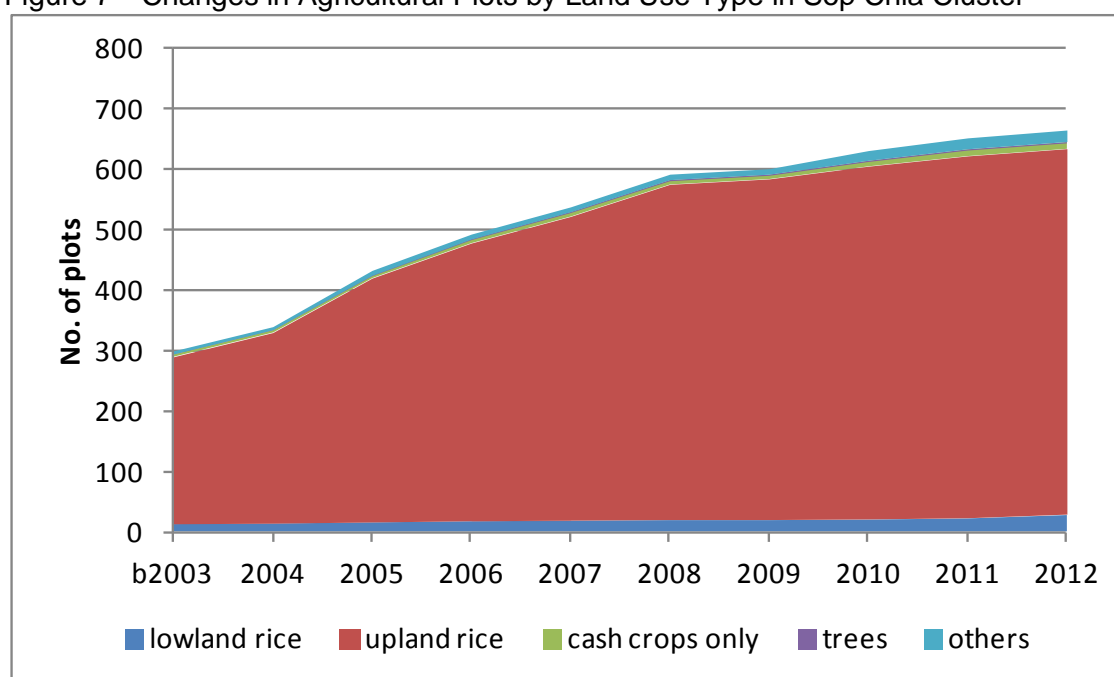
¹⁶ Agricultural land here includes all the lands used for various agricultural activities: upland agricultural land, lowland paddy fields, crop fields and fruit orchards (*Suan* in Lao), livestock grazing land. Upland agricultural land can be either an active production area or a fallow land depending on the stage of rotations of shifting cultivation.

Figure 6 Changes in Agricultural Plots by Land Use Type in Houay Khing Cluster



Source: Survey team

Figure 7 Changes in Agricultural Plots by Land Use Type in Sop Chia Cluster



Source: Survey team

3.2. Land Size

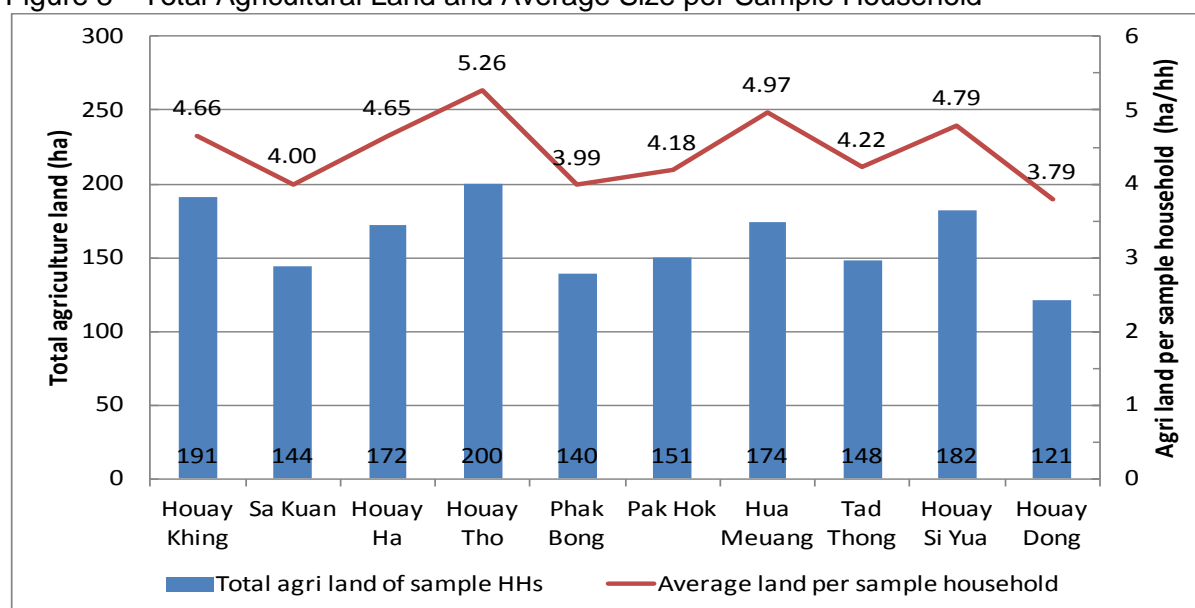
The total number of agricultural plots of 363 sample households was 1,399 (1,622.4 ha), 734 plots (846.6 ha) in HK cluster and 665 plots (775.8 ha) in SC cluster. Out of 363 households, 3 households (2 in Sa Kuan and 1 in Tad Thong) do not have their own agricultural land.

Out of 1,399 agricultural plots, 1,350 plots (705 in HK, 645 in SC) are used for certain agricultural activities at the time of the surveys while 49 plots (29 in HK, 20 in SC) are unused.

Figure 8 shows the total size of agricultural land of 363 sample households, both used and unused, and the average agricultural land per household in each village.

The total size of agricultural land ranges from 121 ha in Houay Dong to 200 ha in Houay Tho. The average size of agricultural land per household is 4.53 ha in HK cluster and 4.41 ha in SC cluster—no major difference between the two clusters. Looking at the average size by village, however, there are major differences. Hoauy Dong and Phak Bong have less than 4 ha of agricultural land per household, while Houay Tho has over 5 ha and the rest have more than 4 ha of agricultural land per household.

Figure 8 Total Agricultural Land and Average Size per Sample Household

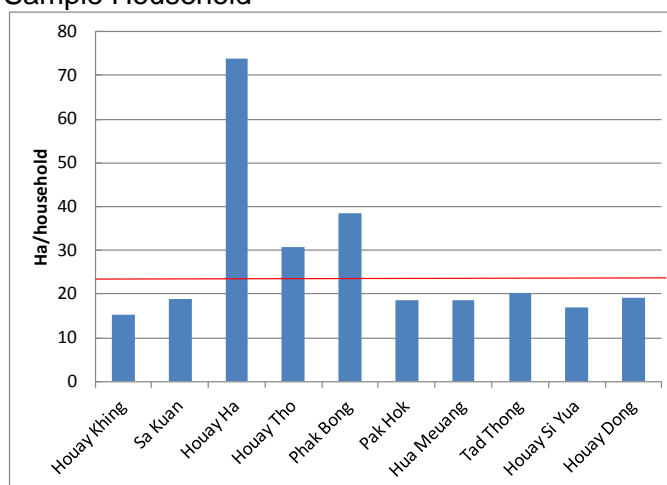


Source: Survey team

To compare the average agricultural land actually used and the availability of agricultural land in each village, Figure 9 shows the average agricultural land available to each of the whole households in each village (possible agricultural land per household, calculated by dividing the *total* agricultural land of the village by the *total* number of households). According to the survey results (Figure 6), Hoauy Dong and Phak Bong have the smallest agricultural land per household among the ten villages, with less than 4 ha. In terms of availability, however, Hoauy Dong and Phak Bong could provide relatively large agricultural land to each household. Therefore, it can be said that the small land size of two villages are not defined solely by land availability but there are other factors such as availability of labor force and type of main income sources (upland/lowland farming, livestock).

As mentioned earlier, there is no major difference in the average size of agricultural land per household between the two clusters. However, the

Figure 9 Average Possible Agricultural Land per Sample Household



*The red line indicates the average of the ten villages (27 ha/HH).

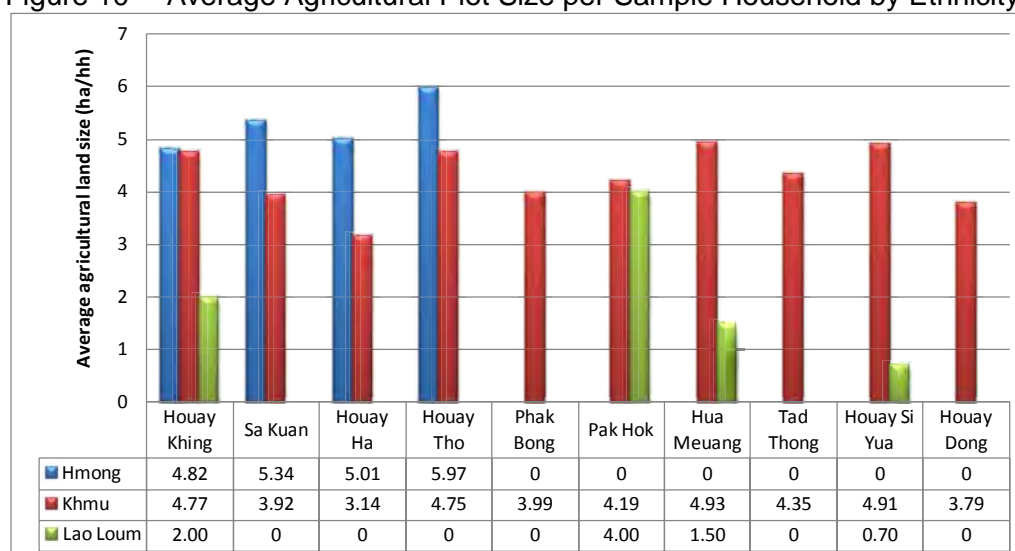
Source: Survey team

average sizes by ethnic group show a different picture (Figure 10). Overall, Hmong households tend to have larger agricultural land per household (5.28 ha/household) compared to Khmu (4.27 ha/household) and Lao Loum (2.05 ha/household), reflecting a larger family size of Hmong households and implying a larger impact on land.

In Houay Tho and Houay Khing, both Hmong and Khmu households have more than 4 ha of agricultural land per household, while Sa Kuan and Houay Ha present a significant difference in agricultural land size between Hmong and Khmu. Sa Kuan and Houay Ha are originally a Hmong village where Khmu have moved in and settled in recent years. Apart from a smaller family size of Khmu, the late settlement of the Khmu group may explain why they tend to have smaller agricultural land in these two villages. On the contrary, Houay Tho is an opposite case where Hmong have moved into an originally Khmu village in recent years but have larger agricultural land than the Khmu group. Average size of Hmong households in Houay Tho is 7.8 persons while that of Khmu is 5.8 persons, which may well explain the large difference in land size between Hmong and Khmu.

The sample size of Lao Loum households is too small to make general assessment, but in general Lao Loum has much smaller agricultural land in this area. This is partly because traditionally they are not used to upland farming and thus tend to engage in off-farm activities, and partly because their family size is relatively small.

Figure 10 Average Agricultural Plot Size per Sample Household by Ethnicity

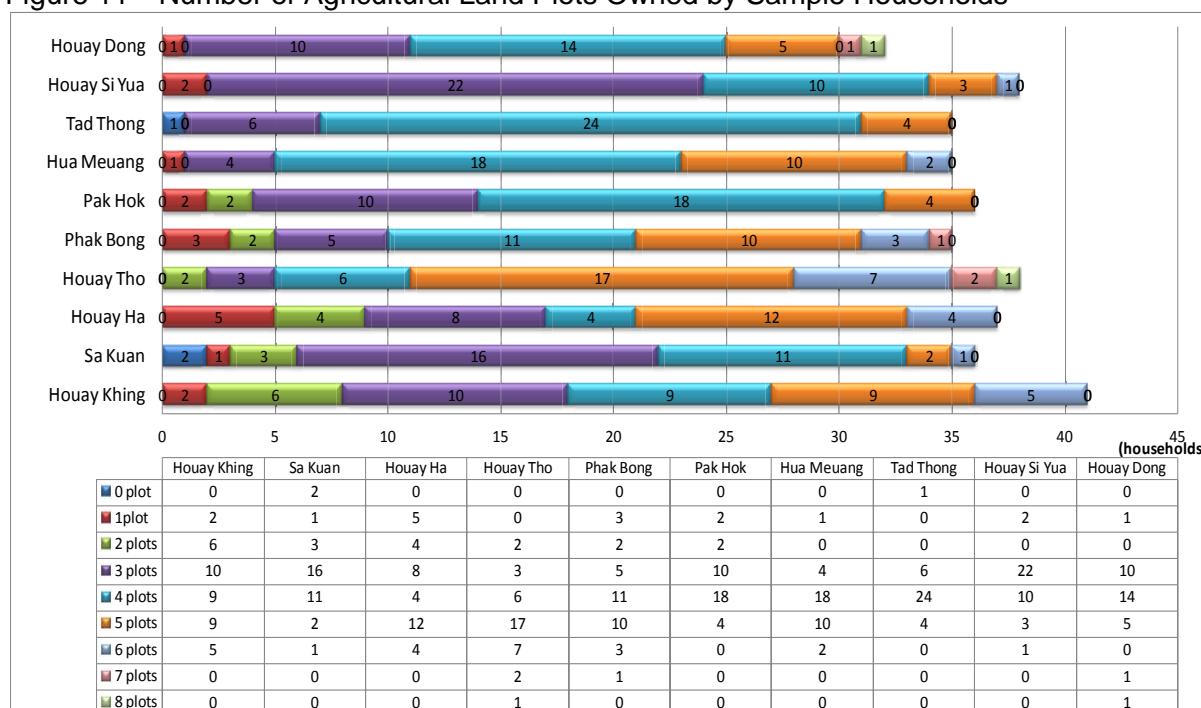


* In the table, 0 indicates that there is no household of the specific ethnicity in the village.

Source: Survey team

As mentioned earlier, the average size of agricultural land of the sample households is 4.53 ha in HK cluster and 4.41 ha in SC cluster. Farmers usually use several plots of land to grow different kinds of crops. Figure 11 summarizes the distribution of the sample households by the number of agricultural plots they have. Among the 363 sample households, there are three households that have no agricultural land and thus are not engaged in any agricultural activities. In Houay Tho, Hua Meuang, and Tad Thong, more than 80% of the households have 4 or more plots of agricultural land. In Houay Tho, in particular, 45% of the households have 5 plots and more than 25% have 6 or more plots. Then Phak Bong, Pak Hok and Houay Dong have more than 60% of households with 4 or more plots. On the other hand, in Sa Kuan and Houay Si Yua, more than 60% of households have only 3 or fewer plots of agricultural land. In Houay Khing and Houay Ha, about 20% of households have 2 or fewer plots.

Figure 11 Number of Agricultural Land Plots Owned by Sample Households



Source: Survey team

3.3. Rotational Periods of Upland Agricultural Plots

In order to protect the forests and improve land use, the government adopted the policy to stabilize shifting cultivation in 1989. Since then, various support has been provided, both by the government and the donor community, to villages across the country to stabilize shifting cultivation. One of such measures was to allocate some plots of land for each household (usually 3 plots but 3 or more for larger families) to cultivate in rotation of around three-years.

In February 2009, Ministry of Agriculture and Forestry issued a new definition of shifting cultivation (MAF Announcement No. 0034), which clarified the types of shifting cultivation and categorized it into two types: rotational and pioneering (opening new forests for agricultural land without rotating). It was made clear that only the pioneering type was banned, because it could destroy forest resources¹⁷. Given such policy measure, villagers across the country have been striving to shift their agricultural practices away from the pioneering type to more sedentary types of cultivation (rotational or fixed) in allocated plots of land. It should be noted, however, that in both HK and SC villages, agricultural plots have not been allocated officially to each household by the authorities; rather, the land use planning in both clusters only registered agricultural plots that have been used by each household in the past. In other words, it was not government-led “allocation” of agricultural plots to households but rather a “confirmation and recording” of current land use by each household.

Among 1,399 agricultural plots in the HK and SC clusters, 1,239 plots are used in rotation (*Moon Vien* in Lao), 22 are pioneering plots (*Leuan Loi*), and 138 are fixed/sedentary plots (*Thavon*). As mentioned above, the pioneering type of shifting cultivation is banned but since official land allocation has not been conducted yet in the area, there still are some plots used for the pioneering

¹⁷ Announcement of Minister of Agriculture and Forestry No. 0034 (February 4, 2009) on “Types and definition of shifting cultivation. “Rotational shifting cultivation” is called *Hai Moon Vien* in Lao and refers to the agricultural practice in which farmers produce rice and other crops by rotating three to five allocated plots of land. “Pioneering” type or *Hai Leuan Loi* refers to a practice in which farmers cut forests and open new land every year using environmentally destructive methods and mainly produce rice.

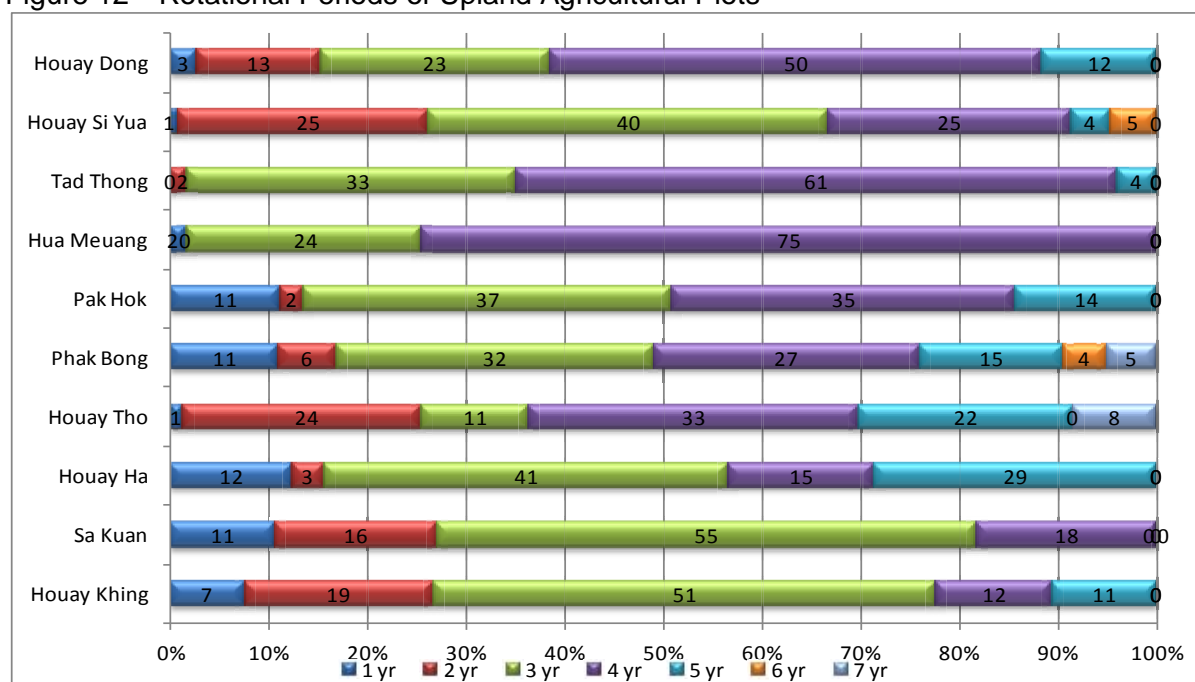
type. Among the 22 plots under pioneering cultivation, one half is in Houay Tho village and 3 plots are in Tad Thong village. Both villages are recently established when villagers re-settled from other areas (2005-2007); therefore, it is natural to assume that some newly settled villagers simply have no choice but open up new land for food production and these plots are counted as pioneering, rather than clear-cutting forests in a destructive manner.

Figure 12 shows the rotational periods of 1,243 plots used in rotations. The rotational periods are inevitably defined, more than any, by the total land size and the number of agricultural plots each household has, as shown in Figure 8 and Figure 11. Where majority of households have 4 or more plots such as Houay Tho, Hua Meuang, and Tad Thong, the average rotational periods are nearly 4 years (3.8, 3.7, 3.7 years respectively). It is worth mentioning that in Hua Meuang and Tad Thong, nearly all sample households rotate their agricultural plots in 4 year period or longer, thanks to the relatively large number of plots they have. Even in other villages such as Houay Ha, Phak Bong and Houay Dong, the rotational periods tend to be 4 years or longer.

On the other hand, the average rotational periods are 3 years or shorter in Houay Khing and Sa Kuan villages (3.0 and 2.8 years respectively). This is because the sample households in these villages have a relatively smaller number of plots (3 plots or fewer).

To sum up the results on land size and rotational periods (Figures 8, 11 and 12), the sample households in both Houay Tho and Hue Meuang have a relatively larger agricultural land (about 5 ha/household) and use them in a long rotation (nearly 4 years). On the other hand, Houay Dong and Phak Bong have a small agricultural land per household (less than 4 ha/household) which is divided into more than 4 plots, thus enabling the average rotation period of about 3.5 years despite the limited agricultural land. This is an ideal practice that can sustain soil fertility even in the face of limited land. Houay Khing and Houay Ha provide a relatively large agricultural land per household divided into a small number of plots, and thus households have to use it in a short rotation (3 year or shorter). This might have something to do with the fact that many of the households in these villages are Hmong, whose families tend to be big in size, requiring them to cultivate large plots to produce enough food each year. Although Houay Si Yua is not a Hmong village, it shows a similar tendency. As these villages tend to use agricultural land intensively in a short rotation, they can put pressure on land and decrease soil fertility unless proper land improvement measures are taken.

Figure 12 Rotational Periods of Upland Agricultural Plots



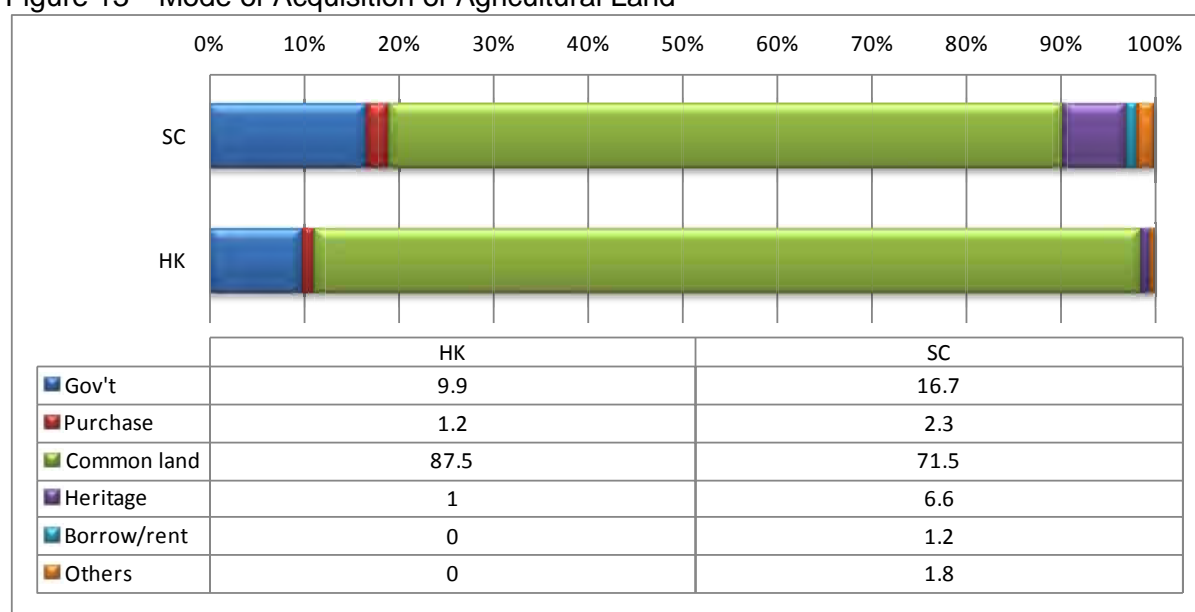
Source: Survey team

3.4. Acquisition and Ownership of Agricultural Land

In HK and SC clusters, land use planning has been done by the district authorities and land has been demarcated into forest areas, agricultural areas and residential areas and so forth. However, the agricultural areas have not been allocated to households for official land titling in these clusters yet. Rather, land ownership is *de facto*, or based on customs. Villagers claim the use right by clearing land, which is to be approved by the village authorities. During the land use planning, such *de facto* rights have been recorded by the land authorities and registered in a book called “*samano theedin*”. Official land titles have not been issued to those who use the land but with the registration they can claim their *de facto* ownership while they have the obligation to pay land taxes according to the size and type of the land.

Figure 13 summarizes the mode of acquisition of all the 1,399 agricultural plots in two clusters. Nearly 90% in HK cluster and 70% in SC cluster have been obtained by clearing common land and getting the use rights to those plots approved by the village authorities. 17% in SC and 10% in HK cluster have been given the land by the government at the time of their resettlement from other areas. In recent years, an increasing number of lands has been sold and bought among villagers. Such transactions are made more in SC cluster than in HK cluster. “Others” are the cases where land has been given by relatives for free.

