

# Workshop Report

## Assessing the socio-economic impact of conservation agriculture in three districts (Pek, Kham, Nonghet) of Xieng Khouang Province

15 July 2010



Co-organized by : the Agriculture and Forestry Policy Research Center (AFPRC) of the National Agriculture and Forestry Research Institute (NAFRI) and the Provincial Agriculture and Forestry Office (PAFO) of Xiengkhouang Province

## Workshop Agenda

08:00 – 08:30 Registration

08:30 – 08:45 Introductory speech by the Director of PAFO

08:45 – 09:00 Introductory speech by the Vice-Director of NAFRI

09:00 – 09:40 1. Objectives of the study and methodology

09:40 – 10:20 2. Diversified patterns of land use changes in Xieng Khouang province over the last decade (2000-2010) and their socio-economic impact. Diffusion of conservation agriculture practices and constraints to diffusion.

10:20 – 10:40 Coffee break + group photo

10:40 – 11:20 3. Impact of socio-economic changes on farming systems and production strategies (2003-2009).

11:20 – 12:00 4. Adoption of conservation agriculture practices and constraints to adoption from 2005 to 2009.

12:00 – 13:30 Lunch

13:30 – 15:00 Three group discussions organized by zone including:

- Diagnosis presented in the policy brief
- Recommendations
- Critical analysis of land use maps

15:00 – 15:15 Coffee break

15:15 – 15:30 Plenary presentation by each group

15:30 – 16:30 Discussion on the implications for policy support to the diffusion of conservation agriculture

16:30 – 16:45: Closing remark by the Director of PAFO

## Workshop Report

### Assessing the socio-economic impact of conservation agriculture in three districts (Pek, Kham, Nonghet) of Xieng Khouang Province

- Leaned on permission paper of workshop program about assessing the socio-economic impact of conservation agriculture in three districts of Policy Research Center of Agriculture and Forestry. No 0164/ສຄນ.10 on 18/06/2010.
- Leaned on informed paper of National Agriculture and Forestry Research Institute. No 1252/ສຄກປ.10, on 21/06/2010.
- Leaned on data collected and analyzed by the CATCH-UP programme.

On this 15/07/2010 the meeting on “**Assessing the socio-economic impact of conservation agriculture in three districts (Pek, Kham and Nonghet) of Xiengkhouang Province**” was opened at the meeting room of the Provincial Agriculture and Forestry Office (PAFO). Mr. Bouasone DALAVONG (Head of Xiengkhouang PAFO) and Mr. Soulivanhthong KINGKEO (Deputy Director of NAFRI) were the chairmen for this meeting. There were 51 participants, including heads of technical departments, projects, 3 districts DAFO (Pek, Kham and Nonghet) and village chiefs.

#### **I. Introductory speech and opening the meeting by the chairmen**

Before opening the meeting Mr. Bouasone DALAVONG (Head of Xiengkhouang PAFO) introduced some point about the conditions of development in the province and the activities of PRONAE in the 3 focus districts of Xiengkhouang Province from 2003-2009. He also mentioned positive and negative aspects of conservation agriculture practices, especially in relation with herbicide use. So far, the socio-economic impact of conservation agriculture is less understood and he welcomed the study that was conducted by the Catch-Up Programme after the PRONAE had left from Xiengkhouang.

Likewise Mr. Soulivanhthong KINGKEO (Deputy Director of NAFRI) made a short introduction to the activities of the PRONAE project (NAFRI-CIRAD) from 2003 to 2009. The project designed innovative cropping systems and tested them in real conditions. It promoted conservation agriculture techniques adapted to the various natural and human environments found in its three target districts in Xieng Khuang Province : Pek, Kham and Nonghet. The joint efforts of NAFRI and and Xieng Khouang PAFO brought many successes but also did bring to the fore many challenges and constraints to the diffusion / adoption of conservation agriculture. These constraints were discussed many times, for example during meetings in Xieng Khouang on:

- action plan for agro-ecology in July 2007
- regional workshop on conservation agriculture in October 2008.

The PROSA project has been developed to help overcome the obstacles and to upscale conservation agriculture to the national level.