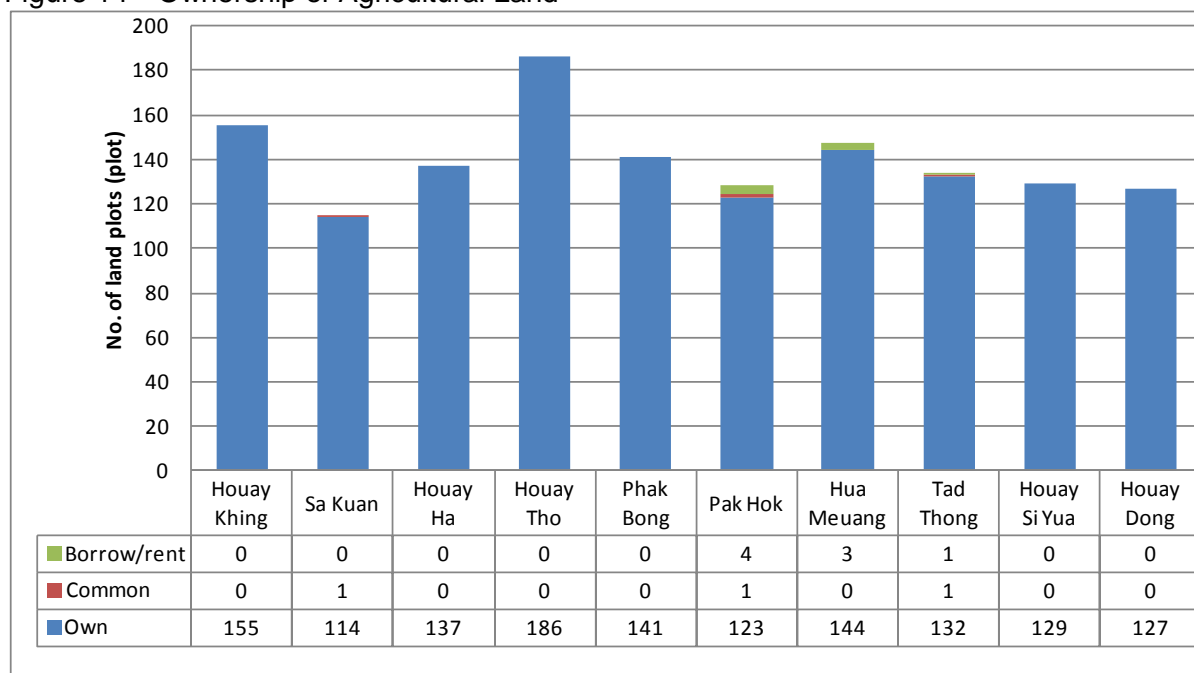
Figure 13 Mode of Acquisition of Agricultural Land



Source: Survey team

Looking at the ownership of 1,399 plots of land, almost all are “owned” by the interviewed households. As mentioned earlier, such ownership is not legally granted ownership; rather it is the ownership recorded and registered with the land authorities, which do not entail the issuance of land title documents. Common ownership here refers to a use right to common land, which is approved by the village authorities for a specific purpose and period. It does not belong to any villager and is to be returned to the village after a specific period. As mentioned earlier, 2 sample households in Sa Kuan and 1 household in Tad Thong do not own any agricultural land; they do not borrow any land and thus not included in the figure below.

Figure 14 Ownership of Agricultural Land



Source: Survey team

3.5. Purposes of Agricultural Land Use

Figure 15 shows the purposes of 1,399 agricultural plots used by the sample households. It highlights the heavy reliance of the villagers on upland rice farming in both clusters. Given the rapidly increasing cash crop farming in the northern part of Laos, it is rather surprising that the majority of farmers in the ten villages still grow only upland rice on most of their plots. This reflects the fact that the road access to and from those villages has been limited and thus such trend of cash crop farming has not influenced the areas as much as other areas with good road access.

However, the road access to the district center has improved in recent years, and so has the access to and from Vietnam. The impact of improved road access has started to show in some villages (Houay Tho, Phak Bong, and Hua Meuang) where about 20 % of the households grow cash crops (e.g. maize, cassava, and chili) and some industrial trees (oil trees, teak). Even among those growing cash crops, many grow maize and cassava for feeding their own livestock rather than selling at the market. With expected improvements to road access to the district center, the expansion of cash crop farming and livestock husbandry are expected and such changes are expected to affect the land use in the areas i.e. possible conversion of forests into agricultural land.

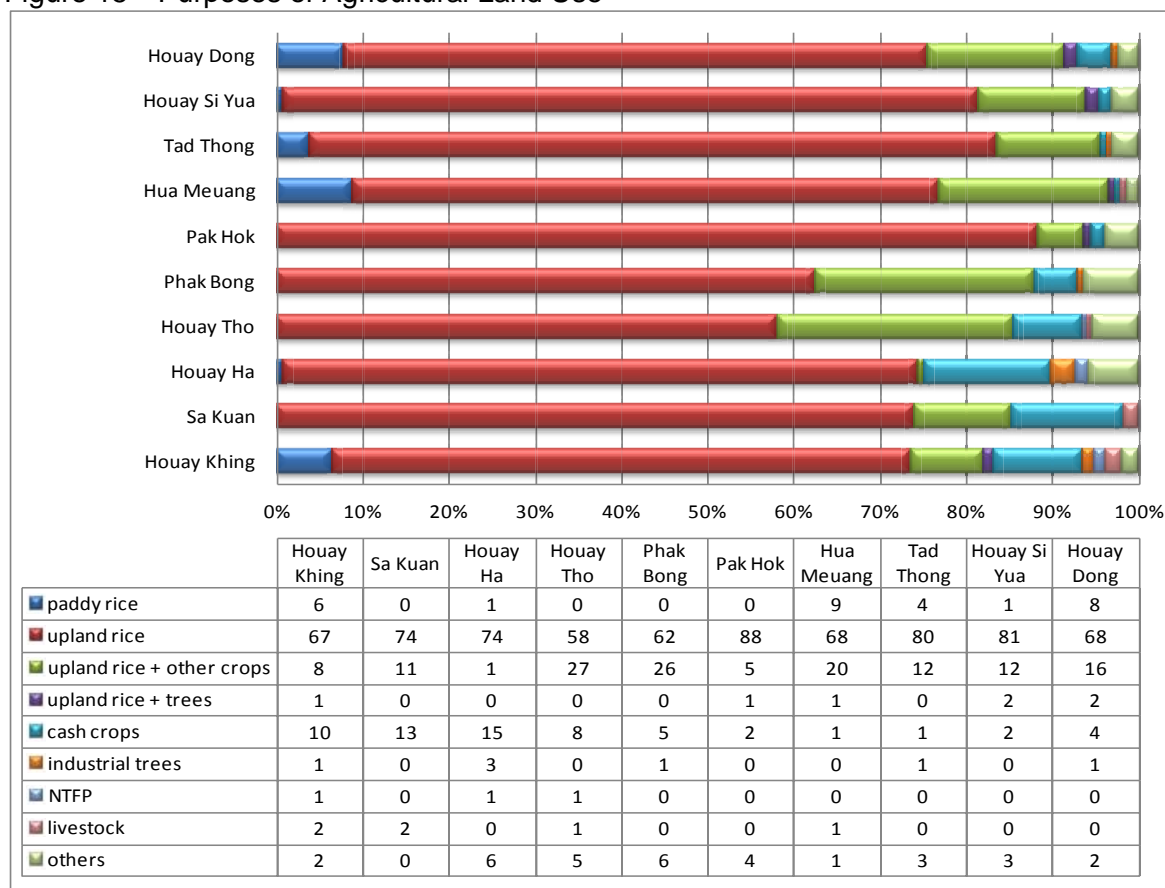
Another feature that is taking place in both clusters but not shown up in the survey result is the rapid expansion of industrial tree plantation. Although only a few sample households have industrial tree plantations, the village profiling reveals that industrial trees, especially *Jatropha* trees, are being promoted by the district authorities and an increasing number of industrial tree plantations are observed in both clusters. This is in line with the government policy to promote industrial tree plantations, which can contribute to both re-forestation and income generation for local communities. In reality, however, most plantations are not under any sort of purchase contracts and currently no market is assured. Therefore, it is not possible yet to conclude that industrial tree plantations are an effective land use in the area. But it is obvious that the government authorities should not only promote industrial tree plantations but also ensure the market for the trees so that those who have invested in the plantations will receive proper return on the investments.

Lowland paddy farming is observed only in 6 villages, 2 in HK cluster and 3 in SC cluster. Only Hua Meuang, Tad Thong and Houay Dong villages in SC cluster have irrigated lowland paddy fields besides rain-fed paddy fields. In HK cluster, an increasing number of lowland rice fields are developed, mainly by better-off households, but they are all rain-fed.

There are a few households that grow NTFPs in HK cluster. 2 households grow *Dou Deua* (a kind of devil's tongue) and 1 household grows broom grass.

Plots in the “Others” category are all fallow land, which is part of upland agriculture rotations and is to be used as agricultural land in coming years.

Figure 15 Purposes of Agricultural Land Use



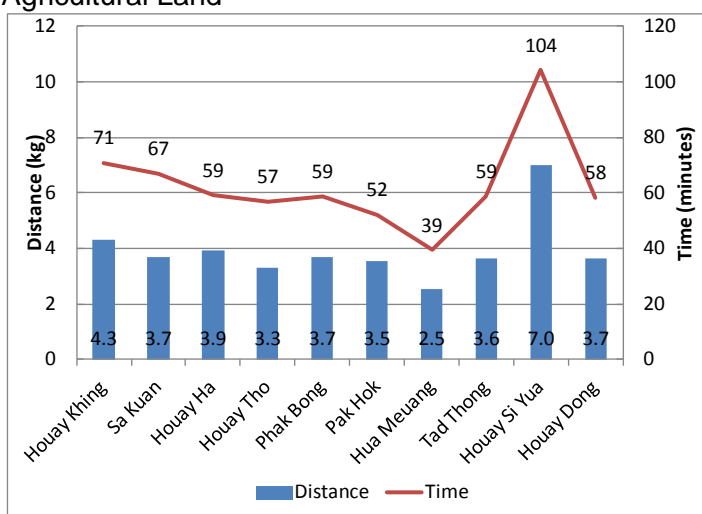
Source: Survey team

3.6. Access to Agricultural Land

The average distance from the village to sample households' agricultural plots is less than 4 km in all villages but Houay Khing and Houay Si Yua. In terms of time required to access their land, villagers in all villages but Hua Meuang have to travel at least one hour just to reach their land.

Houay Si Yua villagers have to travel an exceptionally long distance to their farming land because most of the villagers still cultivate agricultural land in old villages where they used to reside before resettling to the current village. This is partly because there is limited fertile land near the current village and partly because the farming land available nearby the current village is all taken making them to take the farming land located too far from their current village.

Figure 16 Distance and Time Required to Access Agricultural Land



Source: Survey team

Chapter 4 People's Perceptions about Livelihoods and Land and Forest Use

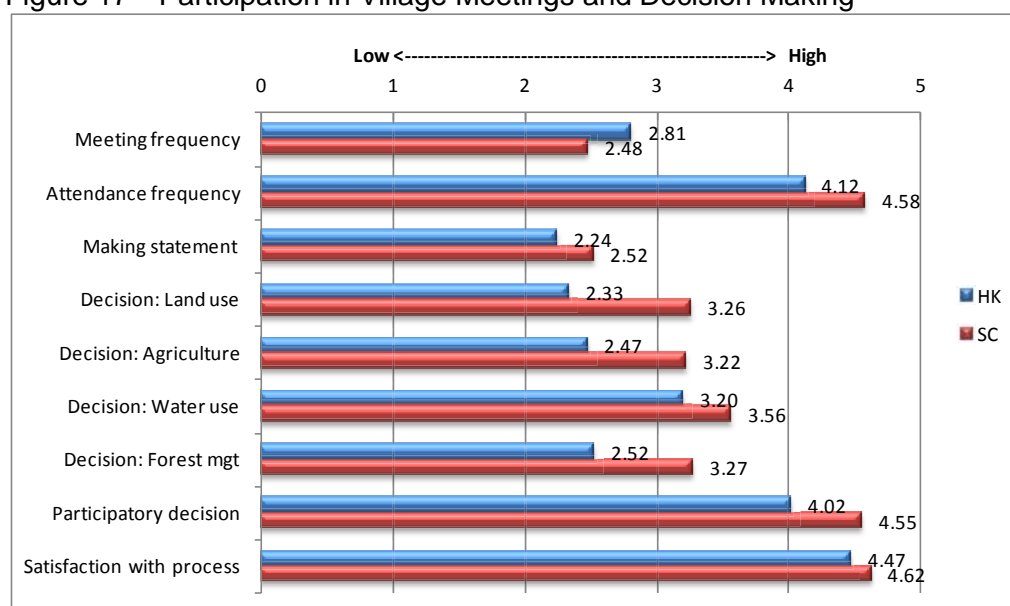
This chapter discusses the perceptions of the people about their livelihoods, resource use, especially land and forests as well as participation in group activities and their decision making based on the household surveys. The purpose is to assess the current level of participation in and capacities for collective action, which are important factors for managing common resources. Regarding people's resource use, the survey not only looked into their current resource use patterns but also their perceptions about the values of forests and forest resources, which help explain why people use or protect forests in certain patterns. The survey also looked into the level of satisfaction with their current livelihoods to assess the quality of life as perceived by villagers, and possible alternative options to improve livelihoods.

The samples (household and female samples) interviewed are the same as those used for the analysis of Chapters 2 and 3, and the total number of samples in two village clusters is 363 with 187 from HK cluster and 176 from SC cluster.

4.1 Perception about Participation in Decisions on Land and Forest Uses

Sample households were asked questions about level of people's participation in village meetings and decision making on important issues. Their responses were given in the scale of 1 to 5 with 5 being the highest unless otherwise noted.

Figure 17 Participation in Village Meetings and Decision Making



Source: Survey team

Figure 17 is the summary of the responses to those questions from sample households by cluster. Meeting frequency refers to the frequency of village meetings per month. Both clusters organize village meetings about twice per month on average.

Frequency of attendance at village meetings to discuss village regulations and activities is high in both clusters; however, if asked if they speak out at meetings, most households responded that they are not active participants and they do not speak out.

Village meetings are organized to discuss issues of importance to the community such as land use, agricultural production, water use and forest management. Asked if they have participated in village meetings to discuss such issues, sample households showed a high level of interest in issues on water use in both clusters, compared to other topics. This shows that water use is of the most importance to

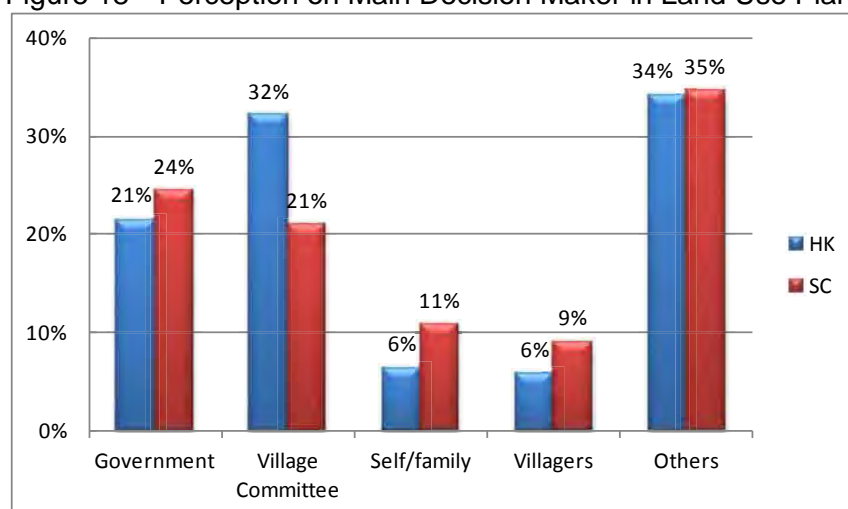
the community members. The issue of forest management was the second highest level of interest in both clusters, followed by agricultural production and land use. The survey results demonstrate that the community members do not have much interest in discussing land use and agricultural production as a common topic for the whole community. In general, however, SC cluster shows a higher interest in discussing these issues of community interest than HK cluster.

Sample households were then asked if it is necessary for all villagers to participate in the process of land use planning. Both clusters responded that participatory land use planning is essential; SC cluster showed a higher level of agreement to participatory process than HK cluster. This can be explained by the fact that land use planning was conducted in SC cluster several years earlier than in HK cluster, providing the villagers in SC cluster with the opportunity to gain experience in, and realize the importance of, participatory process in land use planning.

In order to confirm villagers' support for participatory land use planning, sample households were asked who should decide village land use plans for better land use in the future. Figure 18 shows their responses. Both clusters show a high level of support for decision making by multiple stakeholders, which is shown in "others" (34% in HK cluster, 35% in SC cluster), rather than decisions by a single actor. Among those who chose "others", a largest number favored the involvement of government authorities in land use planning through participatory process by Village Committee and villagers. It was followed by decision making by villagers with the support from Village Committee. A few households support joint decision making by Village Committee and government authority without participation of villagers.

It is worth mentioning that 32% of HK cluster's samples favor land use planning by Village Committee and 21% favor government authorities, meaning that more than half favors land use planning by village and government authorities. Only 6% responded that they want to decide land use either by themselves or by villagers' discussions. In SC cluster, the share of households favoring government and village authorities is slightly less. The households favoring decision by themselves in SC cluster is nearly twice those in HK cluster. A high tendency of HK cluster to reply on government and village authorities may be attributed to the fact that land use planning was conducted only recently in HK cluster and villagers do not have enough experience and confidence in making decisions on their own. Another reason is that HK cluster is more heterogeneous than SC cluster, which require a higher level of authority and support by Village Committee or government authorities in order to reach village consensus on important issues such as land use.

Figure 18 Perception on Main Decision Maker in Land Use Planning



Source: Survey team

4.2 Perception about Participation in Group Activities

Figure 19 summarizes the level of participation in villagers' group activities by activity type and their perceptions about the benefits of group activities.

Households in both clusters responded that the overall level of participation in group activities is high and their levels are almost the same (4.40 in HK, 4.43 in SC). Looking at activity type, however, the sample households in SC cluster enjoy a higher level of group activities in slash-

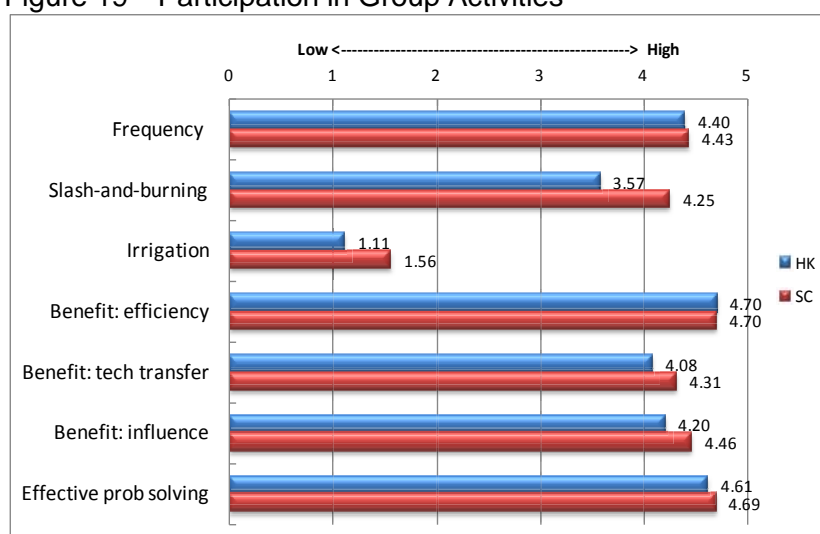
and-burning than in HK cluster. It is because there is still strong value of the community members to help other members when needed and this is regarded as labor exchange. On the other hand, the level of group activities in slash-and-burn in HK cluster is rather low because HK cluster has many villages with multiple ethnic groups and the cooperation among ethnic groups is limited. Participation in irrigation-related activities is low in both clusters because only Hua Meuang, Tad Thong and Houay Dong villages in SC cluster have irrigated lowland paddy fields besides rain-fed paddy fields. In HK cluster, an increasing number of lowland rice fields are developed but they are all rain-fed.

In order to identify the motivation for group activities and collective actions, the sample households were asked to rank various benefits of group activities: efficiency and technology transfer in agricultural production, enhanced influence in decision making, and effectiveness in problem solving. There is no significant difference in the responses from HK and SC clusters and both rated all the listed benefits high. This shows that villagers are actively participating in group activities not because they have to but because they are well aware of tangible benefits of collective actions.

Among them, efficiency in agricultural activities and effective problem solving are rated especially high in both clusters. High level of appreciation of efficient agricultural activities reflects the fact that most households in the survey area exchange labor force and cooperate in agricultural production. As main agricultural activities in the area, upland farming and livestock raising (especially large animals), require intensive labor, it is common for farmers to help each other by forming a production group or working with relatives to increase the efficiency of work. Technical transfer and mutual learning of production skills are rated slightly lower than production efficiency; this shows that farmers regard working in a group as an important occasion to learn production skills and knowledge given that the chance to receive official technical training is limited in the survey area.

Villagers also recognize the benefits of group activities in terms of enhanced influence in decision making and problem solving. These benefits can serve as an incentive for villagers, especially those disadvantaged (i.e. ethnic minority, women) to actively participate in village meetings and get their voice, which is rather difficult if done individually. Such an incentive is a key to ensuring participatory decision making in village development. The high level of appreciation of such benefits in both clusters indicates that both of them have seen relatively successful cases of participatory decision making and problem solving. It can further indicate that both clusters have a certain level of potential and capacities to promote collective actions such as land use planning and agricultural production groups.

Figure 19 Participation in Group Activities



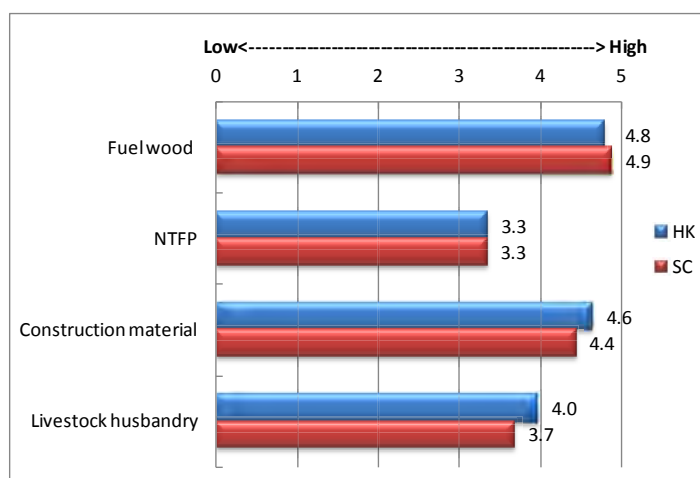
Source: Survey team

4.3 Perception About Forests and Forest Resource Use

Figure 20 summarizes the responses of sample households with regard to the frequency or intensity of forest use by purpose. It shows a similar tendency between HK and SC clusters; villagers use forest and forest resources mostly for obtaining fuelwood and construction materials. Fuel wood is a daily necessity in the area where gas is not the option for cooking or heating; therefore, it is rated highest in terms of the main purpose of forest use.

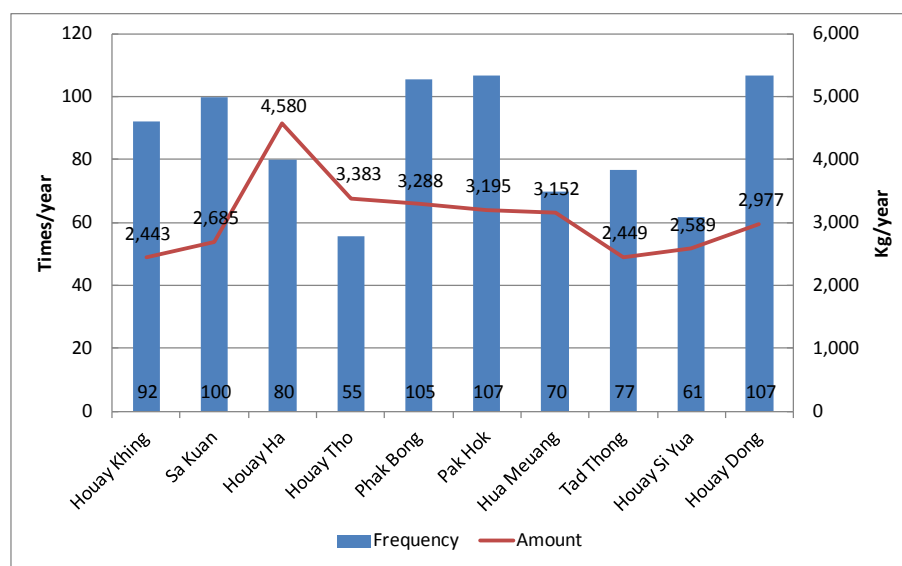
Looking at the detailed situations of fuel wood collection in each village (Figure 21), Houay Ha village uses the largest amount of fuel wood per year per household on average (4,580 kg/year/household), followed by Houay Tho, Phak Bong, Pak Hok and Hua Meuang. On the other hand, Houay Khing, Tad Thong and Houay Si Yua villages tend to use less fuel wood per year (less than 2,600 kg/year/household).

Figure 20 Frequency of Forest Use by Purpose



Source: Survey team

Figure 21 Frequency and Amount of Fuel Wood Collection Per Household



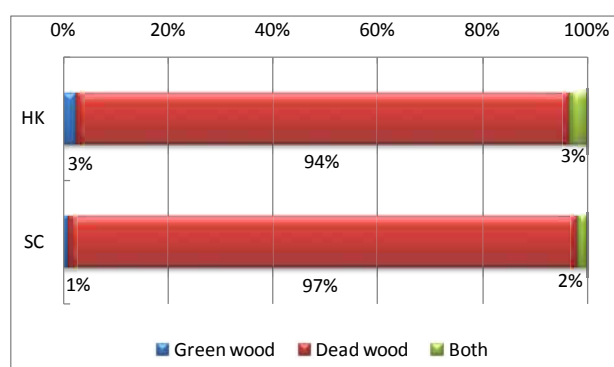
Source: Survey team

Almost all the households collect dead and dry wood and branches to be used as fuel wood (94% in HK, 97% in SC). Only 3% in HK and 1% in SC clusters collect green wood by cutting living trees (Figure 22).

In both clusters, about 60% of the households collect fuel wood in natural forest in common land areas. In HK cluster, 10% of the households collect fuel wood in plantation forests, while only 2% collect in plantations in SC cluster. More than 30% of households collect in the areas other than natural forest or plantations. In HK cluster, many collect in community forest areas which are allocated for villagers to use for various purposes. In SC cluster, on the other hand, villagers tend to collect fuel wood around their residential areas (Figure 23). In villages where regulations on forest use

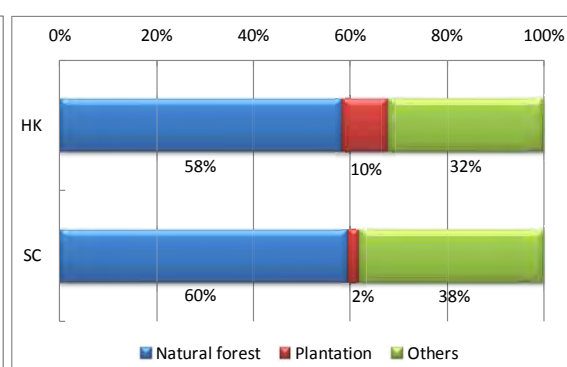
are established, villagers tend to follow the regulations and collect in production or use forests (e.g. Houay Khing, Tad Thong).

Figure 22 Type of Fuel wood



Source: Survey team

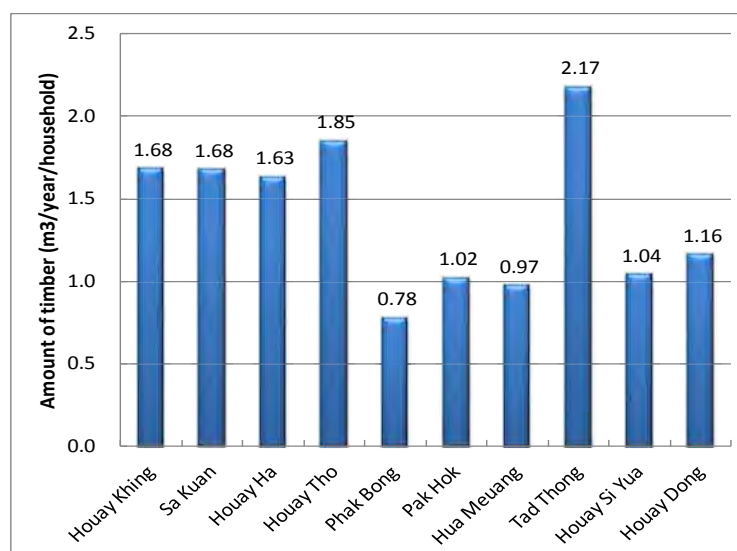
Figure 23 Location of Fuel Wood Collection



Source: Survey team

The pattern of timber use shows a different picture from that of fuelwood. Figure 24 shows households' responses to a question about the timber use. Households were asked how much timber on average they have collected and used in recent years. Villagers in Tad Thong village collected the largest amount of timber on average (2.17 m³/year/household), followed by Houay Tho. The amount collected by Tad Thong villagers is almost twice as much as other villages in SC cluster. The large amount of timber collection and use in Tad Thong and Houay Tho villages is explained by the fact that both villages were established in recent years and residents have used a relatively large amount of timber for construction of houses¹⁸. Other than Tad Thong and Houay Tho villages, villages in SC cluster tend to use much less timber than those in HK cluster.

Figure 24 Average Amount of Timber Collected Per Year



Source: Survey team

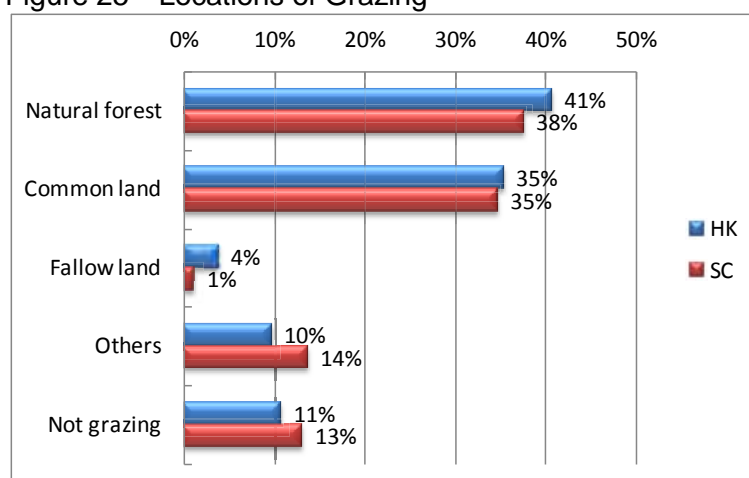
Most heavily used woods are hard wood (e.g. *mai doo*) and bamboo. There are many kinds of bamboo in the area and almost all sample households use them for various purposes in daily life. Industrial trees like teak wood are not commonly collected or used for their own use in the area.

Villagers use forests as grazing land as well. Around 40% of sample households in both clusters individually raise their livestock, mainly cow and buffalos, in natural forests. Another 35% of the households raise livestock in common land such as village's designated grazing area and common farming area (*sanam* in Lao) set up by groups of villagers. Animal husbandry in the area is free-range style but raising large animals in common land requires a watchman; therefore, villagers tend to form

¹⁸ Tad Thong was established in 2005 with 82 households, while Houay Tho was re-established with 52 households (Houay Tho was first established in 1978 but was burnt down in 1988). 29 out of 35 sample households in Tad Thong and 22 out of 38 sample households moved into the village after 2004.

a livestock raising group of their own and take turn at guard duty or put their livestock in herdsman's charge. Very few households raise livestock in their fallow land as it does not provide enough pasture grass (Figure 25).

Figure 25 Locations of Grazing



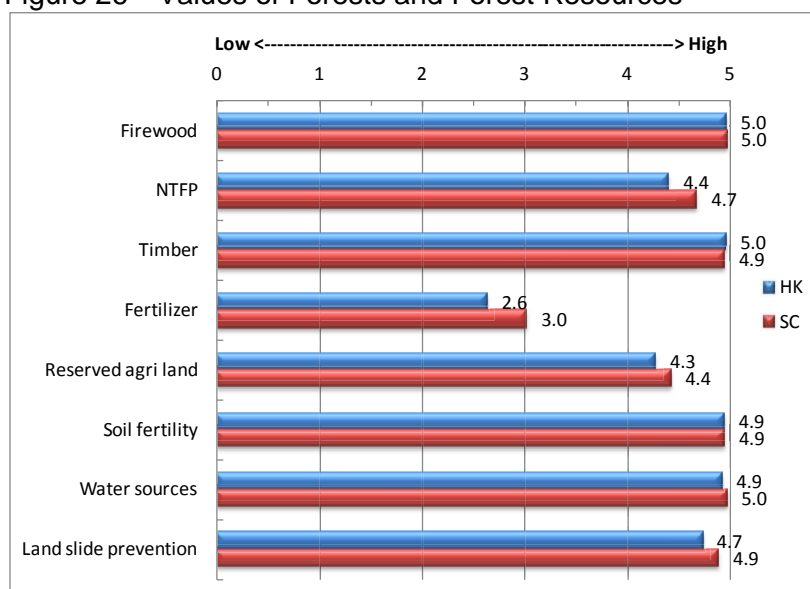
Source: Survey team

4.4. Perception About Values of Forest and Forest Resources

Figure 26 shows how much value the sample households place on forests and forest resources (e.g. firewood, NTFP, timber) and the services forests provide (e.g. water, soil fertility). Households in both clusters show a similar tendency. Almost all households place a high value on forests as a source of fuelwood and timber. Non-timber forest products are valued as well, but not as much as fuelwood or timber as the dependency on NTFP as food or a source of incomes varies from village to village. Households also recognize the importance of forests as a reserved agricultural land for future use. The survey results indicate that villagers value forests as they are, but at the same time they recognize forests as potential agricultural land. People in the area have practiced shifting cultivation for years; for them forest land is not permanent and can be transformed into agricultural land and then left to regenerate back to forests in the long term.

In terms of the services provided by forests, households in both clusters regard all the services, i.e. soil enrichment, water sources and land slide prevention, as highly important. From these results, it can be said that villagers are well aware of the importance of protecting the forests as forests provide them with both direct benefits (e.g. fuelwood, NTFP, timber) and indirect benefits (e.g. water, soil fertility, land slide prevention). Such awareness about the values forests and forest resources provide can serve as an incentive to use forests in a sustainable way.

Figure 26 Values of Forests and Forest Resources



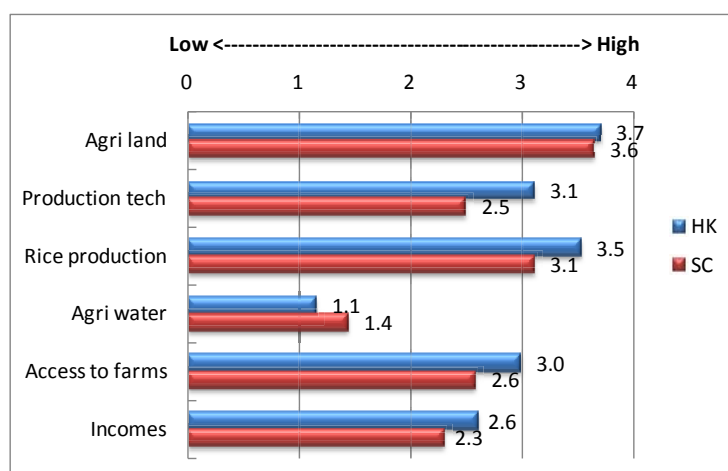
Source: Survey team

4.5. Perception About Livelihoods

In order to assess villagers' perception about their capacities for maintaining and improving livelihoods, the sample households were asked to rate the level of their asset (agricultural land¹⁹), farming skills (production techniques), food security (rice production), access to resources (agriculture water, agricultural land) and economy (incomes).

Rated more than 3 in both clusters were the size of agricultural land and the amount of rice production. This means that on average households tend to have enough agricultural land to cultivate, and they, especially those in HK cluster, are relatively food secure. The details are discussed below, which show some differences among villages. Production techniques, access to farm land, and incomes were rated 3 or less, indicating that households perceive they are at a moderate level on these three aspects and think they could be better. The difference between two clusters is relatively large in the rating of production techniques; households in HK cluster are more confident in farming skills as shown in Figure 27. Both clusters rated agriculture water just over 1, indicating a widespread problem of water shortage in agriculture.

Figure 27 Various Capabilities for Maintaining Livelihoods



Source: Survey team

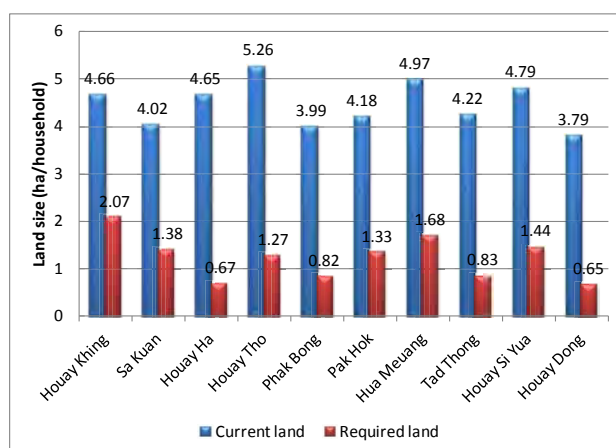
¹⁹ Agricultural land here includes all the lands used for various agricultural activities: upland farms, lowland paddy fields, crop fields and fruit orchards (*Suan* in Lao), livestock grazing land.

Figure 28 shows the average size of current agricultural land per household and the average size of additional agricultural land a household would need to improve livelihoods. As mentioned earlier, households in both clusters are relatively satisfied with the size of their agricultural land. Looking at the average size of current agricultural land per household, all villages enjoy more than 4 ha or just less than 4 ha of farming land per household. Houay Tho tops the list with more than 5 ha per household on average, followed by Hua Meuang (4.97 ha/household), Houy Si Yua (4.79 ha/household) and Houay Khing (4.66 ha/household).

On the other hand, in these villages, except for Houay Ha, households perceive that they would need a relatively large plot of additional agricultural land (1.4 – 2.1 ha/household) if they were to improve their livelihoods. It is important to note this result requires careful interpretation. During the surveys many households responded that they would want more agricultural land but did not have enough labor force to cultivate additional land; hence they gave a realistic answer i.e. no additional land. Therefore, the figures on required additional land might have been underestimated. Two points can be made here. One is that there is a pressure to expand agricultural land in all the villages in the survey area. The other is that labor force is a major factor affecting their land size and consequently production level; limited labor force in the area is keeping the pressure for land expansion under control. Despite existing large plot of more than 4 ha per household, required additional land is relatively large in Houay Khing, Hua Meuang, Houay Si Yua and Sa Kuan because they either have enough labor (e.g. Houay Khing, Sa Kuan), economic resources to hire additional labor (e.g. Hua Meuang), or enough surplus agricultural land and labor force (e.g. Houay Si Yua).

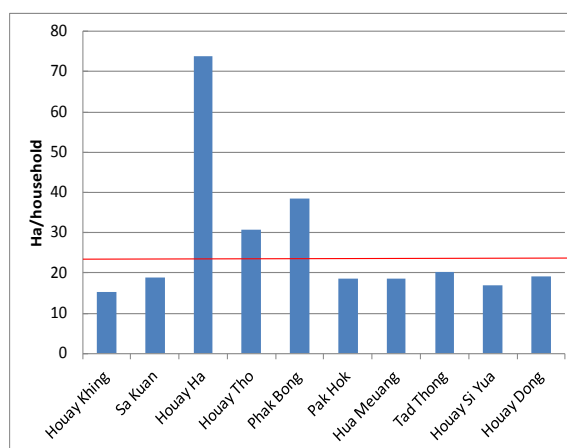
Figure 29 gives a rough picture of potential agricultural land size per household²⁰. Houay Ha has an exceptionally large agricultural land per household because it has the largest agricultural land (4,128 ha) for the smallest number of households in the area (56 households). Phak Bong also has a relatively large agricultural land (3,146 ha) for just over 80 households. Figure 29 implies that all the villages have enough potential agricultural land to support their population if the land is efficiently developed and used. On the other hand, some pressure on land exists in Houay Khing, Sa Kuan and Hua Meuang where agricultural area is relatively small for their population size; therefore, land use in these villages should be carefully monitored and managed so rampant expansion of agricultural land does not occur.

Figure 28 Current and Required Farming Land Size



Source: Survey team

Figure 29 Agricultural Land Potential

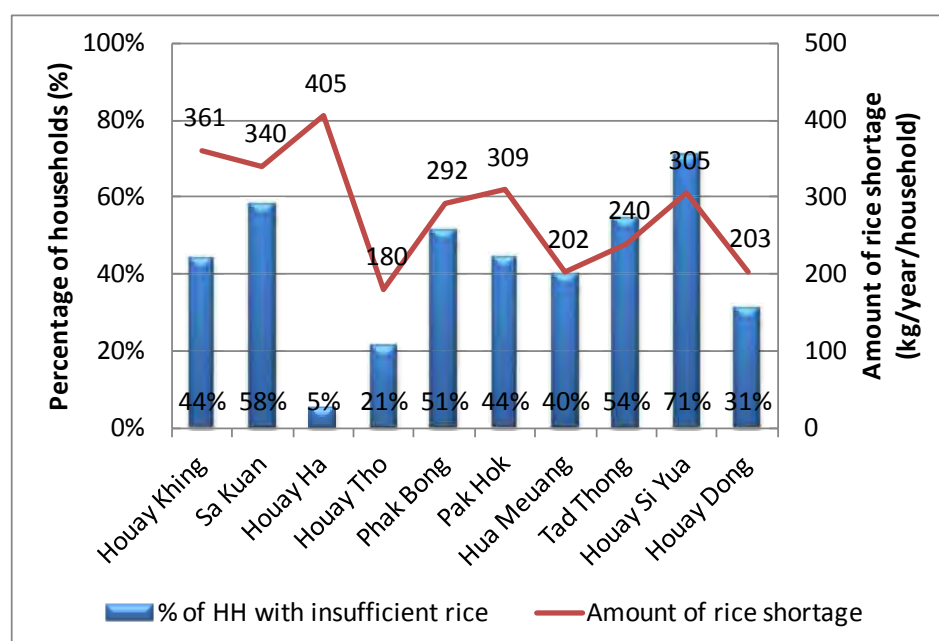


Source: Survey team based on the data from Phonxay District Land Management Authority

²⁰ It is calculated by dividing the total size of agricultural area (the data obtained from Phonxay District Land Management Office) by the number of households in each village.

As mentioned earlier, the households in both clusters rated the amount of rice production just over 3. However, looking at the situation in each village offers a different picture (Figure 30). In terms of the share of households suffering rice shortage, SC cluster tends to have a high rate ranging from 31 to 71 percent. HK cluster has a high rate in Sa Kuan, Phak Bong and Houay Khing, while the rate is very low in Houy Ha and Houay Tho. Houy Ha and Houay Tho share common characteristics of being a small village with a large Hmong population. Not only the small population to feed but also the strong sense of mutual help in production activities among Hmong kinship might be the important factor to help secure food security. It should be noted, however, that there are two households, or the poor, that lack a large amount of rice in Houay Ha. Besides Houay Ha, Houay Khing, Sa Kuan and Houay Si Yua suffer relatively severe rice shortage. This is why, in the earlier section, the households in these villages indicated that they would need a relatively large plot of additional agricultural land to secure enough food.

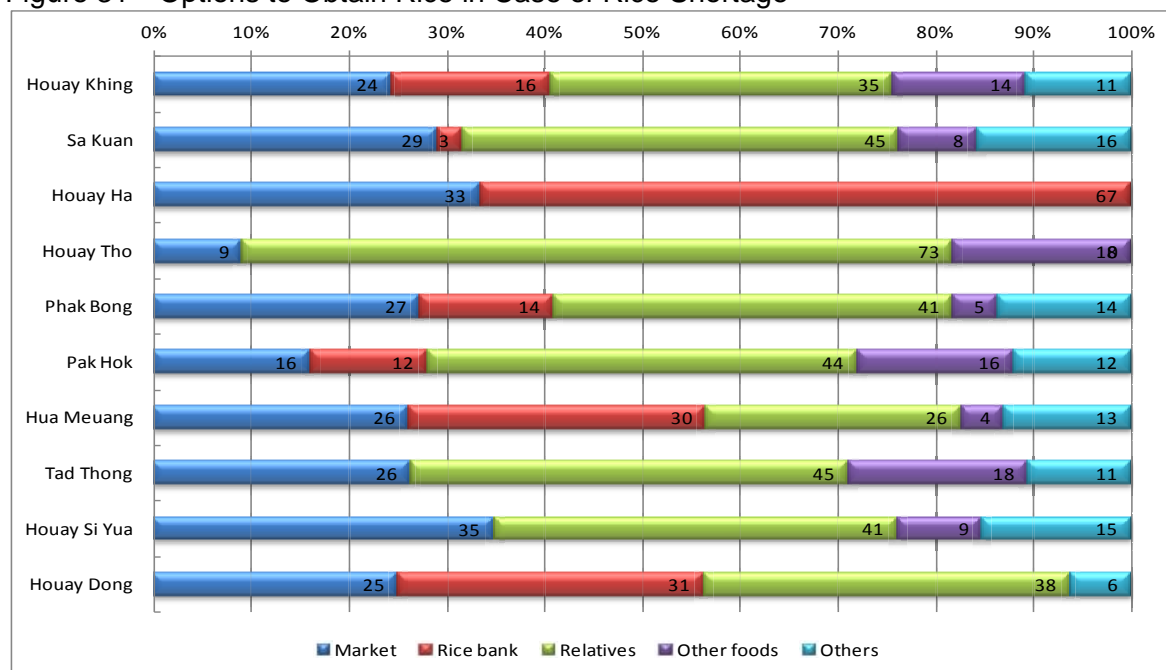
Figure 30 Households Suffering Rice Shortage and the Amount of Shortage



Source: Survey team

Figure 31 shows the responses of the sample households to the question about how they get rice in case of rice shortage. In all villages but Houay Ha, a large proportion of households reply on relatives for food. The rate is significantly high in Houay Tho with 71% partly due to the Hmong culture of mutual help as mentioned earlier and partly due to the lack of rice bank in this village. Nearly 30% of the households purchase rice from market in most villages. Seven out of ten target villages use some kind of the rice bank mechanism from which food-insecure households can borrow rice at interest to survive the period of rice shortage, usually from July to September. Another important survival option is to consume various NTFPs collected in their forest areas. Consumption of NTFP is significant in the villages where a rice bank does not exist (e.g. Houay Tho, Tad Thong); to put it in the other way around NTFP is not a popular option in the villages with a rice bank.

Figure 31 Options to Obtain Rice in Case of Rice Shortage



Source: Survey team

These results highlight the need for continued support for food production, especially to Houay Si Yua and Tad Thong in SC cluster and Sa Kuan and Phak Bong in HK cluster. As discussed earlier, limited labor is one of the main constraints in expanding production in the area; therefore, support for food production should focus on labor-saving techniques and more efficient use of land. In addition, support to a rice bank could offer an effective mechanism for food-insecure households, especially the poor, as a transitional measure.

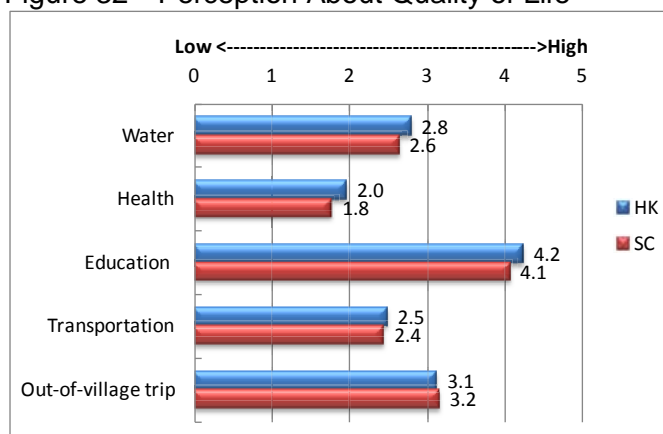
4.6. Perception about Quality of Life

To assess the quality of life of villagers, the sample households were asked whether they were satisfied with the conditions of life such as access to water, health services, education and transportation.

Both clusters show similar patterns of assessment on all aspects of life. Education is rated the highest at just over 4, followed by the frequency or easiness to travel outside the village at just over 3. Access to water and transportation were rated less than 3, indicating insufficient water supply systems and bad road access in the area. All the villages have a gravity-fed water supply system (*nam lin*)

but as the population increases the water supply is becoming increasingly insufficient to support the population. It is said that the changes in weather are also affecting the amount of water available year by year. Regarding the transportation, the road conditions are relatively good for those villages on the main road from the district center; other villages away from the main road have to use a narrow, dirt access road to their villages, which is accessible only during the dry season. Even the main road from the district center to the clusters can be inaccessible in the rainy season as it crosses two streams without a bridge over them. Once heavy rains cause an increase the water levels, the access to the

Figure 32 Perception About Quality of Life



Source: Survey team

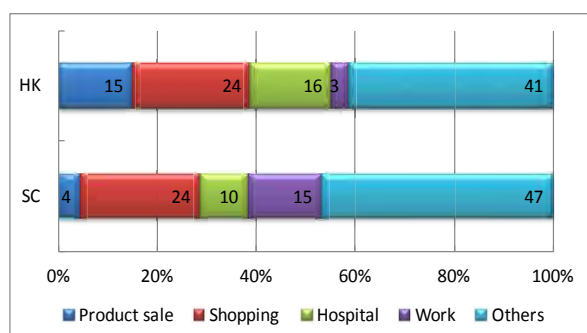
clusters from the district center is cut off. However, improvements in road conditions are expected as a segment from Sop Chia toward Hua Meuang village has been paved with the support from a JICA project in 2012 and the construction of a bridge over two streams is also underway with the support from the government.

Health services were rated the lowest at around 2, reflecting the fact that only Houay Khing village has a dispensary and there is no clinic in the area.

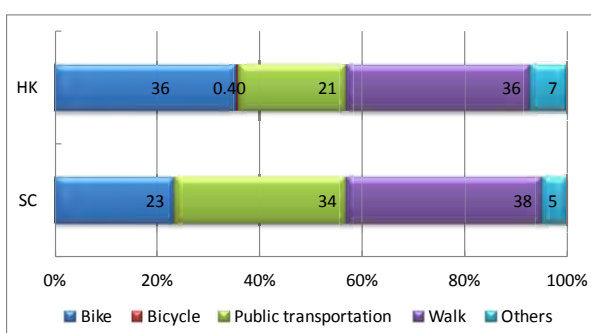
Figure 33 shows the purposes of travels to outside the village. More than 40% of the households in both clusters responded that they go out for the purposes other than selling their products, shopping or work. Many of them go out to visit their relatives and friends in other villages or the district center for various reasons. This kind of interactions with relatives and friends serves as a good opportunity for exchanging information about market prices and business opportunities. The second most cited response was shopping in the both clusters. The difference between the two clusters is that 15% of the households in HK cluster go out to see their products while the same percentage of households in SC cluster go out to other for work. This implies that more households are farmers in HK cluster while in SC cluster, which is closer to the district center, more households work as employers or traders.

Figure 34 shows the mode of transportation the households use when going outside the village. In HK cluster, 36% of the households go out on foot. Another 36% uses a motorbike, which is more than those that use public transportation (21%). In SC cluster, on the other hand, more households use public transportation (34%) than motorbike (23%) because it is closer to the district center and more public transportation is available than in HK cluster. In both clusters, almost no households use bicycle to go outside of the village.

Figure 33 Purposes of out-of-village Travels Figure 34 Mode of Travels



Source: Survey team



Source: Survey team

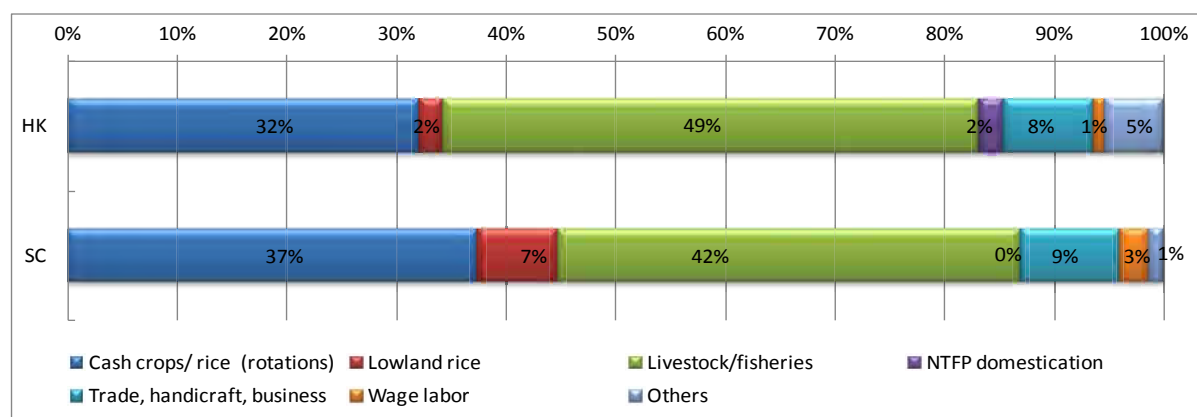
4.7. Alternative Livelihood Options

As mentioned earlier, the government adopted the policy to stabilize shifting cultivation in 1989 with the purpose of protecting the forests and improving land use. Since then, various support has been provided, both by the government and the donor community, to villages to stabilize shifting cultivation and create alternative livelihood options. Given such policy measure, villagers across the country have been striving to shift away from shifting cultivation to alternative livelihoods.

The sample households were asked what kind of alternative livelihoods they are interested in or they have already engaged in (Figure 35). In both clusters, more than 40% of households chose livestock raising (mainly animal husbandry, very few chose fisheries), while more than 30% chose cash crops or rice cultivation in upland areas. Given the lack of lowland paddy fields and irrigation in most villages in HK cluster, very few chose lowland rice cultivation. In SC cluster where three villages have some lowland fields, 7% of households chose lowland rice cultivation as an alternative livelihood option. 8 to 9% of households chose off-farm activities such as trading, handicraft and small-scale business. Only 1-3% chose wage labor as an alternative. NTFP domestication was chosen only in HK cluster where various NTFPs still play an important role in food security and livelihoods.

Livestock raising is a popular alternative not only because livestock is an important asset for villagers but also because Phonxay district specifically promotes livestock raising as a promising industry of the district. Recent improvement of road access to Vietnam and the rapidly increasing demand for meat in Vietnam are making livestock raising a highly promising business in Phonxay district, which has an access to Vietnam through Xiangkhouang province. It is reported that the purchase price of cattle for export to Vietnam is three times as high as that for domestic markets observed in Phonxai district²¹.

Figure 35 Alternative Livelihoods to Shifting Cultivation



Source: Survey team

In order to assess more in detail the perceptions of the sample households about the activities they raised as alternatives to shifting cultivation, they were asked to choose 5 activities that they think are most effective as alternatives to shifting cultivation and put the order of 1 to 5 with 1 being the highest (Figure 36 – 37). Upland farming was divided into two separate production activities: commercial crop cultivation and rotational farming; the latter includes both upland rice and commercial crop cultivation in a rotational manner.

In Houay Khing cluster, more than 90% chose livestock as either the first (53%), second (21%) or third (19%) most effective alternative to shifting cultivation. In fact, Phonxay district promotes livestock raising (especially cattle and goats) as the most suitable economic activity for the district since most parts of the district lie on high lands with cool climate. As livestock raising requires a relatively large amount of initial investment, only wealthy households can afford to raise cattle and buffalos whereas the poor can only afford small animals if any. Therefore, the government and the donor community are increasing their support for the activity.

Among the two production activities on upland, households think of commercial crop cultivation as much more effective than rotational farming. This reflects the fact that commercial crop cultivation is largely for income generation, while rotational farming is partly for self-consumption and partly for commercial sale. If households continue to produce rice for self-consumption, potential incomes from rotational farming are not as much as intensive production of commercial crops. Just over a half of households chose lowland rice farming as either the first (12%), second (22%) or third (18%) most effective alternative to shifting cultivation. In fact, farmers generally think lowland rice farming as one of the most effective alternatives. In reality, however, it is an alternative only for the households with suitable conditions (i.e. plain lowland, water). Therefore, lowland rice farming is considered as effective, but it is not a realistic alternative for most farmers in HK cluster.

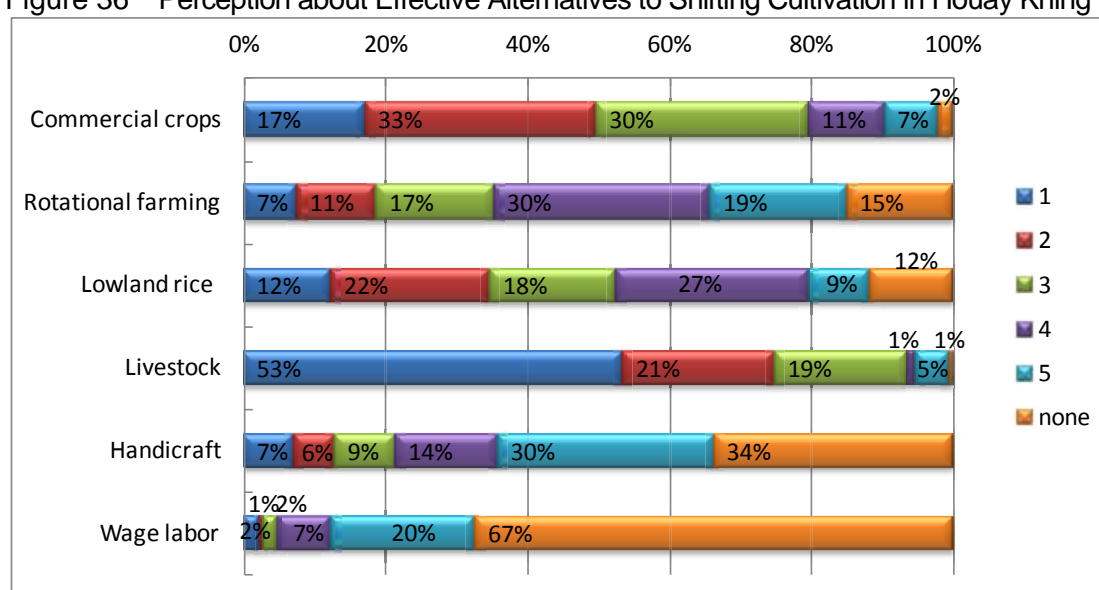
Sop Chia cluster shows very similar patterns. The only noticeable difference is that rotational farming is not regarded as an effective alternative as in SC cluster. This implies that farmers in SC cluster are

²¹ NUDP-TABI workshop in Phonxai District of Luang Prabang Province (September 4, 2012). According to Dr. Phouang Parisak, Vice Minister of Agriculture and Forestry, who co-chaired the workshop, the demand for cattle in Vietnam is about 150,000 heads per year, and the current annual supply from Laos (primarily Xiangkhouang Province) is only 10,000 heads; thus, there is still much room for expansion of cattle export.

engaged more in commercial-based agriculture than in HK cluster where farmers still continue to produce their own rice and food. This shows that commercial-based agriculture is starting to spread to SC cluster at an earlier stage than HK cluster as SC cluster is closer to the district and have a better access to various markets. However, the experience in other parts of northern Laos demonstrate that agricultural commercialization spreads very quickly to areas with good road access and thus it is expected SC cluster, and even HK cluster, will see the same trend once the current improvement of road access is complete. This has an implication that land use in both cluster might change to more fixed, intensive one as the commercialization of agriculture progresses, as demonstrated in other areas of northern Laos where agricultural commercialization drastically changed land use, and in some cases, led to rapid deforestation due to land conversion.

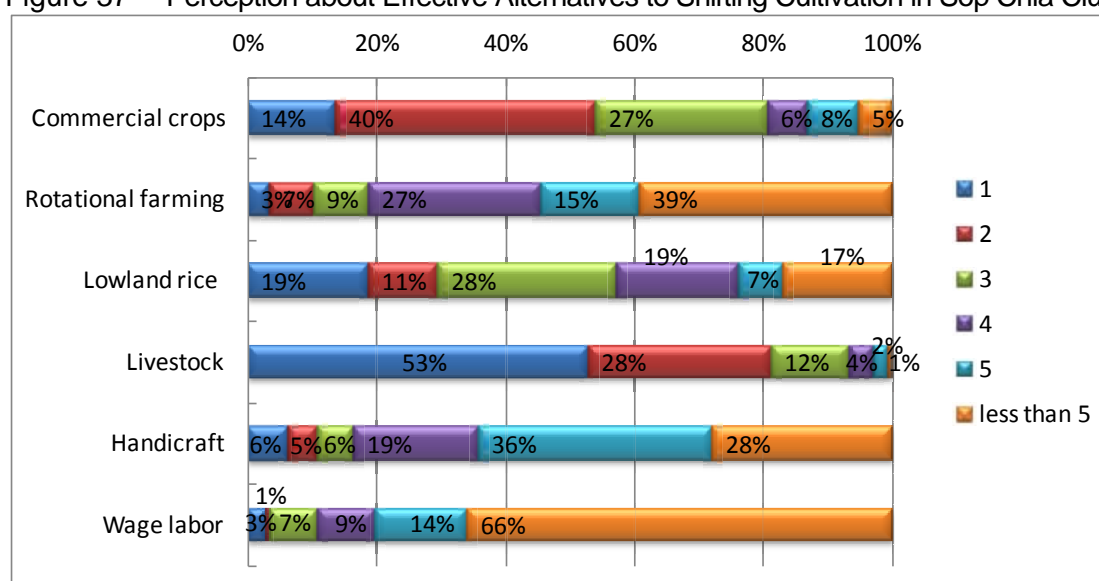
It should be also noted that wage labor is not considered as an effective alternative in both clusters. This can be a unique tendency of both clusters as wage labor, especially in dry season or off season, is usually a popular livelihood option in other parts of Luang Prabang province.

Figure 36 Perception about Effective Alternatives to Shifting Cultivation in Houay Khing Cluster



Source: Survey team

Figure 37 Perception about Effective Alternatives to Shifting Cultivation in Sop Chia Cluster



Source: Survey team

Chapter 5 Drivers of Deforestation and Forest Degradation

The main objective of this survey is to conduct the socio-economic survey and analysis to contribute to the efforts in identifying drivers of deforestation and forest degradation. This chapter aims to summarize main findings from the survey results and identify possible drivers of deforestation and forest degradation in Houay Khing (HK) cluster and Sop Chia (SC) cluster.

5.1. Socio-economic Situations

Population size is much larger in Houay Khing cluster (3,525 persons) than in Sop Chia cluster (2,677 persons). SC cluster is dominated by Khum ethnic group with no Hmong household, while HK cluster has multiple ethnic groups in most villages (Khum 66 %, Hmong 33 %, Lao Loum 1 %).

Among the 363 sample households in the two clusters, more than 90 % are engaged in upland farming (upland rice, cash crops and/or livestock raising). HK cluster especially is heavily reliant on upland farming as only Houay Khing village has some lowland paddy fields, while SC cluster has three villages with lowland paddy fields (Hua Meuang, Tad Thong and Houay Dong villages). In these three villages, 14 % of the sample households are engaged in both upland farming and lowland paddy farming. In both clusters, cash crops cultivation is spreading to wider areas, especially in SC cluster thanks to improved road and market access. In HK cluster, cash crops such as cassava and maize are increasingly grown but mainly produced for domestic uses i.e. feed for pigs, rather than for sale in market due to the limited market access.

In describing the economic activities of the villagers in the target area, it should be noted that almost all sample households are engaged in off-farm activities in addition to the above-mentioned farming activities. Only 7 % of the sample households in HK cluster and 2 % in SC cluster are not engaged in any kind of off-farm activities. This implies that the villagers do understand economic risks of concentrating on one economic activity and thus takes various measures to diversify risks. Among various off-farm activities, wage labor or seasonal employment is limited in the target areas despite the increasing trend of wage labor in other parts of northern Laos. This is due to bad road access and less exposure to information about employment opportunities than in other parts of Luang Prabang.

Another distinctive feature of the socio-economic situations in the target area is the magnitude of immigration in the past decade. On average, 66 % of the total sample households have migrated to the current location in the past, mainly due to village relocation (ordered by the government) or in search for better social infrastructure and road access. The magnitude of migration is especially significant in SC cluster as almost all the sample households in three villages (Tad Thong, Houay Si Yua, Houay Dong) have moved to the current village in the past decade due to the government's decision to resettle the whole villages. Immigration of such a magnitude has inevitably influenced the way land and forest resources are used as well as their livelihoods. In terms of economic status, all the three villages are considered poor because the villagers are still struggling to re-establish their own livelihoods but agricultural production is not enough yet. In terms of land and forest use, newly settled villagers tend to cut trees either to use for house construction or to open agricultural land; hence leading to a high rate of deforestation. The survey reveals that the agricultural area has rapidly increased up to 2008 in SC cluster and 2006 in HK cluster, partly due to the opening of forests as a result of migration and re-settlement. Also, the result shows the use of timber in some of the newly established villages (e.g. Tad Thong, Houay Tho) is significant.

5.2. Land Use

As described earlier, more than 90 % of 363 sample households are engaged in upland farming (upland rice, cash crops and/or livestock raising). Only 5 % in HK cluster and 14 % in SC cluster are engaged in both upland and lowland farming. Almost all farming households have and cultivate their own plots of land, while very few rent in some plots from relatives to supplement food production. Those who rent in agricultural land are mostly newly settled households as late comers tend to have

fewer land or less fertile land. Only 3 out of 363 sample households do not have their own agricultural land.

On average, the sample households have about 4 ha of agricultural land per household. However, in the four villages with Hmong ethnic group in HK cluster, the Hmong is reported to own and cultivate much larger agricultural land (1.3 – 1.6 times) than Khum ethnic group. To compare among the villages, larger agricultural land per household is reported in Houay Tho, Hua Meuang, Houay Si Yua villages where the number of plots per household is also large with more than 4 plots, while small plots are reported in Houay Dong and Phak Bong and Sa Kuan villages. Sample households in Houay Khing, Sa Kuan, Hua Meuang and Houay Si Yua responded that they would need a relatively large “additional” agricultural land if they are to produce enough rice and improve livelihood. In fact, these villages reported a high incidence of rice shortage. Also, they have about 3 or less plots of agricultural plot per household and use the agricultural plots in a short rotation except for Hua Meuang, attesting to the limited availability of agricultural land. In theory, all the ten villages in the target area have enough agricultural land (from 15 ha per household in Houay Khing village to 74 ha in Houay Ha) and reserved land that have been demarcated by the land use planning conducted in recent years. In reality, however, not all the agricultural land has been developed or can be utilized due to difficult access or shortage of labor; hence not enough land for each household. In fact, many sample households reported that they would like more agricultural land to improve livelihoods but (lack of) labor force is the main constraint.

5.3. Perceptions about Collective Actions, Forest Resources and Livelihoods

In order to identify potential drivers of deforestation and address them, it is important to understand not only how local people use their forests and forest resources but also how they perceive the values of forest resources and their capabilities to address issues of communal importance in a collective manner.

Capabilities to address common issues can be assessed by looking at their decision making process and the experience and willingness to participate in group activities. In both clusters, sample households regard participatory decision making on common issues (e.g. water, land and forest use) essential and do participate in village meetings. In reality, however, the survey result shows they are not able to speak out or express their opinions in village meetings. This is partly because many are not confident in speaking out in public and partly because many think important issues should be ultimately determined in line with the decisions by the village authority. Even so, when it comes to land use planning, they are found to prefer decision making by multiple stakeholders. In HK cluster where community members are heterogeneous, villagers prefer land use planning by the village and government authorities, while in SC cluster many prefer decision making without the involvement of the government authorities.

In terms of the experience and willingness to participate in group activities, both clusters show a high level of participation in group activities. The results reveal that villagers actively participate in group activities not because they have to but because they are well aware of tangible benefits of collective actions. Among them are efficiency in agricultural production, effectiveness in problem solving and enhanced influence in decision making. Such high level of collective actions is a good implication that they are willing to collaborate with each other and able to address common problems. In other words, their motivations for collective actions can be promoted and utilized to address issues of deforestation and forest degradation.

In terms of forest and forest resources use, the sample households use them mainly as a source of fuel wood and timber. Houay Ha is found to use an exceptionally large amount of fuel wood, while newly settled villages, e.g. Tad Thong and Houay Tho, use a large amount of timber per household mainly for house construction.

As such, almost all sample households place a high value on forests as a source of fuelwood and timber. They also recognize the importance of forests as potential agricultural land for future use.

Furthermore, both clusters regard all the services provided by forests, i.e. soil enrichment, water sources and land slide prevention, as highly important. From these results, it can be said that villagers are well aware of the importance of protecting the forests as forests provide them with both direct benefits (e.g. fuelwood, NTFP, timber) and indirect benefits (e.g. water, soil fertility, land slide prevention). Such awareness about the values forests and forest resources provide can serve as an incentive to use forests in a sustainable way.

In terms of their perceptions about their abilities to make living and sustain livelihood, sample households regard the size of agricultural land and the amount of rice production as moderate. However, they tend to be unsatisfied with the current level of production techniques, access to farm land and incomes, especially in SC cluster where the majority are newly settled villagers and thus their livelihoods are still unstable. More alarming issue in both clusters is reported to be the shortage of water for agricultural use.

As mentioned earlier, the only major difference in livelihood in HK and SC cluster is that HK cluster is more reliant on upland rice farming whereas SC cluster tend to have more options including lowland rice production and various off-farm opportunities. Villagers in both clusters perceive livestock raising as the most effective alternative to shifting cultivation, followed by cash crop cultivation. Lowland paddy farming is also considered effective, but the lack of irrigation or agricultural water makes it an unrealistic option for most villages.

5.4. Potential Drivers of Deforestation and Forest Degradation

Figure 38 shows possible drivers of deforestation and forest degradation identified from the overall survey results from HK and SC clusters. The main factors driving the deforestation and forest degradation in the target area are found to be 1) shifting cultivation or livelihood options, 2) demographic changes and 3) market forces.

The distinctive feature of the target areas is that there are two major “triggers” that are behind the demographic changes and market forces. The first trigger is the improvement of access roads and infrastructure thanks to the development support from the government and the donor community. This first trigger affected both demographic changes (by attracting people to move to areas with good access and infrastructure) and market forces (by increasing marketing opportunities for both producers and traders). The other trigger is the government policy to relocate remote villages to road side as part of rural development efforts. This inevitably resulted in the influx of people and the concentration of a large population in limited areas, which in turn affected the changes in land and forest use.

The following sections briefly look at each driver of deforestation and forest degradation.

5.4.1. Shifting cultivation/livelihood options

Shifting cultivation has long been practiced in the northern part of Laos and it can be sustainably practiced as long as rotational periods are long enough for soil fertility to recover. However, the survey result shows that the average rotational periods in the area are 3 – 4 years in the target area. With such short rotation periods, some sorts of technologies for soil improvement would be needed to sustain productivity. In reality, the farmers in the target area lack such technologies or knowledge and are not able to address decreasing soil fertility. Given decreased soil fertility, farmers are driven to look for new agricultural land usually by clear-cutting forest areas in order to secure enough food. The survey result shows that only 22 out of 363 sample households are engaged in the pioneering type of shifting cultivation but it is possible that much more households are actually opening up new plots of land for sustaining their livelihood.

Another case in which shifting cultivation can affect forests is when villagers continue to rely on shifting cultivation given no other promising livelihood options, not by choice. If they had other

options, e.g. lowland paddy farming, off-farm, that can earn enough incomes, they would chose to quit less productive upland farming and shift to other economic activities. In reality, the area does not have enough flat land or water for lowland paddies, whereas other economic activities such as employment opportunities are limited. Given the reality, farmers have no other choice but to increase reliance on shifting cultivation. In the face of need to produce more either for an increasing population or for sale, farmers are forced to open up new agricultural land or use the current plots more intensively by shortening rotational periods.

Based on the survey results, Houay Tho and Tad Thong villages have a higher incidence of pioneering type of shifting cultivation because the villagers are resettled only recently (2005-2007). Besides, Houay Khing, Houay Ha and Houay Si Yua villages are already using their land intensively in short rotation, putting pressure on land.

Also, the survey result clearly indicated the Hmong uses a much larger plot of agricultural land per household, thus potentially posing a threat to forest land in the form of forest conversion. This is partly because their family is large in size and partly because they tend to rely more on upland farming (rice, cash crop and livestock) than off-farm activities.

Looking at the years to come, there would be a high level of pressure to expand agricultural land in Houay Khing, Sa Kuan, Hua Meuang, and Houay Si Yua beside the two recently settled villages. Although there are four villages with the Hmong population in HK cluster (Houay Khing, Sa Kuan, Houay Ha, Houay Tho), Houay Ha and Houay Tho villages may not have as much impact on forests as Sa Kuan and Houay Khing as Houay Ha and Houay Tho villagers (especially Hmong) already have enough agricultural land in rather long rotation and produce sufficient rice. In addition, the two villages have large reserved land available for use in the future.

On the other hand, Khum and Lao Loum may not be much of a threat to forests. This is because Khum and Lao Loum are already in the process of shifting toward fixed-land farming (lowland rice farming, or cash crop farming on fixed plots) and off-farm activities. This trend is more significant for the Lao Loum community and for SC cluster which has better access to market and employment opportunities. For HK cluster, it might take some time for villagers to reduce reliance on upland farming but it is unlikely that it will pose a significant threat to forests as most households do not have much labor force to drastically expand their production. Yet, it is important for the government and the donor community to continue its efforts in creating alternative livelihoods for local communities and ultimately reduce shifting cultivation.

5.4.2. Demographic changes

The second driver observed in the target area is rapid changes in demography due to 1) village relocations, 2) voluntary resettlement, and 3) natural increase in population. The trigger for village relocations is the government policy to resettle remote villages (a “push” factor), while the trigger for voluntary resettlement is the improvement of road and infrastructure (a “pull” factor). It should be noted that the drastic demographic changes due to the push and pull factors have been the distinctive and most powerful driver in the target village in the past decade.

Village relocations have been induced by the government policy to relocate remote villages as part of rural development efforts since the early 2000s as the road and infrastructure in the area improves. Village relocations are reported to have brought about demographic changes of significant magnitude in the area. Almost all target villages in HK cluster and three villages in SC cluster are newly settled in the last decade. In addition to policy-induced relocations, there are some villagers who have immigrated into the target area in search of better road access and social infrastructure (water, education, health services). Together, this roughly translates into the migration of about 1,000 households or 6,000 people into new locations along the main road.

The consequence is the concentration of large population in limited areas along the road side, which has inevitably resulted in the opening of new agricultural land near the new settlements and the conversion of large area of forests into agricultural land in a short period of time. Yet another impact

on forests comes from the need for timber for house construction in newly settled villages. Furthermore, an increase in population leads to more use of fuel wood though this may not have as much impact as tree felling for timber.

As mentioned earlier, most villages in the target area are established in recent years due to village relocations. Among them, Houay Khing and Sa Kuan villages are under most pressure of land use as their population is large and they already use land intensively, implying limited land availability and possible pressure to further expand agricultural land.

Deforestation and forest degradation can be a problem also in Houay Tho and Tad Thong villages because their relocations are only recent and they are reported to use a large amount of timber.

5.4.3. Market forces

The third driver is market forces, which refer to increased demand for agricultural products of high market values and consequent increase in investment in marketable products (agricultural commercialization).

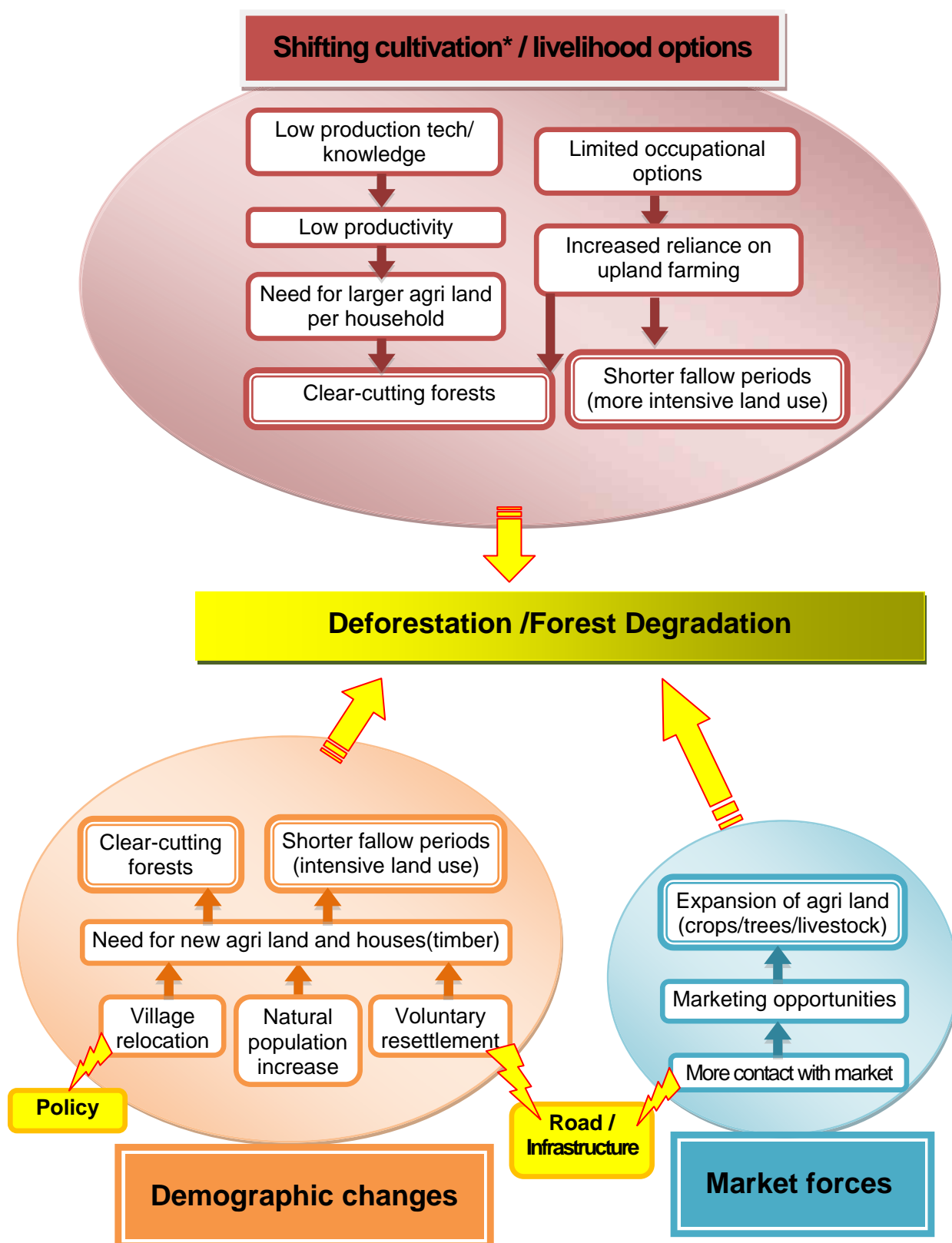
This is a general trend observed in many parts of Laos and thus not the trend only observed in the target area. Many parts of Luang Prabang province, including Phonxay district, had been isolated from market transactions in the past due to its difficult access. This situation has been rapidly changing thanks to the improvement in road access. As road conditions get better, so does market access. Better road access not only means better market access for producers but also more marketing opportunities for traders and investors. When the road conditions improved in the target area in the early 2000s, farmers got exposed to market information and market opportunities that were not available before. They learned what kind of crops were in demand in market and how many buyers were out there ready to purchase their produce. In fact, Phonxay district was land locked before but with the better road access it has turned into a hub linking markets in Luang Prabang and Vietnam. An increasing number of cash crops are being introduced to the farmers in the target area, which was reflected in the land use change. Furthermore, Phonxay district promotes livestock raising as a promising economic activity for a dual goal of stabilizing shifting cultivation and improving livelihoods. In fact, the survey result reveals that many sample households perceive livestock raising as a good income generating activity and a more effective alternative to shifting cultivation than cash crop cultivation.

It should be noted that significant deforestation and forest degradation due to such market forces have not been observed in the target area yet because the area is still early stage of agricultural commercialization. In other words, such market forces are yet to be a serious driver of deforestation or forest degradation. However, empirical evidences suggest that market forces are usually so intense that they can drastically change local livelihood and land use. Good example is the rapid expansion of marketable products (e.g. maize, cassava, rubber) in northern Laos and consequent changes in land use including conversion of forest into agricultural land. Behind these market forces are the ever increasing demand for food and raw materials in neighboring countries: China, Vietnam and Thailand.

As both HK and SC clusters are located in between Luang Prabang and Vietnam, they will be inevitably influenced by the market forces from Vietnam as well as Luang Prabang. As the demand for livestock and cash crops in Vietnam is high, the existence of Vietnamese buyers is already increasing in the clusters. Therefore, the market forces should be regarded as a potentially strong driver for deforestation and forest degradation.

Another potential threat, though not significant, is the increasing number of industrial tree plantations. The survey reveals that industrial tree plantation is being promoted in all the target villages (e.g. *Jetrophia*) either by the government or private companies. As long as trees are planted in fallow land, plantations do not pose any threat. However, it has been reported that some plantations are created by clearing forests. Therefore, close attention should be paid to the expansion of industrial tree plantations as well.

Figure 38 Drivers of Deforestation and Forest Degradation in Target Area



*Shifting cultivation here refers to both i) pioneering type and ii) highly intensive use of plots in rotation.

Source: Survey team

Chapter 6 Conclusions

This study aimed at investigating the relationship between the people's livelihoods and drivers to deforestation. To do so, it analyzed the socioeconomic situation of the HK and SC clusters by focusing on the survey in ten villages; identified drivers to forest degradation by looking at the degree of people's participation in land and forest use planning; and then provided recommendations to the development of suitable livelihood activities of rural people participation for REDD+. The main conclusions on the findings and issues discussed earlier chapters are provided below.

Understanding the socio-economic situation of HK and SC clusters was drawn from the findings of 363 interviewed households (187 in HK cluster and 176 in SC cluster). The interviews included a large number of Khmu and Hmong population, making a majority of samples in the study areas. In other words, HK cluster is Khmu-Hmong community whereas SC one is Khmu dominated one.

The main agricultural activity of the people in the HK and SC clusters is upland farming (mostly of rice, coupled with other crops), thus regarded as the main livelihood of the people in those clusters. Their upland farming is usually associated with slash and burn farming practices. More and more households are growing cash crops and raising livestock to seize the emerging marketing opportunities thanks to the improvements of road access to and from district center and Vietnam. The other important source of livelihood is the collection of forest products. Forests have been the main sources of livelihoods for many households.

The survey results show that local people are well aware of the importance of forests and forest resources in their livelihoods. Not only the forest resources but also the services they provide are highly valued by the local people. On the other hand, people's dependency on natural resources or forest resources (e.g. NTFPs, firewood, and timber) and their perception towards the forests as a reserved agricultural land for future use are potentially putting significant pressure on forests in both clusters. In fact, the search for fertile land for agricultural production by clearing and encroaching forest areas has been prompted by various factors such as relocation, migration and population growth.

Data on population growth and trend in the target villages were limited, making it difficult to fully understand a greater extent of a possible relation between population growth and declining forests through expansion of agricultural land in search for fertile land. However, agricultural land expansion due to the population growth was reported at the time of the survey. Expansion of agricultural land in search for fertile farming land was reported to be the main cause for the forest losses. The improvement of road access in recent years would mean greater potential for agricultural land expansion and conversion from forest land, putting pressure on forests.

Rural economic development cannot be driven and dictated by the government policy alone but requires people's participation. The study finding shows a high level of support for decision making by multiple stakeholders (e.g. government, village committee, and community members). Rural people's participation in issues related to communities and livelihoods is essential to sustainable development and natural resources management. It enhances collective values or a sense of collective actions in their community. At the community level, the majority of the people see the importance of the participation among the members, a kind of collective actions e.g. exchanging labor, helping each other build houses. This value is essential for group formation in forest protection, forest use, agricultural cropping or production, knowledge transfer to increase work productivity, problem solving and so forth and thus will enhance people's influences in decision making and negotiation power.

It is important and recommended that the local community be fully involved in land and forest use planning as well as decision making of important issues. More importantly, a sense of ownership of the community should be promoted in land and forest use and management. In order to help them effectively manage land and use in a sustainable manner, it is recommended that studies on the quality of existing production land be conducted to identify suitable crops or introduce production techniques and alternative livelihoods (e.g. livestock raising, potential cash crops).

Based on field visits, interviews and observations and by taking into account a realistic approach in the project implementation, the specific local context and potential challenges to overcome, the following table shows some main findings, recommendations and steps in association with the alternative livelihoods development, sustainable use of natural resources, and village development.

Main Findings, Recommendations, and Next Steps

Findings	Recommendations	Initial Steps
1. Existing Livestock raising system is not well functioning	Training program be provided to farmers on building livestock pens, feeding techniques and vaccination	<ul style="list-style-type: none"> DAFO/project provides technical support on how to make appropriate livestock pens (animals, poultry), including techniques to take care of them DAFO/project provides training on how to estimate food rate and specific types of feeds for respective livestock
2. Lack of networking among livestock actors	Rapid Market Survey and Value chain Assessment in livestock be conducted in Phonexay, Luang Prabang district and Xieng Kuang province (currently there are traders from Xeing Kuang buying livestock and poultry from HK cluster as it is not located too far from Xieng Khuang).	DAFO/Project/identified Local Capacity Builder/Non-Profit Association together work together on how to conduct the rapid market survey and then value chain analysis.
3. Ability to supply sufficient livestock limited	<p>Livestock Production Groups (e.g. cattle, buffalo, pig, goat, poultry groups) be studied and established</p> <p>Other support funds (revolving funds, vaccination funds, etc) be strengthened where available and be established where unavailable</p>	DAFO/project organize meetings at village level to initiate group formation and funds, including group / fund management mechanisms, rules and regulations
	Pig husbandry program be piloted for potential households in SC cluster (location close to Phonxay district center for a purpose of easy access to market)	<ul style="list-style-type: none"> DAFO/Project/DOIC to work together to identify input suppliers in LP (piglet producers, pig feeds) and potential buyers or markets in Luang Prabang town DAFO/Project/DOIC expand networks or contacts with producers (e.g. Thangon CP pig let producing factories) in technical exchange and support, even potential buyers Project invests 10-30 piglets with potential households.
4. Current upland rice farming practices in associated with shifting cultivation / slash and	Systematic terrace farming be studied as one of the alternatives by drawing lessons from previous projects in the country and by learning lessons and experience from countries in the region	<ul style="list-style-type: none"> Review lessons learnt from CESVI project to identify gaps Exchange experience and lessons with region Develop a new project that fits in the existing situation

Findings	Recommendations	Initial Steps
burn harmful to forests		
5. Farmers lacking business oriented knowledge and skills	Community based business training be provided to stakeholders (esp. farmers, production groups)	DAFO/Project/identified Local Capacity Builder/Non-Profit Association together provide training on basis business development and management, marketing
6. Absent food processing system	Small household business be surveyed to identify potential producers and supply chain be assessed	Supply chain and baseline study on small household businesses and their market linkage (e.g. linking to LPQ banana processors, food processing businesses, other concerned agencies, etc. that could provide training on food processing, marketing, etc.) <i>(At the initial stage, the project should support finance, related activities...)</i>
7. Food insecurity (rice) during the rainy season (farmers' coping strategy is to borrow money from local unofficial moneylenders to buy rice and repay with rice after harvest). Moneylenders also act as rice retailers selling rice to needy people at a higher price esp. during the rainy season)	Rice bank or group be established in target villages	<ul style="list-style-type: none"> • Consultation meeting with Phonexay district authority on the previous project (CESVI) that supported the same work – rice bank – to learn lessons and experience and applied to the existing rice banks • Study potential to set up rice bank committee in respective villages • For piloting, DAFO/Project considers to contribute rice as a revolving fund to start up the rice bank • Initiate consultation and cooperation with existing agencies working on rice bank development
8. Lack of sustainable NTFP collection	Value chain analysis be carried out to identify potential forest products and develop/domesticate them (if needed)	<ul style="list-style-type: none"> • Value chain analysis should be conducted in target villages • Forest products collection group formation be considered and established with rules and regulations
9. High rate of using fire wood in cold season	Clay house construction be considered as an alternative to conventional housing	<ul style="list-style-type: none"> • Pilot project should be started with 1 or 2 clay houses per cluster using local resources (clay, rice straw, etc.)

Findings	Recommendations	Initial Steps
because existing houses are made with local materials – wood and bamboo and thus cold air flows easily into houses		<ul style="list-style-type: none"> • Training on clay house construction be organized to interested villagers
10. High rate of using fire wood for cooking negatively associated with forest resources and wasting time	The use of stove be introduced to households replacing the conventional one	Stove making project be considered utilizing local makers in Luang Prabang town to provide training to villagers how to make stoves
11. Health services limited	Revolving drug funds for village medical kit center be expanded	Establish revolving drug funds in target villages which require the project's facilitation
12. High rate of illiteracy among women	Non-formal education program be started	Coordination with provincial and district office of education to seek for solutions
13. Sanitation not widely used	Sanitation facilities be provided to target villages that don't have	Govt/project to provide financial report
14. Gender balance issues in planning processes	Gender awareness training for Kumban officers and village authorities	Govt/project to provide financial report

APPENDIXES

Appendix 1: Village Profiles of HK Cluster

Description	Houay Khing	Sa Kuan	Houay Ha	Houay Tho	Phak Bong
Establishment Year	2003	2002	1960	1978-79	2001
Demographics					
Population	1,355	910	434	346	480
Female	663	449	205	173	273
Households	220	123	56	58	82
Poor households	55	53	36	6	4
Ethnic Group by Households:					
Lao Theung (<i>Khmu</i>)	124	101	6	34	81
Lao Loum	5	6	-	-	1
Lao Soung	91	16	50	24	-
Direction / Bordering					
North	Houay Tho	Kew Lai	Long Eaung	Long Lath	Long Lath
South	Sop Huad & Na Pheing	Long Eaung	Houay Khing	Na Phieng	Phak Hok
West	Houay Tho & Long Lath	Na Ngew	Long Lath & Phak Bong	Houay Chia & Houay Dong	Houay Chia
East	Kew Lai	Houay Ha	Sa Kuan	Houay Khing	Houay Ha
Land Use Planning					
Conservation forest (ha)	4	1.5	77.6		131.3
Protection forest (ha)	1,572	-	3,261		1,261
Production forest (ha)	59	250	-		705.8
Community forest (ha)	5	-	-		-
Grazing land (ha)	972	500	-		2,974
Cemetery forest (ha)	10	5	3	-	10.3
Residential area (ha)	394	124	6.8		3.9
Agriculture area (ha)	-	-	2,094		15.8
Total Land area (ha)	-	4,114.8	-		3,974.1
Occupation					
Main Occupation	Upland rice farming (<i>hai</i>)	Upland rice farming (<i>hai</i>)	Upland rice farming (<i>hai</i>)	Upland rice farming (<i>hai</i>)	Upland rice farming (<i>hai</i>)
Supportive Occupation	Cash cropping, livestock	Cash cropping, livestock	Cash cropping, livestock, NTFPs	Cash cropping, livestock, NTFPs	Livestock, NTFPs
Infrastructure					
Road accessibility	Both in dry/wet seasons (located on main road) (36km to district center)	Only in dry season (8km from main road) (46km to district center)	Only in dry season (6km from main road) (38km to district center)	Only in dry season (9km from main road) (39km to district center)	Both in dry/wet seasons (located on main road) (27km to district center)
Electricity	Not available	Few houses use solar panel	Not available	Not available	Few houses use solar panel
Primary School	1	1	1	1	1
Lower Secondary School	1	-	-	-	-
Dispensary	1	-	-	-	-
Gravity-fed water (<i>nam lin</i>)	1	2	1	1	1
Rice Bank	1	-	-	-	-
Gross Domestic Product	-	LAK 487,805/HH	-	-	LAK 5,475,609/HH
Village Forests Used	The forest is decreasing because of slash and burn farming	The forest is decreasing because of slash and burn farming	The forest is decreasing because of slash and burn farming and population growth	The forest is decreasing because of slash and burn farming	The forest is decreasing because of the population growth as people moved in for better road

Description	Houay Khing	Sa Kuan	Houay Ha	Houay Tho	Phak Bong access and available electricity
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Source: Survey Team

Appendix 2: Village Profiles of SC Cluster

Description	Phak Hok	Hua Meuang	Tad Thong	Houay Si Yua	Houay Dong
Establishment Year	1975	1952	2005	2001	2000
Demographics					
Population	602	436	534	595	510
Female	317	224	269	293	255
Households	95	83	82	93	85
Poor households	41	12	13	31	12
Ethnic Group by Households:					
Lao Theung (<i>Khmu</i>)	94	82	81	92	84
Lao Loum	1	1	1	1	1
Lao Soung	-	-	-	-	-
Direction / Bordering					
North	Phak Bong	Phak Hok	Thad Sang	Tad Thong	Houay Chai
South	Hua Meuang	Sop Chia	Houay Si Yua	Sop Chia	Houay Thone
West	Tad Thong	Kok Pho	Houay Thone	Pha Touap	Houay Lung Soung
East	Houay Tho	Sop Chia	Phak Hok	Hua Meuang	Chom Chieng & Houay Tho
Land Use Planning					
Conservation forest (ha)	1027 incl. protection forest	-	1011 incl. protection forest	1,294	233
Protection forest (ha)		69		-	
Production forest (ha)	1012	97	1627	2,705	1470
Community forest (ha)	-	9	-	279	-
Grazing land (ha)	1746	151	127 (& 666.5 for livestock)	764	210
Cemetery forest (ha)	22	9	13	1.8	12
Residential area (ha)	10	11	3	4	4
Agriculture area (ha)	<i>(it is included in production forest area)</i>	933	<i>(it is included in production forest area)</i>	2	-
Reforestation area (ha)	-	625	-	-	-
Upland farm area (ha)	-	781	-	-	-
Total Land area (ha)	3,817	2,685	3,446.5	5,130	1,929
Occupation					
Main Occupation	Upland rice farming	Upland rice farming	Upland rice farming	Upland rice farming	Upland & lowland rice farm
Supportive Occupation	Cash cropping, livestock	Cash cropping, livestock	Cash cropping, livestock	Cash cropping, livestock	Cash cropping, livestock
Others	-	-	-	-	-
Infrastructure					
Road Accessibility	Both in dry/wet seasons (located on the main road) (16km to district center)	Both in dry/wet seasons (located on the main road) (13km to district center)	Only in dry season (9km from main road) 25km to district center)	Both in dry/wet seasons (2km from the main road) (13km to district center)	Only in dry season (10km from the main road) (18km to district center)
Electricity	Some houses use solar panel	Not available	Not available	Some houses use solar panel	Not available
Primary School	1	1	1	1	1
Gravity-fed water (<i>nam lin</i>)	1	1	1	1	1

Description	Phak Hok	Hua Meuang	Tad Thong	Houay Si Yua	Houay Dong
Rice Bank	1	1	1	-	-
Gross Domestic Product	-	-	LAK 5,000,000	-	-
Village Forests Used	The forest is decreasing because of slash and burn farming	The forest is decreasing because of slash and burn farming	The forest is decreasing because of slash and burn farming	The forest is decreasing because of slash and burn farming	The forest is decreasing because of slash and burn farming and of logging business (by a company)

Source: Survey Team

Appendix 3: Historical Events Taking Place in HK and SC Clusters by Village

Houay Khing		Houay Tho		Phak Hok (continued)	
Year	Situation	Year	Situation	Year	Situation
2003	3 villages merged together where Houay Khing became the focal	1978-79	Village established with 70 households	2003	Gravity fed-water system established by World Vision
		1988	Village burnt down leading to some people migrating to other places	2004-05	Road upgraded and connected with other villages
2004	Village and road constructed Car and motorbike available	2004	Increasing number of people moving in	2005	Cars/trucks available
		2007	Village re-established with 52 households	2006	Grocery shop established
2004-05	Disease spread	2005	Primary school established offering 1-2 grade class	2008	-Flooding causing hardship / food shortage -Motorbikes available
2004-05	Primary school established (grade 1-5)	2007-08	Primary school starting a grade 3-4 class	2009	Kindergarten established
2005	Drought	2009	Primary school starting a grade-5 class	2010	Primary school established
2004	gravity fed-water system established by World Vision	2010	Gravity fed-water system built	2010	Disease outbreaks caused death of livestock
2004	Dig Lowland rice and fish pond for people by Cesvi of WorldVision			2010-11	Electricity (solar panel) available
2006	Electricity available by France Project	Phak Bong		2011	Toilet use campaigned
2007	Dispensary established	Year	Situation	2012	Television & mobile phone signal
2007-08	Secondary school established	2000	Road constructed	Hua Meuang	
Sa Kuan		2002	Village established	Year	Situation
Year	Situation	2003	Grocery shop installed	1952	Village established
		2005	Some houses built with zinc roofing and equipped with TV/ DVD and motorbikes	1986	Primary School established
2002	Village established	2006-07	Cars/trucks available	1986	Drought
2005	Disease spread	2002	Primary school built	1988	Disease outbreaks
2005	Road construct- and motorbike available	2004	Gravity fed-water system built	1992	Village officially established with its own stamp
2006	Drought-	2008	Mobile phone signal available	2000	Road constructed
2006	Grocery available-			2002	Grocery shop
2007	Electricity by solar	Phak Hok		2005	Televisions available
2008	Gravity fed-water system establish	Year	Situation	2006	Motorbikes available
2008	Primary school establish from Grade 1 -5-	1975	Village established	2007	Gravity fed-water system established by World Vision
2010	Village hall established	1978	Primary school established		Mobile phone signal available
Houay Ha		1983	Village officially established with its own stamp		Rice bank established by (Cesvi) WorldVision
Year	Situation	2001	Drought	2008	Flooding causing hardship / food shortage
		2002	Village road manmade		Toilets made available for people use
1960	Village established with 30 households	2002	Rice bank established by (Cesvi) WorldVision		

Houay Khing		Houay Tho		Phak Hok (continued)	
Year	Situation	Year	Situation	Year	Situation
2003-04	Road constructed	2003	Gravity fed-water system established by World Vision	2010	Cars/trucks available
2004	Bicycles available	2004-05	Road upgraded and connected with other villages	2011	Electricity made available
2009	Drought	2005	Cars/trucks available		Disease outbreaks
2010	Gravity fed-water system built by GAP project	2006	Grocery shop established		
2010	Mobile phone signal reached	2008	-Flooding causing hardship / food shortage		
2011	Flooding caused hardship / food shortage		-Motorbikes available		
		2002	Rice bank established by (Cesvi) WorldVision		

Appendix 3: Historical Events Taking Place in HK and SC Clusters by Village (continued)

Tad Thong		Houay Si Yua		Houay Dong	
Year	Situation	Year	Situation	Year	Situation
2005	Village established	2001	Village established & village's hall established with less households moving in	2000	Village established
2006-07	Road constructed	2001	Village bridge constructed	2001	Primary school established
2006-07	Mobile signal reached	2002	Village officially established as having more households (as many as 82) & thus being eligible to have its own official stamp	2002-03	Houses built with permanent (zinc) roofing or tiles replacing typical huts
2007	Motorbikes available	2004	Road constructed and motorbikes available	2004	Televisions and tractors available
2008	Cars/trucks available	2006	Drought	2005	Gravity fed-water system established by World Vision
2008	Had primary school	2007	Mobile phone signal available	2005	Rice fields made available to 11 families by CESVI
2008	Community had television	2008	Rice bank established by (Cesvi) World Vision	2006	Water turbines (<i>nam yord</i>) available
2008	Heavy raining made people were in difficult situation to find food.	2011	Gravity fed-water system established with WorldVision support	2006	Drought
2009	Drought	2012	Toilet use campaign and constructed	2007	Toilet use campaigned and built
2010	Gravity fed-water system established by World Vision				Motorbikes available
2010	Disease outbreaks				Village hall constructed
2012	Rice fields allocated with TABI support				
2012	Disease outbreaks				

Annex 4: Collection Time of Some Identified Crops and NTPFs in 10 Target Villages

Name of Crops and NT FPs	Month												Cluster Houay Khing					Cluster Sop Chia				
	1	2	3	4	5	6	7	8	9	10	11	12	HK	SK	HH	HT	PB	PH	HM	TT	HSY	HD
Upland rice													3-12	4-11	2-12	2-12	3-12	3-11	3-12	3-12	3-11	3-11
Maize													3-12	3-8	2-10	2-10		6-9	3-12	6-12	3-12	6-9
Cassava													4-12	2-5	1	5-12			4-2	6-12		5-12
Banana															4-5	1-12		6-2	5-12	1-12	1-12	1-12
Jobs tear													3-12						3-9	2-12	1-12	
Ginger																		3-6	5-12	7-11	6-12	6-1
Sesame													3-10							5-9	3-12	6-12
Vegetables (mak kheau, mak ton...)															5	5		4-12	3-8	7-10	6-10	5-11
Vegetables (chilli, eggplants,...)																		3-6	2-9	6-12	5-10	5-7
Roots (taro, sweet potatoes,...)														1-11						6-1	1-12	
Sugarcane																					4-10	
Pieapple																						1-12
<i>Mak Nam Maan</i> (e.g. jatrophia)																		1-12	6-9	6-9	6	1-12
Teak																						1-12
Coffee																		3-6	1-12			

Forest Products (NT FPs)

<i>Dauk Deua</i>													9-11	1-2				9-6	1-12		12-4	
Broom Grass													2-3	4-5				2-4	6-3		2-4	10-11
Bark <i>Peuak Meuak</i>													1-12	1-12				10-4	3-7		4-5	8-12
Bamboo Worms (<i>Mae</i>)													6-9	9-10				9-10	8-10		10-12	10-11
Bamboo Shoots													6-11					6-8	6-10		7-10	5-7
Paper Mulberry (<i>Pasa</i>)														5-6				5-7	4-6			5-7
Wild Vegetable (<i>Pak Waan</i>)														1-12				5-8	1-12			5-7
Wild Vegetable (<i>Pak Nao</i>)																		3-7	3-7			5-7
Wild Mushrooms (<i>Hed Deng</i>)																		7-10	6-9		8-9	6-7
Wild Ginger													1-12									
Sugar Palm Seed (<i>Mak Tao</i>)																			1-12		10-12	1-12
Cardamon														9-10								8-9
Rattan																						6-12
<i>Sakaan</i>																			1-12			1-12

Source: Data obtained from the meetings held at the target villages in 2 clusters (October 2012)

**Developing livelihood and capacity development strategies for Houaykhing
Village, Luang Prabang Province, LAO PDR**

Table of Contents

Summary	1
1. Introduction	3
1.1 Background	3
1.2 Scope of the study	4
1.3 Methodology	5
2. Current situations in the target village.....	5
2.1 Demography and general socio-economic condition	5
2.2 Agricultural sector.....	6
2.2.1 Shifting cultivation.....	6
2.2.2 Situation of paddy fields/permanent agricultural land.....	9
2.2.3 Rice sufficiency	10
2.2.1 Production of other cash crops.....	10
2.3 Livestock	11
2.4 Forestry sector	12
2.5 Market sector.....	13
2.6 Access to finance.....	14
2.7 Housing and energy.....	14
2.8 Local knowledge and expertise	15
2.9 Strengths, Weaknesses, Opportunities and Threats (SWOT) of socio-economic and natural resources situation of the village.....	15
3. PCM for livelihood development	17
3.1 Problem analysis	17
3.2 Strategies for alternative livelihood	21
3.2.1 Agriculture sector development.....	22
3.2.2 Improved system for livestock raising.....	22
3.2.3 Commercial farming of cash crops	23
3.2.4 Forestry sector development	26
3.2.5 Access to market: establishment of a weekly village market	26
3.2.6 Developing saving credit mechanism	27

3.2.7	Alternative energy using bamboo/wood waste briquette.....	27
3.2.8	Local capacity building through skill development training and community awareness programme	28
4.	Project implementation strategies.....	28
5.	Conclusion	32
	Annex A: Workshop results.....	32
	Annex B: Interest groups for demonstration project activities	39
	Annex C: Tentative schedule, budget and partners/collaborators for capacity building and demonstration activities.	43

Summary

This report has been prepared based on recent socio-economic study carried out in Houaykhing village of Luang Prabang Province. The main objective of the study was to assess the current socio-economic situation of the village and to develop sustainable livelihood strategies. Participatory method was applied to gather information from the village. Formal and informal discussions were made with individuals from Hmong and Khmu ethnic communities, representing gender and individuals with or without paddy fields. A workshop was also carried out to explore their interests and assess their capacities. In the final stage of the study, discussions were made with specific interest groups who would be willing to adopt changes in their agricultural practices in the future.

The Project Cycle Management (PCM) tool was used to assess the present situation of the village. The study found that forest concession, shifting cultivation, forest encroachment for agricultural land expansion, uncontrolled livestock grazing in forests and fuel wood based energy for cooking and heating were the major drivers of deforestation. No forest management activity exists in the village except the recent zoning enforcement that has divided village forests into production, conservation and protection forests. The zoning regulation restricted villagers to access in the conservation and protection forests. However, some villagers said that the zoning regulations are not strictly followed as the majority of them don't have options but to expand their fallows for rice production which is the only or major livelihood option in the village.

Shifting cultivation is not an isolated problem but is the results of many other root problems exist in the village. It is a traditional and subsistence agricultural practice which doesn't involve any land management activity. Moreover, lack of enough labors and irrigation facilities have forced people to rely on shifting cultivation for their livelihoods. Similarly, lack of market system for agricultural products has discouraged people to produce fruits, vegetables and other cash crops in large scale, which have great market potentials.

After assessing the current situation, it is concluded that the complete abolishment of the current slash and burn practice is not a feasible option. A phase wise and gradual approach should be adopted. In the short run, the focus should be given to improve the livelihood

condition of people by improving the current agricultural practices and developing agricultural market system. In the long run, people should be encouraged to adopt permanent agriculture system with intensive farming by applying scientific land use and management practices. Similarly, the current shifting cultivation practice has to be gradually improved by improving cultivation practices such as soil management, fertilization, agro-forestry and integrated cropping. Villagers should be encouraged to cultivate market potential cash crops such as coffee, tobacco and mulberry trees in the old fallows to maximize income from their farmland. In the long run, agricultural re-zoning should also be applied to consolidate scattered lands with clear land tenure policy. Village market and credit systems should be developed to increase productivity and sales of the agricultural products.

1. Introduction

1.1 Background

Lao People's Democratic Republic (PDR) has the highest proportion of forest in Southeast Asia. Forests have been an essential part of the national economy and rural livelihoods in Lao PDR with wood exports accounted for 34% of national exports in 1998 (World Bank, 2001¹). Forest is the source of food, shelter and energy for more than 90% rural people in the country. Non timber forest products have been the major source of household income in rural Laos accounting for almost 50% of annual rural household income (Duangsavanh et al. 2002²) and providing a source of food.

However, the forest cover has declined rapidly since last few decades from 49% coverage in 1982 to 41% in 2002. Shifting cultivation and forest concession are regarded as the main causes of forest degradation in the country. To combat the deforestation problem, the Lao government initiated policy reform in natural resource management in the early 1990s which was officially known as Forest Allocation (LFA) policy (Fujita and Phanvilay, 2009³). The main objective of the policy was to improve productive use of land in rural areas by minimizing environmental degradation and controlling the expansion of shifting cultivation in the upland areas. Demarcating village boundary with clear land use classification, transferring resource management responsibilities to a village committee and issuing temporary land use certificate to allocate agricultural and degraded forest lands to individuals were the major components of LFA policy (Fujita and Phanvilay, 2009).

With the emergence of REDD+ under the UNFCCC, Lao PDR established a REDD task force in 2008 under the assistance of JICA to develop its national strategies. REDD plus activities in Lao PDR are expected to reduce deforestation, promote forest management and contribute to mitigate global warming by reducing emissions from deforestation. In order to

¹ World Bank (2001). Lao PDR: Production forestry policy. Status and issues for dialogue, Vol. I. Main report.

² Duangsavanh, L., Bouahom, B. and Raintree, J. (2002). Country review, Lao PDR. In X. Jianchu and S. Mikesell (eds.) Landscapes of diversity, the third Mountainous Mainland South East Asia (MMSEA) conference proceedings, pp79–100. Lijiang, China: Yunnan Science and Technology Press

³ Fujita, Y. And Phanvilay, K (2009) land and forest allocation in Lao PDR. Comparison of case studies from community based natural resources management research. Society and Natural Resources, 21:120-133.

facilitate REDD plus, JICA has been implementing a project “Participatory Land and Forest Management Project for Reducing Deforestation (PAREDD)” project since 2009 including Validation and Registration on REDD plus project. Houaykhing village cluster of Phonsay District, Luang Prabang Province has been considered as a target area of the project.

1.2 Scope of the study

The PAREDD plus has identified socio-economic issue as a major component of the project as it has direct link with current land use practice and deforestation in the country. Within the framework of project scope, the main goal of the study was to assess the current socio-economic situation of the Houaykhing village and to develop alternative livelihood strategies to reduce deforestation and forest degradation. Specifically, the study aimed to achieve the following objectives;

- (i) to identify the major drivers of deforestation in the target villages,
- (ii) to assess the current socio-economic situations,
- (iii) to identify the current land use practices and their links with socio-economic and deforestation in the study area,
- (iv) to develop alternative livelihood strategies based on natural and human resources potential, and
- (v) To identify key areas of short and long term project interventions.

Capability approach was applied to assess and develop the livelihood strategies. Specifically, the assessments were based on

- (i) Natural resources potentials such as; (a) the current land use and productivity (what they have currently?) and (b) the potential land use and productivity (what they can have?).
- (ii) Human resources potentials such as (a) what are they doing currently?, (b) what can they do more?, and (c) what are they actually interested to do?.

1.3 Methodology

Participatory method was applied to gather information from the village. The data collection involved villagers throughout the process. The information was collected in three steps i.e. Individual interview; workshop and group discussion. The first step was formal interviews with villagers. Individuals from Hmong and Khmu ethnic communities, representing gender and individuals with or without paddy fields were selected for interviews. Interviews were carried out using checklist in informal setting so as to provide villagers comfortable environment. The interviews were mostly focused on assessing current livelihood activities, problems related to current livelihood activities, forestry situation and suggestions for alternative livelihood options. Based on the interviews, a list of alternative livelihood options was prepared, which was evaluated during a workshop conducted in December 18 to 21, 2012. A total of 22 participants from four villages attended the workshop representing both gender and ethnicity. The workshop primarily focused on assessing the interests and capacities of the participants to adopt alternative livelihood options. The results of the workshop have been provided in Annex A. In the final stage of the study, group meetings were carried out with specific interest groups who were willing to adopt changes in their agricultural practices and livelihood options in the future.

A Project Cycle Management (PCM) tool was used for the analysis of the present situation of the village. PCM approach includes problem analysis, objective analysis and strategy development. PCM has been used frequently for situational analysis and project development by many development organizations including JICA and GTZ.

2. Current situations in the target village

2.1 Demography and general socio-economic condition

Table 1 provides the demography of Houaykhing village. The village has 223 households with the total population of 1477 and the average family size of 6.6. Khmu constitutes the highest number of HHs (116) with total population of 704 and average family size 6.10; followed by Hmong community with 96 HHs and 715 population and Lao Lorum with only 11 HHs and 49

populations (average family size 4.45). The total number of labors availability in Khmu, Hmong and Lao Lorum communities are 240, 180 and 17 respectively.

In terms of social activity and leadership, Khmu ethnic community holds the highest number of position in the village (53.8%) which includes position in village's various groups, employment in school etc. followed by Hmong community (25.6%) and Lao Lorum (20.6%).

The village has only eight business owners, of which four of them are from Hmong community. The average annual cash income is the highest among Lao Lorum community (8.5 million Kip) followed by Hmong (5.5 Million kip) and Khmu communities (3.75 million kip).

Table 1: Demographical structures of the Houaykhing village

Ethnic groups	Total number of households	Total population	Average family size	Farm labor availability	Positions held in the village	Number of business owner	Average cash income (Million Kip)
Hmong	96	715	7.5	180	10 (25.6%)	4	5.5
Khmu	116	704	6.1	240	21 (53.8%)	2	3.75
Lao Lorum	11	49	4.45	17	8 (20.6%)	2	8.5
Total	223	1477	6.6	437	39	8	4.5

2.2 Agricultural sector

2.2.1 Shifting cultivation

Slash and burn has been the predominant type of agricultural practice in the target villages. The average numbers of fallow owned by each family is about three and the size of each fallow is about one hectare. Currently there are 661 fallows owned by the villagers, occupying about 695 ha of land (Table 2). However, these figures were based on estimation provided by the villagers and may differ from actual possessions they have, as the villagers tend to reveal only the official figures to comply with the recent zoning rules of the village.

The study found that shifting cultivation is not an isolated problem but is associated with many social and economic development issues in the region. Traditional cultural practice, lack of knowledge on improved agricultural system and permanent agriculture, lack of irrigation facility,

lack of clear land tenure policy, and lack of technical inputs from concerned organization are found to be major reasons for such practice.

Table 2: Agricultural land and production in the village

	Hmong	Khmu	Lao	Total
Total number of fallows (by each ethnic group)	294	352	15	661
Average number of fallows (by each ethnic group)	3	3	1.4	2.97
Number of paddy field owners	31	16	1	48
Total size of paddy fields	24.1 ha	11 ha	0.5	35.6 ha
Number of families with rice sufficiency (12 months or more)	81 (84%)	51 (44%)	8 (73%)	140
Number of families with rice deficiency	8 (8.3%)	65 (56%)	3 (28%)	76
Number of families with rice deficiency more than three months	2 (2.1%)	47 (40%)	1 (9%)	50

The majority of villagers responded that slash and burn is a labor intensive and difficult practice and they are ready to switch to an improved agricultural system if appropriate technical and financial inputs are provided. The villagers also acknowledged the fact that the slash and burn is not a sustainable practice and they would not be able to sustain their livelihood with such practice in the long run as the practice involves extensive land use with intensive labor inputs and poor land productivity. Moreover, due to recent zoning enforcement, the villagers are required to limit the number of fallows to three, which means they have to rotate and re-cultivate the fallow once in three years. According to villagers, the productivity of the three years old fallow is significantly lower, sometime 50% lower than the newer fallows. Generally, villagers prefer five to seven years rotation to get the better productivity. Therefore, if the villagers follow the zoning rules strictly, their total rice production is going to be reduced significantly impacting their livelihood situation unless they switch to an alternative agricultural practice to maintain or raise their productivity and income.

Generally, shifting cultivation is considered as a destructive agricultural practice having significant environmental impacts which leads to the destruction of forests, soil erosion, loss of soil fertility and degradation of the overall natural environment. The problems are associated with the removal of vegetative cover and the continuous cultivation without adequate soil management in erosion prone landscape. Some of the features of slash and burn in Houaykhing village are;

- Highland rice variety is well known for its rich taste and has higher market price, which encourages people to produce highland rice in steep slope using slash and burn practice. Some farmers also grow vegetables, chilli and NTFPs in the fallows.
- The majority of villagers used to have more than five fallows with the fallow period ranging from 5 to 7 years. However, the recent zoning rules have restricted the total number of fallows to three which may significantly impact the majority of the villagers.
- The most of the fallows, especially those of Khmu families, are distant from their home. The majority of these fallows are inaccessible to motor vehicles and may require two to three hours walk to reach the plots.
- The most of the fallows are located in gentle to steep slope lands (with slope gradient more than 70%) and are highly vulnerable to soil erosion.
- As the fallows are distantly located and scattered, it is difficult to apply group farming system or to establish cooperation for labour exchange. It has also discouraged farmers to produce multiple crops due to difficulty in crop transportation.
- The agricultural practice is highly primitive and unscientific without any application of soil management, fertilizer and irrigation system. Therefore, the fallow period may or may not be sufficient to restore soil fertility since the minimum period required to restore the soil fertility varies by soil type, climate and land management.
- The fallows are generally not suitable to re-cultivate after three years unless proper soil management practices were applied to conserve soil and maintain the soil fertility. In such circumstances, villagers revealed that the only option they have either to expand the size of their fallows by encroaching the forests or to look for a new fallow in the production forests.
- Shifting cultivation prevails here as the practice does not need a high level of management or external inputs and the villagers think that it is the easiest way to cultivate rice in the hilly areas.

Some of the adverse environmental impacts of shifting cultivation noted during the field survey were;

- Quality and extent of forest are declining: The most of the villagers agreed the fact that the slash and burn practice has severely affected the extent and quality of forest in the village.
- The productivity of cultivated land is declining: According to elderly and experienced farmers, land productivity is declining even if the fallow periods are maintained. The recent trend to reduce the fallow period has accelerated the process of declining productivity.
- Soil erosion is common in fallow areas especially those located in steep slope.
- Some villagers also reported that water flows from the sources are declining compared to past few years.

2.2.2 Situation of paddy fields/permanent agricultural land

Beside slash and burn, a limited number of farmers own paddy field, especially those farmers whose lands are located close to the permanent water sources. The sizes of these paddy fields are generally very small, ranging from 0.3 ha to 2 ha. However, they are not being managed and utilized to its full capacity. The most of the paddy fields are cultivated only during rainy season for rice production and are left without cultivation during the winter. As the most of the farmers get their rice production from slash and burn plots, they are reluctant to adopt improved agricultural practice in paddy fields.

One experienced farmer who has been practicing rice cultivation in his paddy field said that though the development of paddy field is difficult and labour intensive initially as one needs to develop terrace and irrigation system, it is much easier and less labor intensive than the slash and burn practice once the paddy field is developed. Another farmer (Mr Buichunga) who has been cultivating highland rice in the paddy field told that his rice productivity is almost same every year from his paddy field. He also told that the highland rice cultivated in paddy field is equally tasty as that of cultivated in slash and burn fields.

2.2.3 Rice sufficiency

Despite considerable size of land holding, more than 50% of villagers indicated they don't have enough rice for 12 months and majority of them are from Khmu community (56%) (Table 2). These people fulfill their daily needs by borrowing rice from rice bank, or from relatives and friends. They generate income from off-farm employment and selling their livestock. Rice deficiency is expected higher in the coming years due to increasing family size and zoning law enforcement.

2.2.1 Production of other cash crops

Based direct observation in the agricultural field and discussion with people, it can be inferred that both climatic and edaphic factors of the village are suitable to grow a variety of cash crops such as vegetables, fruit trees and NTFPs. Villagers are currently growing banana, mango, jack fruit, papaya, mango, tobacco, coffee and many types of vegetables in their home gardens for their personal use, which indicates that these cash crops could potentially be grown commercially to generate cash income for villagers.

In summary, the noted issues in agriculture sector are;

- Lack of knowledge on farm management: The majority of the villagers said that they lack knowledge on improved farm management system such as terrace making, maintaining soil fertility, water harvesting and irrigation, agro-forestry etc. As a result, they continue farming in steep slope without any soil management which would contribute to soil erosion and loss of moisture readily making fallow unsuitable to cultivate in the next season.
- Less intensive and less integrated farming system: Mono-cropping is a common practice in the village. People cultivate rice and leave fallow uncultivated in the winter season. In addition, livestock is not a part of farming system which would provide compost manure that could be used to maintain soil fertility. Similarly, agricultural land is not optimized

for cultivation such as some of the leguminous crops which could be integrated with rice have not been practiced.

- Limited water resources for irrigation: Some villagers who were interested to develop paddy field told that they were not able to do so due to lack of water sources or lack of infrastructure for irrigation system. Only a few numbers of farmers have access to irrigation facility which was initially developed by CESVI.
- Labor availability: Lack of labour is said to be one of the reasons for not practicing intensive farming. The village doesn't have group farming or labour exchange system and mainly depend upon family members for agriculture labor. Moreover, the distant fallows consume considerable time of family members for farm production.
- People's mindset: It is also said that people's mindset is also one of the important factors influencing agricultural practice in the village. As subsistence agriculture with slash and burn system has been the practice from their ancestor in the village, people feel comfortable and convenient following the tradition. Generally they would not like to risk the uncertainty by applying new technique unless they are convinced that it would benefit them significantly.
- Lack of technical inputs: There are no agricultural inputs from concerned institutions. Farmers hardly get any technical and material supports for the improved agriculture practice.

2.3 Livestock

Livestock is an important part of economy of the village which has a promising existing market with growing market price. About 43 % of villagers own large size cattle (cow and buffalo), 60 % of them own pig and goat and more than 80% of them own chicken and ducks (Table 3). Hmong people have higher average number of livestock than Khmu communities. However, livestock raising technique is very primitive and unscientific. Large size cattle (cow and buffalo) are raised freely in the forest contributing significantly to forest degradation. Uncontrolled and free grazing in the forest has also caused higher mortality of cattle due to possible contamination with the diseased wild animals.

Table 3: livestock in the Houaykhing village

Livestock possessions by villagers	Hmong	Khmu	Lao	Total
Number of families with cow and buffalos	69	28	0	97 (43%)
Average number of cow/buffalo per family	6	3.4	0	5.24
Number of families with pig and goat	62	67	3	132 (59%)
Average number of pig and goat per family	10.7	3.5	12	7
Number of families with Chicken/ducks	88	87	7	182 (82%)
Average number of chicken and ducks/family	32	14.6	22.3	23.5

2.4 Forestry sector

Forest management activity doesn't exist in the village. Villagers have free access to forest to collect forest products as they require. Beside slash and burn practice, forest encroachment is also common in the village to expand agricultural lands.

Recently forest zoning system has been applied and implemented in the village. According to zoning regulations, forests are divided into three categories i.e. utilization forest (2487.24 ha and 10 areas), protection forest (2358.6 ha and 6 areas) and conservation forest (4.4 ha and 2 areas). According to zoning regulations, villagers are allowed to collect necessary forest products freely from production forests except for restricted trees and non timber forest products specified by PAFO or DAFO, which, however, are not clearly stated in the regulation. The main objective of conservation forest is to protect wildlife, local ecosystem and biodiversity. Except for unrestricted NTFPs, villagers are not allowed to do other activities in these areas. Protection forests are allocated to prevent soil erosion and to protect water resources in the village. Villagers are allowed to collect unrestricted NTFPs and cut softwood and small trees to build their houses from protection forests.

During the survey, the majority of villagers indicated that they have heard about the zoning enforcement in the village. However, the most of the respondents implicitly said that zoning regulations are not followed strictly as forest products are still being collected from other forests and slash and burn practices are still continuing in utilization and other forests. People who have followed the zoning regulations have suffered severely as they are restricted to three fallows causing increasing months of rice deficiency. Khmu people are mostly suffered from zoning enforcement than Hmong or Lao Lorum.

Non timber forest products (NTFPs): The forest has rich NTFP resources. The local people collect many species of NTFPs both for domestic consumption and for sale. The common NTFPs are bamboo, dukduwa (elephant yam), wild mushroom, rattan and many types of wild herbs. NTFPs have good market in the nearby cities with their ultimate destination to China, Thailand and Vietnam.

2.5 Market sector

The one of the obvious constraints for income generation in the Houaykhing village is the lack of market system for agriculture and forestry products. Although the village has very high potential to commercially produce vegetables, livestock, fruits, NTFPs and many other cash crops, there is no existing market or direct linkage with market system to sell these products. Villagers largely depend upon middlemen to sell their products, who control both demand and price of the products. The market uncertainty has also discouraged people to grow cash crops in large quantity. Similarly, villagers had experiences of middlemen who asked villagers to produce some crop in large quantity (such as zinger) and bought just once and never showed up again. Therefore, villagers are also very cautious about producing any products in large quantity.

We carried out market study in Luang Prabang city for NTFPs and agricultural products. We found that chopstia, corn, dukduwa, mulberry paper, coffee, tobacco and bamboo products have good market potential. The fresh fruits and vegetables can also be sold through appropriate market channel. However, the market price of these products seems to be controlled by Chinese buyers. For example, the price of chopstia was 4000 kip/kilo two years ago and decreased to 2000 kip/kilo recently.

Beside price uncertainty, the steady supply of good quality products can be a challenge for the villagers. A bamboo entrepreneur who sells bamboo furniture and handicrafts in Luang Prabang city told us that there is a good demand for bamboo handicrafts both from tourist and local hotels. However, the issue remains on the supply of both quality and quantity of the products, when there is a demand for large quantity. Due to poor quality control, they hardly get uniform sizes and dimensions of the products which have hurt their business. The entrepreneurs

suggested developing quality control system for locally developed products to promote both local and international markets.

2.6 Access to finance

The most of the villagers indicated that they don't have easy access to finance to invest in business or agriculture sector. However, according to policy bank located in Phonsay district, the bank has a clear policy to provide short or long term loan to the poor farmers for investing in livestock and business. The bank aims to contribute to poverty reduction in the rural areas and provides loan to 47 districts focusing on the agricultural productivity especially to support agriculture, forestry, handicraft and industries. Bank provides loan to both individual and small group of farmers. However, individual borrower requires collateral for the loan. Similarly, the bank has certain criteria that the interested borrowers need to meet to be eligible for the loan such as bank statement for the last two years, collateral etc, which may not be practical for poor families. The annual interest rate varies from 7% for short term (1 year) to 10% for medium to long term.

2.7 Housing and energy

Bamboo and wood are the common traditional building materials in the village. About 90% of the villagers live in poorly made bamboo houses. As villagers don't have knowledge on building higher quality and permanent bamboo house, their houses need to be maintained regularly, at least once in two to three years. Their housing condition draws serious concern on poor living condition, health as well as pressure on bamboo forests.

Similarly, wood is the only energy source for cooking and heating in the village. Although, firewood collection is free in production forest and is easily available so far, the use of fire wood is not sustainable option as it is energy inefficient, unhealthy and will contribute to deforestation in the long run. Development and promotion of efficient sustainable energy option is highly recommended.

2.8 Local knowledge and expertise

In spite of various issues and problems in agriculture and natural resources sector, many useful knowledge and expertise exist in the village. It was observed that the most of the villagers have traditional knowledge on growing fruits and vegetables, though mostly they do for domestic consumption. The majority of Khmu people are adept in bamboo crafting and weaving (Table 4). Hmong people are skillful in embroidering, sewing and iron works. Some of them have knowledge on coffee plantation, traditional medicine, terrace making etc. Such local knowledge could be promoted and transferred locally through proper extension education activities.

Table 4: Available expertises and skills in the village

	Khmu	Hmong	Lao	Total
Bamboo crafts/ weaving	28	4	1	33
Construction	13	0	0	13
Fishnet	1	0	0	1
Iron works (smith)	5	8	0	13
Mechanics	1	6	2	9
Wood works	1	0	1	2
Embroidering	0	14	0	14
Nursing	1	0	1	2
Traditional medicine	1	0	0	1
Driving	1	8	0	9
Sewing	0	6	0	6
Terracing/paddy field making	0	2	0	2
Coffee plantation	0	1	0	1
Other	0	2	0	2
Total	52	50	5	108

2.9 Strengths, Weaknesses, Opportunities and Threats (SWOT) of socio-economic and natural resources situation of the village

Based on above analysis on socio-economic and natural resources situations of the Houaykhing village, a synthesis has been prepared using SWOT tool, which is provided in table 5.

Table 5: SWOT analysis of livelihood development options at Houaykhing village cluster

Strengths <ul style="list-style-type: none"> Many high value fruits, vegetable and cash crops can be grown in the village 	Weaknesses <ul style="list-style-type: none"> Unscientific agricultural practices such as rice cultivation without terrace in steep slopes. Such
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<p>which could potentially be cultivated commercially in large scale. Many villagers have already grown many of these high value crops for domestic use.</p> <ul style="list-style-type: none"> • Some seasonal and year around streams are available in the village that could be used for developing irrigation system. • Regulations for land zoning has been developed and approved by authorities that divides forest lands into three categories: utilization, conservation and protection forests. • According to new zoning rule, each village member has got at least three plots equivalent to at least 1 ha/plot that could potentially be used for permanent agriculture and producing cash crops. • Good existing market for livestock, chilli, dukduwa, coffee, bamboo etc. • Road under construction that would facilitate the marketing of agriculture products in the near future. • Rich forest resources with a lot of high value NTFPs that could potentially be managed and produced commercially (such as dukduwa, bamboo, wild mushroom and several varieties of local herbs) 	<p>practice would increase soil erosion and would reduce soil fertility and moisture.</p> <ul style="list-style-type: none"> • Mono cropping and less optimization of agricultural lands. Villagers cultivate one season only which could potentially be used also for winter farming for some legume or other cash crop species to generate cash income, which would also enhance soil fertility. • Lack of irrigation facility to develop paddy field. • Free livestock grazing in forests has not only contributed to forest degradation but also cattle mortality. • Lack of market system. Villagers are unable to sale many of their high value crops. • Lack of easy credit facility to initiate agro business. • Existence road condition is not good enough for regular transportation. • Lack of forest management plan and activity leading to forest degradation. • Lack of local knowledge on forest resources management. • Lack of enough labor availability for intensive agriculture as they depend upon family members for agricultural labor. • Peoples' cultural mindset that rice is only the crop to sustain their livelihood and the slash and burn is the easiest way for rice production. • Scattered agricultural lands making difficulty for irrigation and to implement land development plan. • Land zoning regulations are not strictly followed by villagers. • Wood based energy system may lead to more forest destruction in the future.
<p>Opportunities</p> <ul style="list-style-type: none"> • Developing markets for existing agricultural crops (fruits, vegetable and other cash crops) through market promotion strategies which would encourage people to grow alternative crops for cash earning and would discourage slash and burn practice. • Enhancing existing livestock market by introducing improved livestock raising system. • The area is suitable for growing some high value cash crops that have existing market in Luang Prabang such as cassava, coffee, tobacco, bamboo furniture and handicrafts. • The forests of Phonsay district and surrounding areas have rich bamboo forests with several species suitable for construction, weaving, furniture and food. The bamboo forest has not been managed currently but has potential to be managed 	<p>Threats</p> <ul style="list-style-type: none"> • Increasing village population may lead to higher demand for lands for agriculture causing more slash and burn in the future. • The promotion of livestock may lead to more forest degradation by allowing cattle free grazing in the forest as villagers don't have culture to confine the cattle in shed or their farm land. • Good market of products may also encourage people to seek more land to make more money for luxury. • Price fluctuations of the products such as chopstia's price went down from 4000 kip/Kg to 2000 Kip/Kg recently. Market prices are generally controlled by the foreign buyers.

<p>and used for livelihood development in the region.</p> <ul style="list-style-type: none"> • The existing streams can be developed for water storage and irrigation system to develop paddy fields for permanent agriculture. • Policy bank located in Phonsay district is willing to support poor farmers to raise livestock in the rural areas. • Bamboo briquette could be developed to substitute fuel wood, which would provide energy efficient cooking facility and the briquette may have good markets in the city areas as well. 	
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3. PCM for livelihood development

3.1 Problem analysis

Figure 1 provides the detailed cause and effect relationship among the problems that exist in the village. Forest concession, shifting cultivation, forest encroachment for agricultural land expansion, open access grazing and wood based energy for cooking and heating are found to be the major causes of deforestation in the village. Forest management activity doesn't exist in the village. Although, the recent zoning of the forest has restricted villagers to expand slash and burn plots in the conservation and protection forests, they are still free to collection NTFPs from these forests. However, villagers also said that the zoning rules are not strictly followed as villagers don't have option but to expand their agricultural field for rice production which is the only livelihood option so far in the village.

Shifting cultivation is not a problem itself but was found to be the results of many other root problems that the village have. It is a traditional approach and knowledge that villagers have acquired from their ancestors. Therefore, the majority of them have not been exposed to improved agricultural techniques such as permanent agricultural using rice terrace, integrated cropping, water harvesting and irrigation etc. Similarly, there are no technical inputs from concerned government and non governmental agencies on improved agricultural system.

Villagers also indicated that lack of permanent water sources or irrigation facilities have forced them to depend on upland rice production. The subsistence agricultural practice without land management has significantly reduced the productivity of land, forcing people to look for new land every year for subsistence rice production. Moreover, villagers also fear to take risk switching to new techniques until they are sure that it will benefit them significantly.

Villagers indicated that unavailability of enough labors restricts them to apply intensive agricultural technique, as they largely depend upon family labors. Group farming or labor exchange system has not been the part of their traditional agricultural system. As the community is new, such system has not been established yet. Moreover, the distant and scattered agricultural fields or plots make them difficult to cooperate for the agricultural labor exchange.

Similarly lack of market system for agricultural products has discouraged people to produce fruits, vegetables and other cash crops in commercial scale. Villagers mostly depend upon middlemen to sell their product, which, according to villagers, has not been a reliable system so far.

Livestock is an important source of income in the village and it has a good market so far. However, the livestock raising technique is very primitive and unscientific. Villagers raise livestock freely in the forest without proper care and management. By such practice, villagers are not only losing valuable compost manures that could be used to fertilize their agricultural land but also are making their livestock prone to various diseases that could be contaminated through wild animals. Villagers have already experienced increasing cattle mortality in the forest.

Figure 1: Problem Analysis

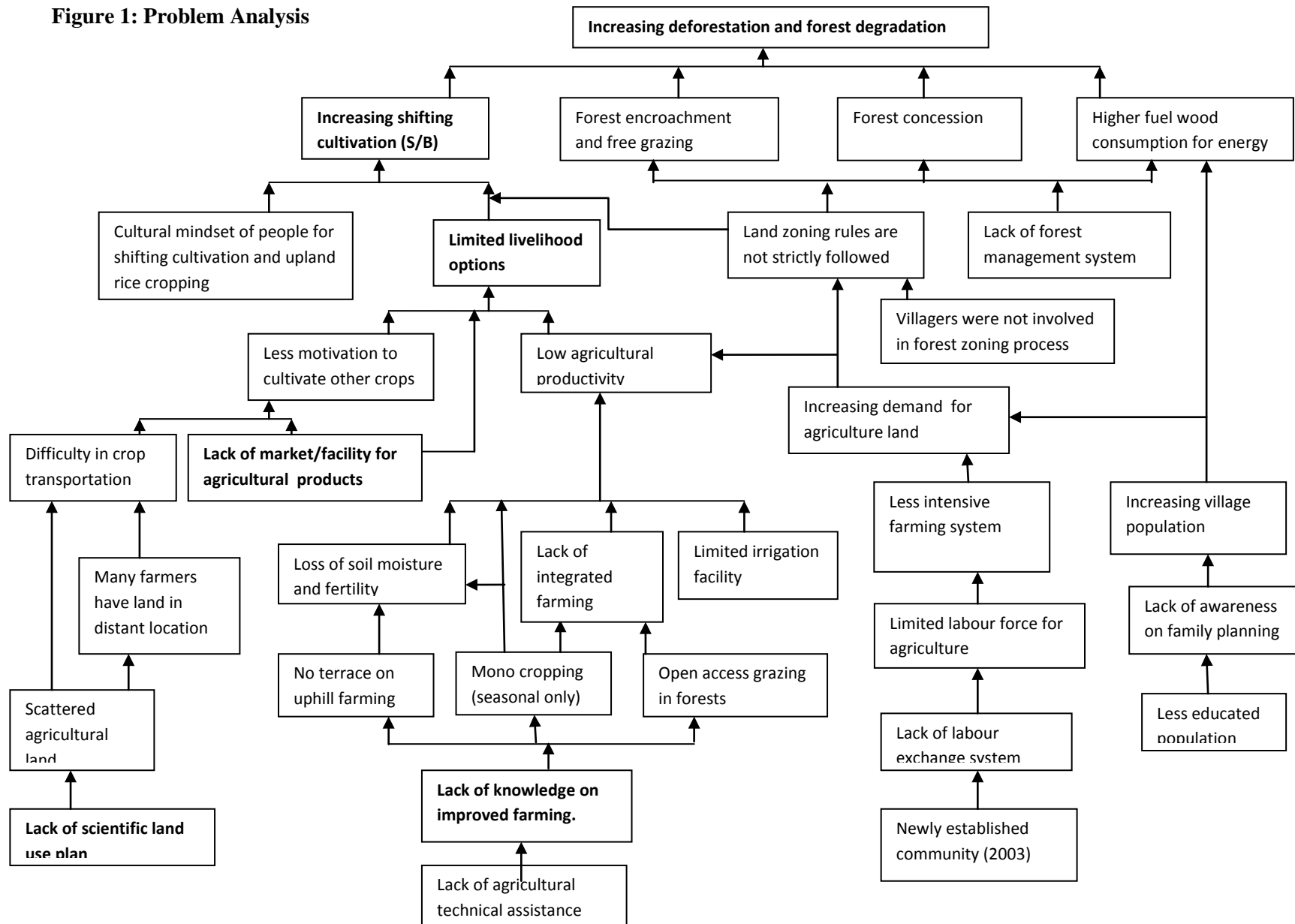
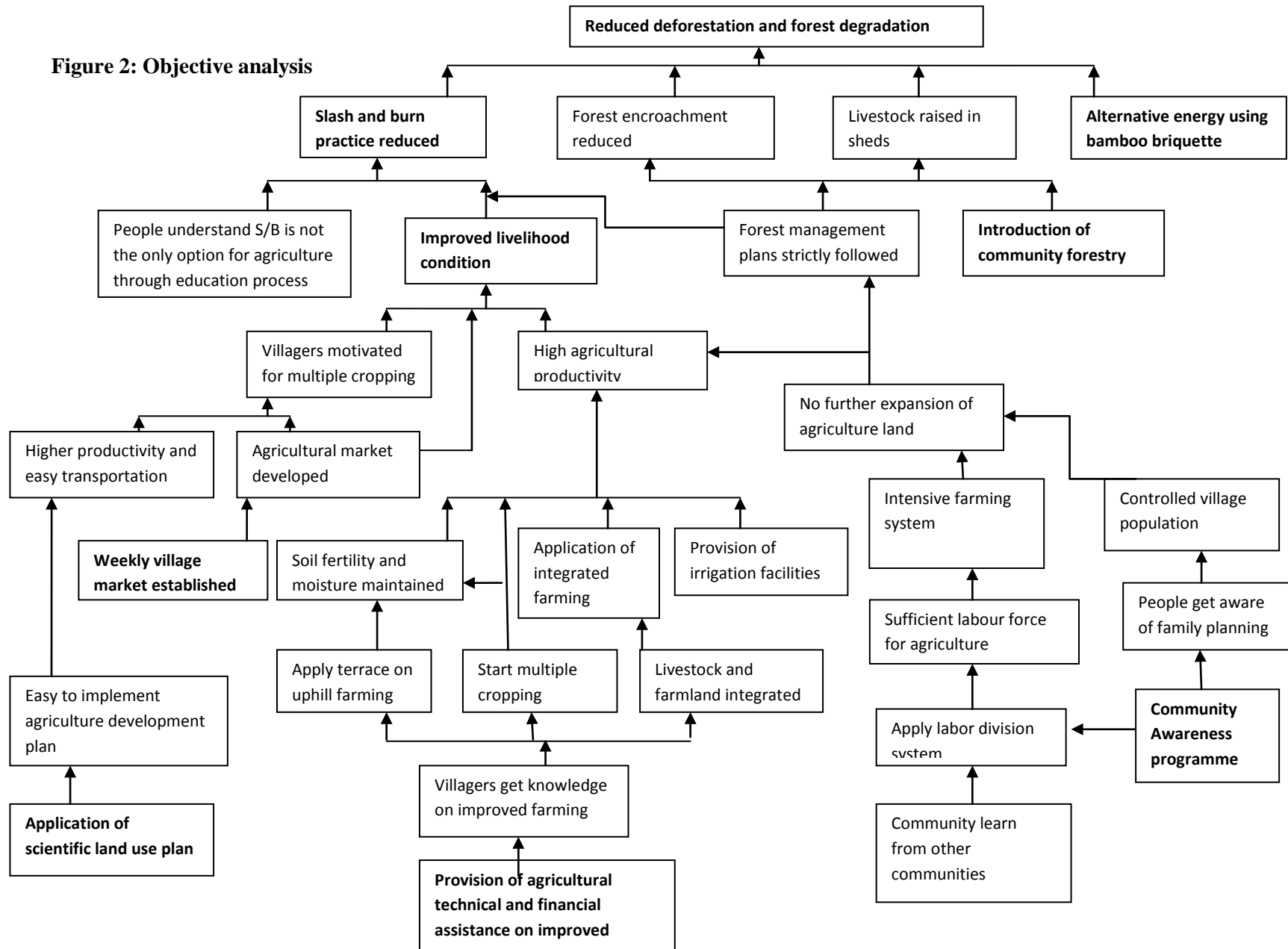


Figure 2: Objective analysis



3.2 Strategies for alternative livelihood

The objective analysis (Figure 2) has indicated some of the important interventions (highlighted in bold) that are suggested to be implemented to reduce deforestation and forest degradation in the village. The analysis showed that scientific re-zoning of land with clear land tenure system, development of agricultural market system, provision of technical and financial assistance on improved agricultural system, community awareness programmes, provision of alternative energy and introduction of community forestry for the better management of forest are crucial both for providing better livelihood options and to reduce the deforestation and forest degradation. During the survey, villagers also indicated their interests in various options that they would like to adopt to improve their livelihood, which are listed in Table 6. The suggested interventions are discussed in details in the following sections. The demonstration livelihood activities were evaluated during the workshop and the final results are provided in Annex A-2. The names of the interested farmers for demonstration livelihood development activities are provided in Annex B.

Table 6: Number of families Interested in different types of livelihood development options

	Khmu	Hmong	Lao	Total
<u>Interests in livestock</u>				
Chicken/ducks	38	24	4	66
Pig and goats	40	13	2	55
Buffalo and cow	16	25	1	42
Introduction of improved livestock raising	6	8	0	14
<u>Interests in improved agriculture</u>				
Paddy field development (Terracing)	8	20	0	28
Development of irrigation system	8	9	0	17
Coffee plantation	16	17	0	33
Bamboo plantation	3	3	0	6
Corn cultivation	2	1	0	3
Cassava	3	1	0	4
Fruit tree plantation	8	6	0	14
Fisheries	0	2	0	2
<u>Other interests</u>				
Weaving	16	13	0	29
Construction training	3	1	0	4
Cooking training	1	0	0	1
NTFP promotion	3	2	1	6
Furniture business	3	0	0	3
Mechanical works	1	7	1	9
Business development	2	10	3	15
Iron works	0	1	0	1
Other	0	2	1	3

3.2.1 Agriculture sector development

After assessing the current situation, it is concluded that the immediate abolishment of the current slash and burn practice is not a feasible option. A phase wise and gradual approach should be adopted. In the short run, the focus should be given to improve the livelihood condition of people by improving the current agricultural practices and by developing agricultural market system. In the long run, people should be encouraged to adopt permanent agriculture and intensive farming system by applying scientific land use and management practices.

While the majority of the villagers have realized that slash and burn is not a sustainable agricultural practice, they have serious concern on immediate abolishment of the practice. They clearly indicated that as shifting cultivation has been the traditional practice and is one of the major sources of livelihood, they cannot imagine their livelihood without it unless they are sure about the alternative livelihoods. They, however, are ready to change the practices towards improved system and gradual phasing out of slash and burn once they are assured that the alternatives will benefit them positively.

The current shifting cultivation practice has to be gradually improved by improving cultivation practices such as soil management, fertilization, agro-forestry and integrated cropping. Such approach will provide adequate time to progressively phase out shifting cultivation through the creation of alternatives such as off-farm employment and increasing production from permanent cultivation. The use of improved soil management to improve soil fertility would permit farmers to increase the period of cultivation and decrease the fallow period, and the introduction of tree crops and new crop varieties would increase the productivity per unit area.

3.2.2 Improved system for livestock raising

Villagers should be encouraged to raise their cattle in shed or confined area either individually or in a group. Especially, they should be encouraged to confine their livestock closer to their rice fields in order to use dung as compost manure to fertilize agriculture land. Stall feeding or grazing in confined areas should be encouraged to avoid forest destruction and cattle mortality.

3.2.3 Commercial farming of cash crops

As aforementioned, several kinds of NTFPs could be produced commercially and marketed for income generation. However, the commercial potential of these products have not been tapped yet. Cash crops should be cultivated as agro-forestry practice to maximize land productivity. The some of the cash crops that have readily available market in the city and could generate significant income to the villagers are discussed below.

(i) Coffee

Coffee is one of the potential cash crops that could be introduced in the village for the large scale commercial production. A few villagers have already planted coffee for their domestic consumption. Coffee plantation would not only provide lucrative income to the villagers annually, would also help reforestation of old fallows as coffee requires shading for its better productivity. More than 60 villagers have shown interests in coffee plantation and 33 of them are already interested to participate in the demonstration coffee plantation.

We discussed with successful coffee entrepreneur Mr David Dale, director of Saffron coffee in Luang Prabang, for the possibility of collaboration to introduce coffee in the Houaykhing village. Mr Dale was highly positive for the possible collaboration to introduce coffee in Houaykhing village. He suggested introducing coffee Arabica, with proper shading and organic fertilization. According to Mr Dale, he purchased fresh coffee at the rate of 4000 Kip/Kilo this year and the price is expected to grow steadily due to growing international market. He also assured that he would be able to buy all the coffee produced by the villagers. According to him, one hectare land could yield 3000 to 10000 kilos of coffee annually. The first harvest starts 2.5 years after the plantation.

3300 seedlings per hectare are required for plantation. Currently, one coffee seedling costs 1000 Kip. Therefore, establishment of village level nursery has been suggested to produce coffee seedlings in large scale. The nursery could also be used for other useful species such as bamboo and fruit trees. TABI has already introduced coffee in few villages in Phonsay district and has a plan to introduce small scale coffee plantation in Houaykhing village. TABI is interested to

collaborate to introduce coffee in the village and to establish a coffee nursery. Similarly, Saffron is also interested to train villagers on organic coffee plantation.

(ii) Tobacco

Tobacco is one of the common crops that many villagers have planted in their backyard for their personal consumption. Tobacco has a well established market in Luang Prabang. We discussed with a tobacco company in Luang Prabang that currently buys tobacco from several villages. They have growing demand for raw tobacco and are highly interested to collaborate with villagers for the commercial cultivation.

The company informed that tobacco has several advantages. This crop can be planted after rice harvesting, making use of land during winter season, would enhance soil fertility, and would contribute to enhance rice productivity. It takes only three months from plantation to final harvesting. One hectare land can yield 6000 Kg tobacco. The current market price varies from 500 to 1000 Kip/Kilo, hence would provide net benefit of 3 to 6 million Kip per hectare. The company said that at least 30 hectare land should be available in the village for the tobacco cultivation and to establish small drying factory at village, which would also provide employment to the villagers. The company provides seeds, technical knowledge and fertilizer to villagers. The villagers would have to provide land and labor contribution only.

(iii) Mulberry plantation, silk production and weaving

The survey indicated that many village women are skillful in weaving works, especially those from Khmu community. 30 women showed interests in building their capacity on high quality weaving works and requested for training and necessary supports for the purpose.

We discussed with Mrs Kommaly Chanthavong, director of Mulberries Company in Phonesavanh city. She is a renowned development practitioner who has dedicated more than 20 years to develop mulberry plantation, silk production and community weaving program and is currently working with more than 600 villagers. She also provides training to villagers for high quality weaving. According to Mrs Kommaly, beside capacity building on high quality weaving, it would be better to introduce Mulberry plantation and silk production in the village as there is a high demand for silk and silk products both in national and international markets. Her company

is also ready to provide necessary training to villagers for both mulberry plantation and silk production and is also interested to buy those products from the villagers.

(iv) Bamboo

Participants of the bamboo workshop reported that there are 13 species of bamboo in Houaykhing village. Of which, Mai Xang, Mai Hok, Mai Por, Mai Bong and Mai Lor are abundantly available in the forests, whereas, Mai Xod, Mai Hia, Mai Pok, Mai Lai, Mai Nor wan, Mai Nor Kom, Mai Nor Lan and Mai Kao Lam are rarely available. Due to lack of management, bamboo resources have been dwindling rapidly since the last few years. Participants also reported that currently they have to travel at least one hour to collect bamboo culms from the forest which used to be less than 15 minutes 10 years back. Bamboo has been locally used for making houses, mat, hat, baskets, fence and trays. About 90% of the houses in the village are made of up bamboo. The results of bamboo workshop have been provided in Annex A.

Bamboo is easy to cultivate and grows profusely and has a very short rotation (3 to 6 years). Villagers should be encouraged to plant bamboo in their homestead gardens and agricultural fields as agro-forestry. Bamboo has a very good market both locally for making houses and small handicrafts and also in Luang Prabang for furniture industries and housing.

The interested villagers should be trained in bamboo cultivation, furniture making and housing. A small to medium size bamboo industry should be promoted locally to commercialize bamboo resource and to provide employment to the villagers. The potential bamboo factories that could be promoted in the village are bamboo furniture, bamboo toothpick, bamboo housing, bamboo mats, bamboo chopstick and bamboo charcoal.

(v) Other crops

Dukduwa, chopstia and cassava are some of the important crops that villagers would like to cultivate in large scale in their fallows. However, market prices of these crops are mostly controlled by foreign buyers and are likely to fluctuate depending upon market demand in China. For example, the price of chopstia dropped from 4000 Kip/Kilo two years ago to 2000 Kip/Kilo this year due to oversupply in the market. However, the price of dukduwa is still steady, about 12000 Kip/Kilo an average.

3.2.4 Forestry sector development

Community forestry should be introduced to initiate forest management activities in the village by decentralizing responsibilities and ownership of forest management to the villagers. Local communities should be involved fully in the preparation of forest management plan, rules and regulations. A local institution such as forest management committee should be established to look after overall forest management activities and to enforce forest management rules and regulations.

The current land and forest management regulations have focused only on rules and restrictions for forest utilization but have nothing about technical aspect of forest management. A thorough capacity building and awareness raising activities are required to build local capacity on technical aspects of forest management such as to prepare and implement a forest management plan systematically to achieve long term goal of forest management.

However, the implementation of forest management plan may affect some villagers negatively especially those who fully depend on forests for their livelihood. For example, the enforcement of the current zoning regulations has impacted some people's livelihood severely. Alternative options should be guaranteed for these people before implementing forest management plan or enforcing forest zoning regulations.

3.2.5 Access to market: establishment of weekly village market

Lack of market was found to be one of the discouraging factors for villager to grow potential cash crops in large quantity. The villagers currently depend upon middlemen to sell their livestock and agricultural products. In order to promote agricultural products, a weekly village market is recommended. Such system has been practised in many countries to promote market for local products. In this system, a particular routine day once a week (generally weekend) in a particular location is set for village market, where all the villagers bring their products for sale. Such system would facilitate direct linkage between villagers and city businessmen, as they

would know when they should come to village for business. Such system would also slowly discourage barter system and would increase cash flow in the village.

Similarly a market information system should be established to provide villagers information on potential saleable products and market prices. This would also facilitate them to choose the right crop to cultivate. In addition, villagers would be benefitted if a truck can be donated to them to transport their products from village to nearby cities as per the market demand.

3.2.6 Developing saving credit mechanism

The most of the villager said they don't have access to credit or financial resources to start new venture, though there is a policy bank that could provide loan for small farmers. They either don't have information about the bank loan or there might be a lengthy administrative process involved to get accepted for the loan. Therefore, a village level saving credit or micro credit scheme would benefit villagers to get easy access to small credits. The mechanism of saving credit scheme varies according place to place and largely depends upon members' decision. However, the mechanism should provide easy access to credit to all the villagers as they require. A saving credit or cooperative board should be formed representing various sector of the village including school, village leaders, ethnic groups, business enterprise, local bank etc. A clear manual and policy should be developed to regulate the saving and credit mechanism. The learning from other micro-credit schemes would be an asset.

3.2.7 Alternative energy using bamboo/wood waste briquette

As an alternative to current energy system which is largely fuel wood based, development of bamboo or wood waste briquette system would be an option. Such system uses any wood or bamboo waste and other waste materials to make briquette. The briquette system is energy efficient, healthy and has also good market potential in nearby city such as Phonsay or Luang Prabang where many restaurants depend on wood charcoal for cooking. Training and installation

of one full carbonized-grinder briquette making system, that produces about 1 ton/hour, would cost about USD 25000.

3.2.8 Local capacity building through skill development training and community awareness programme

Beside improving agricultural system and establishing village market, the project should also enhance local skills by providing various hands-on training and capacity building activities. Some of the training needs identified during the survey are provided below.

- Building improved bamboo house (completed)
- Bamboo furniture and crafting
- Bamboo/wood briquette making
- Weaving
- Improved and intensive farming system
- Improved livestock raising system
- Community forestry/forest management

Similarly, public awareness campaigns and conservation education activities should be conducted to sensitize the rural community to the adverse impact of uncontrolled shifting cultivation and to adopt appropriate alternatives. Various awareness and education programme on forest management and REDD+, family planning and population control, social harmony for group agriculture etc should also be initiated for the overall development of the village.

4. Project Implementation Strategies

Gradual process with active community participation is vital for the successful implementation project activities, especially while working with community whose livelihoods are fully dependent on subsistence agriculture. Phase approach is recommended for the gradual changes in the current practices, to improve local livelihood and to curb deforestation in Houaykhing village

cluster. The development phase should focus on appropriate land use practices for sustainable production which should be complemented by the improvement of existing shifting cultivation practices, integrated livestock farming, horticulture development and small-scale income generation schemes. The following three phases approach should be applied to abolish slash and burn practice in village and to enhance livelihood options.

(I) Phase I: demonstration activities

Based on farmers' interests and needs, a few demonstration activities should immediately be implemented in order to assess their effectiveness in the long term development plan. The demonstration activities would also encourage and motivate farmers to actively participate in the project plans and activities. The list of farmers who are interested in one or more demonstration activities are provided in Annex B. The following demonstration activities are recommended which are based on the interests and suggestions from villagers.

- Manage and improve the cultivation practice in the existing fallows to maintain soil quality and to increase land productivity through agro-forestry, terracing in slope lands, multiple cropping and intercropping with legume crops etc.
- Provide necessary supports to existing paddy fields or interested farmers who would like to develop paddy fields during the demonstration stage. For example, support for constructing small dams in the existing water sources which could potentially irrigate a few paddy fields.
- Encourage to apply improved livestock raising system (in sheds or confined areas). Provide necessary inputs and supports to construct shed or fencing system and to cultivate improved grass variety.
- Increase labour efficiency in agricultural activities by encouraging villagers to initiate group farming or establishing cooperation for labor exchange.
- Encourage and build capacity on the cultivation of cash crops and NTFPs. Provide necessary inputs and techniques such as seeds and fertilizer for the cultivation of such crops. Currently, coffee, tobacco, mulberry, bamboo handicrafts and dukduwa have potential market opportunities which could be grown and pre-processed at village level,

providing employment opportunities for the farmers. The concerned entrepreneurs in Luang Prabang are interested to cooperate with villagers to promote those cash crops.

- Specific capacity building activities should be conducted for participating farmer groups in the specific demonstration activity. For example, the coffee group should be provided training on coffee plantation and pre-processing.
- Develop market for agricultural products. A weekly village market should be initiated to promote market for village products and to develop linkage with city market. A necessary supports (such as infrastructure and vehicle) should be provided to village to establish weekly market.

(II) Phase II: evaluation of demonstration activities

The demonstration activities should be evaluated once a year to assess their overall effectiveness on land productivity, people's livelihood and forestry sector. Evaluation should be based on capability approach to assess people's capacity to adapt new practices and their responses towards the outcome of the demonstration activities. The evaluation process should closely involve participating farmers in order to get real and clear pictures of impacts of demonstration activities. The long term plan should be developed or revised based on the evaluation report of demonstration activities.

(III) Phase III; Long term activities

Based on the evaluation of demonstration activities, the long term strategy should be developed or revised and implemented in agriculture sector to abolish slash and burn practices. However, the following actions are suggested to consider in the long term strategies'

- Scientific zoning of agriculture land should be done in order to consolidate scattered fallows. This would make easier to implement agricultural development activities such as establishment of irrigation system, to make easy access to all the farm lands and to increase labour efficiency. The upland farms in steep slope should be moved to lower to middle land to reduce soil erosion and labour requirement.

- The strategic agricultural development activities should be implemented such as development of irrigation system, development of agricultural sub-zoning to categorize land for different crops etc.
- Land tenure policy should be clear and legalised to provide clear land title and ownership to farmers. There should be clear and legal mechanisms for land ownership transfer. All the agriculture lands should be registered with the local and district authorities with exact size, location and title information.
- Once villagers learn the improved agricultural practice and start increasing their land productivity through demonstration activities, they should be encouraged to practise permanent agriculture system. Initially, villagers may apply combined practises of both slash and burn and permanent agriculture. Once they are ensured that permanent agriculture can sustain their livelihood, they should be discouraged to cultivate rice in old fallows. In addition, there should be both legal and incentive measures to motive farmers to improve and maintain physical qualities of their land.
- Intensive farming system should be adopted in permanent agricultural land. Farmers should be encouraged to diversify crop production to satisfy cash income needs from permanently cultivated land and while they may continue to get subsistence needs from shifting cultivation until their needs are not fully met from permanent lands. A package training on agro-forestry, multi cropping and two season farming (such as legumes crops followed by rice) to maintain the soil fertilization and increase the land productivity. Similarly, marginal land should be planted with cash crops such as bean which would fix nitrogen in the soil and would increase the total productivity.
- Sufficient technical supports should be provided to help farmers to increase production on marginal land for cash crop or pasture development and should encourage them to adopt conservation practices on such lands for sustainable.
- In order to supply enough labour for intensive farming, villagers should be encouraged to establish a smaller group by their interests, or ethnicity or by other criteria to develop cooperation for labor exchange or group farming. This would solve the problem of labor requirement for initial farm preparation such as terrace making in the village.

- Scientific forest management practice should be initiated to improve the quality and quantity of forest through community forestry approach by decentralizing ownership and management responsibilities to the communities.
- As an alternative to current energy system, which is largely wood based, development of bamboo or wood waste briquette system should be developed.
- A village level saving credit or micro credit scheme should be developed for villagers to get easy access to small credits for agricultural and business development.

5. Conclusion

Based on thorough assessment of natural and human resources, it can be concluded that Houaykhing cluster village has ample of opportunities and potentials for developing long term sustainable livelihood options. However, it is important to change the perception and attitudes of people to switch from current practice to improved techniques. Gradual process is required which should include demonstration of proven techniques, motivation of farmers through incentives such as technical and financial supports. Based on the evaluation of the demonstration activities, a long term development strategy should be developed which should include not limited to both policy and practices of current agricultural and forest management and develop market for high value agricultural products.

Annex A: Workshop results

Annex A-1: Evaluation of livelihood improvement strategies

Livelihood improvement options	Very important	Important	Less important
Development of terrace for permanent agriculture	18	3	0
Multi-cropping/two season cropping	16	5	0
Applying labour exchange system for providing required labor for intensive farming	14	7	0
Raising cattle in shed/confined areas	15	5	1
Commercial cultivation of cash crops	19	1	1
Alternative energy using bamboo/wood charcoal to make briquette for energy	15	2	4
Developing market for agriculture products	19	1	1
Cooperative saving credit scheme	15	6	0

Annex A-2: Evaluation of livelihood strategies by groups (3 Hmong and 3 Khmu groups)

Table A-2-1: Perceptions of workshop participants regarding development of terracing

Questions regarding terracing	Responses	Khmu	Hmong	Total
Heard about terrace?	Yes	2	2	4
	No	1	1	2
Have you made terrace?	Yes	2	0	2
	No	1	3	4
Do you know how to make terrace?	Yes			0
	No	3	3	6
Do you believe it will improve rice plantation?	Yes	3	3	6
	No			0
Would you apply it if you know how to do terrace?	Yes	3	3	6
	No			0
Why would you apply terrace?	To learn its application	3	2	5
	Prefer terrace compared to upland	1	0	1
	To do permanent agriculture	0	1	1
	To improve	1	0	1
	To encourage new generation to stop slash and burn	0	1	1
Advantages of terracing	Soil conservation	3	3	6
	Permanent rice cultivation	3	2	5
	Maintain soil nutrient	3	1	4
	Maintain soil moisture	2	1	3
	Improve productivity	0	1	1
	Reduce slash and burn	0	1	1
What is the major difficulty and disadvantages of terrace?	Difficult to dig land make terrace in upland	1	2	3
	If no rain, difficult to cultivate in terrace	1	1	2
	Labor intensive and may be difficult	1	2	3

Table A-2-2: Perceptions of workshop participants regarding raising cattle in shed or confined areas

Questions about raising cattle in shed or	Responses	Khmu	Hmong	Total
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confined areas				
Heard about cattle shed?	Yes	3	3	6
	No	0	0	0
Do you have cattle shed?	Yes	1	1	2
	No	2	2	4
Do you know how to raise cattle in shed?	Yes	1	0	1
	No	2	3	5
Is it a better practice?	Yes	3	3	6
	No	0	0	0
If you get necessary supports, would you practice it?	Yes	3	3	6
	No	0	0	0
Main advantages?	It is safe	0	1	1
	Easy to take care of cattle	1	1	2
	Less chance of disease contamination	2	3	5
	Prevent forest degradation	1	2	3
	Better care of cattle	1	2	3
	Cow dung can be used for manure	2	1	3
	Less chance of stealing	1	2	3
Main disadvantages?	Difficult to make shed	1	2	3
	More labor requirements	1	1	2
	Need to find food for cattle	1	0	1

Table A-2-3: Perceptions of workshop participants regarding development and promotion of alternative energy

Questions regarding alternative energy	Responses	Khmu	Hmong	Total
Have you heard about charcoal briquette?	Yes	3	1	4
	No	0	2	2
Do you know how to make wood charcoal?	Yes	0	0	0
	No	3	3	6
Do you believe alternative energy would prevent deforestation?	Yes	3	3	6
	No	0	0	0
If you know how to make briquette, would you use it for cooking?	Yes	3	3	6
	No	0	0	0
What would be the reason to change from wood to briquette?	Easier to use	1	0	1
	Would save labor for collecting fire wood	1	1	2
What do you think the major benefit of using alternative energy?	Save time	1	2	3
	Prevent deforestation	3	3	6
	Easy to use	2	2	4
	Healthier than wood	1	1	2
Main disadvantages of briquette as an alternative energy?	No disadvantages	2	2	4
	Process may be difficult	1	1	2

Table A-2-4: Perceptions of workshop participants regarding development of village market system

Questions about village market system	Responses	Khmu	Hmong	Total
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Developing market system is important?	Yes	3	3	6
	No	0	0	0
Heard about weekly village market?	Yes	3	3	6
	No	0	0	0
Weekly market will encourage you to produce more crops?	Yes	3	3	6
	No	0	0	0
Main advantages?	Easy to buy products	1	2	3
	More focus on cash crops than upland rice	1	1	2
	Would improve villagers livelihood	0	1	1
	Easy to sell products to city buyer	2	0	2
	Generate more income	2	1	3
	Villagers know when to sell products	1	1	2
	Easy to link with major markets	1	0	1
Main disadvantages?	More thieves	1	3	4
	More garbage	1	0	1
	More expenses	0	1	1
	Low price for the products	1	0	1

Table A-2-5: Perceptions of workshop participants regarding cultivation and promotion of cash crops

Questions about cash crops	Responses	Khmu	Hmong	Total
Do you cultivate cash crop	Yes	1	1	2
	No	2	2	4
How much extra income do you have from cash crops		200000 Kip	500000 Kip	
Do cash crops improve your total income?	Yes	3	3	6
	No	0	0	0
Are you interested to plant cash crop in large scale if you get support?	Yes	2	3	5
	No	1	0	1
Main advantages of cash crops?	More income	2	2	4
	Prevent deforestation	1	2	3
	Improve livelihood	2	2	4
Main disadvantages?	Livestock may destroy crops	1	1	2
	If no market then wastage of time	0	1	1
	No market	1	2	3
	More labours	0	1	1

Table A-2-6: Perceptions of workshop participants regarding establishing labour exchange system or group farming

Questions about labor exchange or group farming system	Responses	Khmu	Hmong	Total
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Heard about labour exchange system?	Yes	3	3	6
	No	0	0	0
Would it help agriculture improvement?	Yes	3	3	6
	No	0	0	0
Are you interested to apply such practice?	Yes	3	3	6
	No	0	0	0
Main advantages?	Can finish work earlier	2	3	5
	Bring social harmony	1	1	2
	People can exchange knowledge	1	1	2
Main difficulties?	Some people are lazy and not interested	1	1	2
	It is more hard work	0	1	1
	No difficulties	1	1	2

Annex A-3: Summary of bamboo availability and uses in Houaykhing cluster

Questions regarding bamboo	Houaykhing Village	Phakbong Village	Houayha Village	Houaythor Village
Bamboo species and availability	<ul style="list-style-type: none"> - Mai Xang – abundant - Mai Hok – abundant - Mai Por abundant - Mai Bong – abundant - Mai Lor – abundant - Mai Xod – rare - Mai Hia – rare - Mai Pok – rare - Mai Lai – scare - Mai Nor wan – scare - Mai Nor Kom – scare - Mai Nor Lan – scare - Mai Kao Lam – rare 	<ul style="list-style-type: none"> - Mai Hok - abundant - Mai Xod - abundant - Mai Hae - abundant - Mai Norlan - abundant - Mai Hia - scare - Mai Xang - scare - Mai Nor wan – scare 	<ul style="list-style-type: none"> - Mai Xang – abundant - Mai Hae – abundant - Mai Por – abundant - Mai Hia – abundant - Mai Lan – abundant - Mai Nor Kkom – abundant - Mai Hok – scarce - Mai Xod – rare - Mai Bong – rare - Mai KaoLam – rare - Mai Pok – rare - Mai Lor – rare 	<ul style="list-style-type: none"> - Mai Xang – abundant - Mai Hia – abundant - Mai Xod – abundant - Mai norLan – abundant - Mai Lai – scarce - Mai Bong – rare - Mai Kao Lam – rare - Mai Norwan – scare - Mai Hok – scare
Current uses of bamboo	Mats, baskets, straws, hats, trays, fence, etc	Walls, mats, baskets, fence livestock huts, roof	baskets, huts, houses, paper, for sale, wall, brooms, fence, chairs, doors, beds	Baskets, wall, houses, beds and food
Resource availability compared to 10 years ago	Less available	More available	Less available compared to 10 years ago	Very low due to over harvesting
Travel time to collect bamboo 10 years ago	15 Minutes walk	30 minute walk	1 hour walk	2 hours walk (20 minute drive)
Travel time to collect bamboo now	1 hour walk	20 minute walk	2 hours walk	3-5 hours walk (40 minute drive)
Average yearly income per family	500,000 Kip	150,000 Kip	500,000 kip	500,000 Kip

Annex A-4: Overall evaluation of workshop

Criteria	Indicators	Number of respondents (Total 22)
Relevancy of the workshop content	Relevant	22
	Not relevant	0
Meeting the expectations from the workshop	Fully met	11
	Partially met	11
	Not met	0
Understanding of the contents	Fully understood	6
	Partially understood	16
	Not understood	0
Major learning during the workshop	building bamboo house	19
	Making terrace and multi-cropping	9
	Making bamboo wall	9
	Treating bamboo	6
	Selecting bamboo for construction	6
	Bamboo harvesting techniques	5
	Knowing bamboo species	5
	Cement plastering of bamboo house	4
	Making durable bamboo joints	4
	Making traditional bamboo wall	4
	Bamboo utilization	2
	Important of cash crops	2
	Raising cattle in sheds	2
	Importance of bamboo for livelihood	1
	Learnt how to work in group	1
Suggestions for the content and topics of future training and workshop	Cultivating cash crops	12
	how to do terracing	10
	How to take care livestock	10
	Multi-cropping	7
	How to make bamboo briquette	3
	How to plant bamboo	3
	Construction	3
	How to do and use compost manure	2
	Two season cropping	2
	Steps of planting café and other crops.	1
	How to Construct 2 floors bamboo house	1
	how to do a small irrigation	1
How to improve future workshop?	More longer time	9
	More clearer explanation	9
	More slower explanation	5
	More practice	4
	More picture show	4
	More practice	4
	teach Lao language	1

Annex B: Interest groups for demonstration project activities

Annex B-1: Weaving group (29 women are interested, 13 and 16 women from Hmong Khmu communities respectively. The majority of Khmu women have experiences in weaving. This group will also be introduced to Mulberry plantation for silk production)

SN	Name	Ethnicity	SN	Name	Ethnicity
1	Ms. Daodee	Hmong	16	Ms. Siew	Khmu
2	Ms. Lia Ya	Hmong	17	Ms.Sen	Khmu
3	Ms. Ye Xong	Hmong	18	Ms.Sa	Khmu
4	Ms. Buavone	Hmong	19	Ms.San	Khmu
5	Ms. Sengchan	Hmong	20	Ms.Da	Khmu
6	Ms. Mai Neg	Hmong	21	Ms.Song	Khmu
7	Douangmany	Hmong	22	Ms. Bua	Khmu
8	Ms. Sondavan	Hmong	23	Ms. Mot	Khmu
9	Ms. Mai Lee	Hmong	24	Ms. Nom	Khmu
10	Ms. Sua ya	Hmong	25	Ms. Ui	Khmu
11	Ms. Sua Hur	Hmong	26	Ms. Lieng	Khmu
12	Ms. Dao	Hmong	27	Ms.Khamkeo	Khmu
13	Ms. Sengmany	Hmong	28	Ms. Vandy	Khmu
14	Ms. Phim	Khmu	29	Ms. Duang	Khmu

Annex B-2: Horticulture group (14 families are interested to cultivate various types of fruits in their fallows, with total land availability equivalent to 9 ha)

SN	Name	Ethnicity	land size (ha)
1	Mr. Noyi Hur	Hmong	1
2	Mr. Yia Tua Hur	Hmong	1
3	Mr. Vanthong	Khmu	0.5
4	Mr. Kham Oun Dok	Khmu	1
5	Mr. Chantha	Khmu	0.5
6	Mr. Jatu Lee	Hmong	0.5
7	Mr. Bounlieng	Khmu	0.5
8	Mr. Sommee	Khmu	1
9	Mr. Vanlay	Khmu	0.5
10	Mr. Jue Kong Ya	Hmong	0.5
11	Mr. Nor Tu Lee	Hmong	0.5
12	Mr. Somechit Ya	Hmong	0.5
13	Mr. Sesavanh	Khmu	0.5
14	Mr. Thongphat	Khmu	0.5

Annex B-3: Terrace group (28 farmers are interested to develop paddy fields for permanent agriculture. The majority of them are from Hmong community)

SN	Name	Ethnicity	land size (ha)	SN	Name	Ethnicity	land size (ha)
1	Mr. Thongpan Ya	Hmong	2	14	Jupoya	Hmong	0.5
2	Mr. Jer wawa	Hmong	2	15	Jatu Lee	Hmong	1
3	Mr. Mua Hur	Hmong	1	16	Buajong Ya	Hmong	1
4	Mr. Jongwa Hur	Hmong	1	17	Po Hur	Hmong	1
5	Mr. Thongthip Hur	Hmong	1	18	Xeng Ya	Hmong	1
6	Bounthavee Hur	Hmong	1	19	Jusua Hur	Hmong	0.5
7	Bounthan Hur	Hmong	1	20	Mr. Phonsy	Khmu	1
8	Vathai Hur	Hmong	0.6	21	Thongsing	Khmu	1
9	Nengpha Ya	Hmong	1.5	22	Thongpat	Khmu	1
10	Sayphone Hur	Hmong	1	23	Mr. Khamdy	Khmu	1
11	Bounlert Ya	Hmong	1.5	24	Singkeo	Khmu	1
12	Yia Thongya	Hmong	1.5	25	Soi	Khmu	1
13	Vatua Hur	Hmong	1.5	26	Chanthysot	Khmu	1
14	Jupoya	Hmong	0.5	27	Bounhueng	Khmu	0.5
15	Jatu Lee	Hmong	1	28	Vilaysak	Khmu	0.5

Annex B-3: Livestock group (14 farmers are interested to confine their livestock either in shed or confined areas using fencing, and are interested to integrate agriculture and livestock)

	Name	Ethnicity
1	Singkeo	Khmu
2	Phonesy	Khmu
3	Rhongthip Hur	Hmong
4	Nengphaya	Hmong
5	Chanthysack	Khmu
6	Jerwawa	Hmong
7	Bounlert ya	Hmong
8	Bounthan hur	Hmong
9	Sayphone Hur	Hmong
10	Vilaysack	Khmu
11	Thongpat	Khmu
12	Thongsing	Khmu
13	Vwatua hur	Hmong
14	Wathau hur	Hmong

Annex B-4: Coffee group (33 farmers are interested to introduce coffee plantation. Approximately 30 ha land is available for coffee plantation, which is the minimum requirement to attract the buyers)

SN	Name	Ethnicity	Land size (ha)	Shading	Location
1	Thongphanya	Hmong	1	yes	Nam Mat
2	Mr. Jongwa Hur	Hmong	0.5	yes	Nam Mat
3	Yaku Hur	Hmong	1	no	Nam Mat
4	Jaxeng Hur	Hmong	1	yes	hoi song
5	Saidua hur	Hmong	1	no	Nam Mat
6	Pajai Hur	Hmong	1	no	Nam Mat
7	Bouanthan Hur	Hmong	1	yes	Nam Mat
8	Xenglao Thor	Hmong	1	no	Nam Mat
9	Jerwawa	Hmong	1	no	Hoijik
10	Buajong Ya	Hmong	3	no	Nam Mat
11	Yia Tho ya	Hmong	1	no	Nam Mat
12	sayphone Hur	Hmong	0.2	no	Nabon
13	Wathai hur	Hmong	1	yes	
14	watua hur	Hmong	1	no	Nam Mat
15	Xengya	Hmong	1	no	Nam Mat
16	Bounlert Ya	Hmong	0.2	yes	Near Village
17	Nengpgaya	Hmong	0.5	no	Nam Mat
18	Mr. Phonsy	Khmu	1	yes	Nam Mat
19	Mr. Sisavanh	Khmu	1	yes	Near Village
20	Somdy	Khmu	0.5	yes	Hoi Jik
21	Mr. Chandy	Khmu	1	no	Phoukong
22	Vilaysael	Khmu	1	yes	Hoitalo
23	Bounhuang	Khmu	1	yes	Near Village
24	Setsavanh	Khmu	1	no	Hoi Yung
25	Bounleng	Khmu	1	no	Near Village
26	Bounpheng	Khmu	0.5	yes	Near Village
27	Chantha	Khmu	0.5	no	Hoi Yung
28	Mr.Soi	Khmu	1	no	Near Village
29	Chanthy sack	Khmu	0.5	yes	Near Village
30	Bounsiew	Khmu	1	yes	Hoitalo
31	Khampheng phoun	Khmu	1	yes	Near Village
32	Chanthy sot	Khmu	1	no	hoi bon
33	Mr Oi	Khmu	1	yes	Near Village

Annex B-4: Irrigation group (17 farmers are interested to develop irrigation system , half of them are from Khmu community.

Name of the water sources	beneficiaries	Ethnicity	Total areas to be irrigated	Total cost (USD)
Unknown	Mr. Noyi Hur	Hmong	4ha	1000
	Mr. Buajong Ya	Hmong		
	Mr. Pajai Hur	Hmong		
	Mr. Kham Oun Dok	khmu		
Hoi Pha	Mr. Bounlieng	khmu	0.5 ha	250
	Mr. Bounsiew	khmu		
Hoi Mat	Yia Lao Hur	Hmong	3.5 ha	750
	Mr. Singkeo	khmu		
	Mr. Wakuwa	Hmong		
Hoi Yung	Mr. Setsavanh	khmu	1 ha	625
	Mr. Vilay sack	khmu		
Hoi Yung	Mr. Vanthong	khmu	0.5 ha	250
Hoi Mat	Mr. Jatu Lee	Hmong	3 ha	1875
	Mr. Jupo Ya	Hmong		
	Mr. Phonesy	khmu		
Hoi Mat	Mr. Paji Hur	Hmong	2 ha	625
	Mr. Kauju Hur	Hmong		

Annex C: Tentative schedule, budget and partners/collaborators for capacity building and demonstration activities.

Activities		Estimated cost (USD)	2013												2014			Partners and consultants
			Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	
Activities: 1 Grouping Activities	1.1 Establishment of a village nursery (for coffee and fruit trees)	11000																TABI/DAFO
	1.2 Development of terrace in upland farms of interested farmers	9600																TBD (local)
	1.3 Improvement of irrigation system of existing paddy fields	5500																TBD (local)
	1.4 Introduction of improved livestock raising system	7000																TBD (local)
Activities 2: Livelihood improvements	2.1 Coffee plantation (including shade trees)	14500																Saffron
	2.2 Fruit tree plantation	2000																TABI/DAFO
	2.3 Bamboo plantation	1500																TBD (local)
	2.5 Establishment of cooperative weaving facility	9000																Mrs Kommaly
	2.5 Village market development	15000																TBD
Activities 3: Capacity building	3.1 Capacity building on weaving	9000																Mrs Kommaly
	3.2 Mulberry plantation and silk production	5000																Mrs Kommaly
	3.3 Improved stove/bamboo briquette for energy	10000																International
	3.4 improved bamboo products development (high quality handicrafts/furniture)	9000																Eldot
	3.5 Community forestry study tour to Nepal to demonstrate the show case of success of community forestry	15000																TBD
Total Budget		112100																