In 2009, after five years of activities of the PRONAE in Xieng Khouang, the Multi-country Support Programme for Agroecology (PAMPA) of the French Agency for Development (AFD), French Ministry of Foreign and European Affairs (MAEE) and French Fund for World Environment (FFEM) funded a study on impact analysis of conservation agriculture in pilot countries, including Laos. From October 2009 to April 2010, the Agriculture and Forestry Policy Research Centre (AFPRC) of the National Agriculture and Forestry Research Institute (NAFRI) in relation with the Catch-Up Programme (NAFRI-IRD-CIFOR) has been investigating the socio-economic impact of the innovative agricultural systems in these three districts.

The time has come to assess the outcomes of all the efforts done to promote conservation agriculture in Xieng Khouang province. The team from the Policy Research Centre will present its preliminary results and discuss with the participants to this workshop about the main issues raised by this diagnostic study.

## **II. Presentation the primary result of research team from Catch-Up Programme**

- (1). Objectives of the study and methodology.
- (2). Diversified patterns of land use changes in Xieng Khouang province over the last decade (2000-2010) and their socio-economic impact. Diffusion of conservation agriculture practices and constraints to diffusion.
- (3). Impact of socio-economic changes on farming systems and production strategies from 2003 to 2009.
- (4). Adoption of conservation agriculture practices and constraints to adoption from 2005 to 2009.

**(Please see PowerPoint below)**

## **III. Summary of comments by participants during plenary session**

1. Mr. Phimpha (Head of livestock and fishery section, Xiengkhouang PAFO) said that DMC is a suitable technique for Pek District, but the adoption of DMC hasn't continued after the PRONAE left. There are many reasons for that. First, low investment capacity of the households, which makes it difficult for them to refund their credit if they borrow from the bank with high interest rate. Second, farmers dislike difficult techniques and they are afraid of herbicides because they have less experience on herbicide use. "*Saoban maak ngay - People like to do it the easy way*". Furthermore, soil conditions are more constraining in Pek than in Kham. But it may change in the future as many farmers in Kham tend to till by tractor for soil preparation, which increases soil erosion.
2. Mr. Bounleut KHOMMACHAN (Deputy Director of Pek DAFO) explained the reasons for limited DMC adoption in his district:

- Building-up an improved pasture requires high capital, people were afraid of economic risk related to potential technical failure or natural disaster.
  - Villagers' knowledge is insufficient, especially about how to use equipments.
  - Health risks related to the application of chemicals (herbicide quality is uneven and misuses are common) affect negatively innovation adoption and make people afraid.
  - Prior to the termination of PRONAE project, there was no summarized report that would detail the knowledge gained from the project (like a DMC manual), people do not know who took over the project responsibility and if it continues; so this makes us disbelieve in the Project.
  - DMC adoption is also limited because the technology transfer (technical skills, methods, use of equipments) has not been extended to enough people.
3. Mr. Saengphet (From cropping section, Kham DAFO) talked about the implementation of PRONAE activities. The total area of maize in Kham district is approximately 11 250 ha including an area of 1290 ha where chemical are sprayed for weed control. In general, there are 3 methods used for weed control: tillage, herbicide and hand weeding. If we compare them: initial capital for applying herbicide is approximately 500.000 to 600.000 kip/ha for a yield of 4 t/ha and tillage is approximately 800.000 kip/ha for 5 to 6 t/ha. These are the main factors people take into account prior to adoption of a new technology.
4. Mr. Xiakertlor YIAHOUA (Head of Nonghet DAFO) commented as follows:
- Nonghet is an upland district where farmers mainly grow upland rice for self-consumption,
  - Adoption of conservation agriculture practices require to use herbicide, capital and we should therefore start in locations where tractors cannot get access for land preparation and for commercial crops as farmers will not invest capital for subsistence crops. It is too risky.
  - Phakkhaetay village has the potential to expand DMC areas, but in order to support diffusion we need to make sure people buy good quality herbicide, know how to store it and have been trained how to use it properly.
5. Mr. Thongxay (TABI Project) said that there is a potentially negative impact of conservation agriculture on the environment because of the use of chemical herbicides and fertilizers. Turning these systems to sustainable agricultural production without soil tillage would require to reduce chemical use and to resort more on organic fertilizers such as compost.
6. Mr. Phimpha PHOMSAVAT (Staff of Kham DAFO) said that DMC adoption can really conserve soil fertility. People who till their land every year start to experience yield decline. There is a chance that DMC adoption will increase in the future if people are trained about this new practices.

Improved pasture areas have decreased sharply in the Northern Kham district when the market for grass seeds that the project had setup stopped with the end of the

PRONAE. Farmers were left with grass seeds they could not sell and they stopped maintaining their plots planted with Barchiaria.

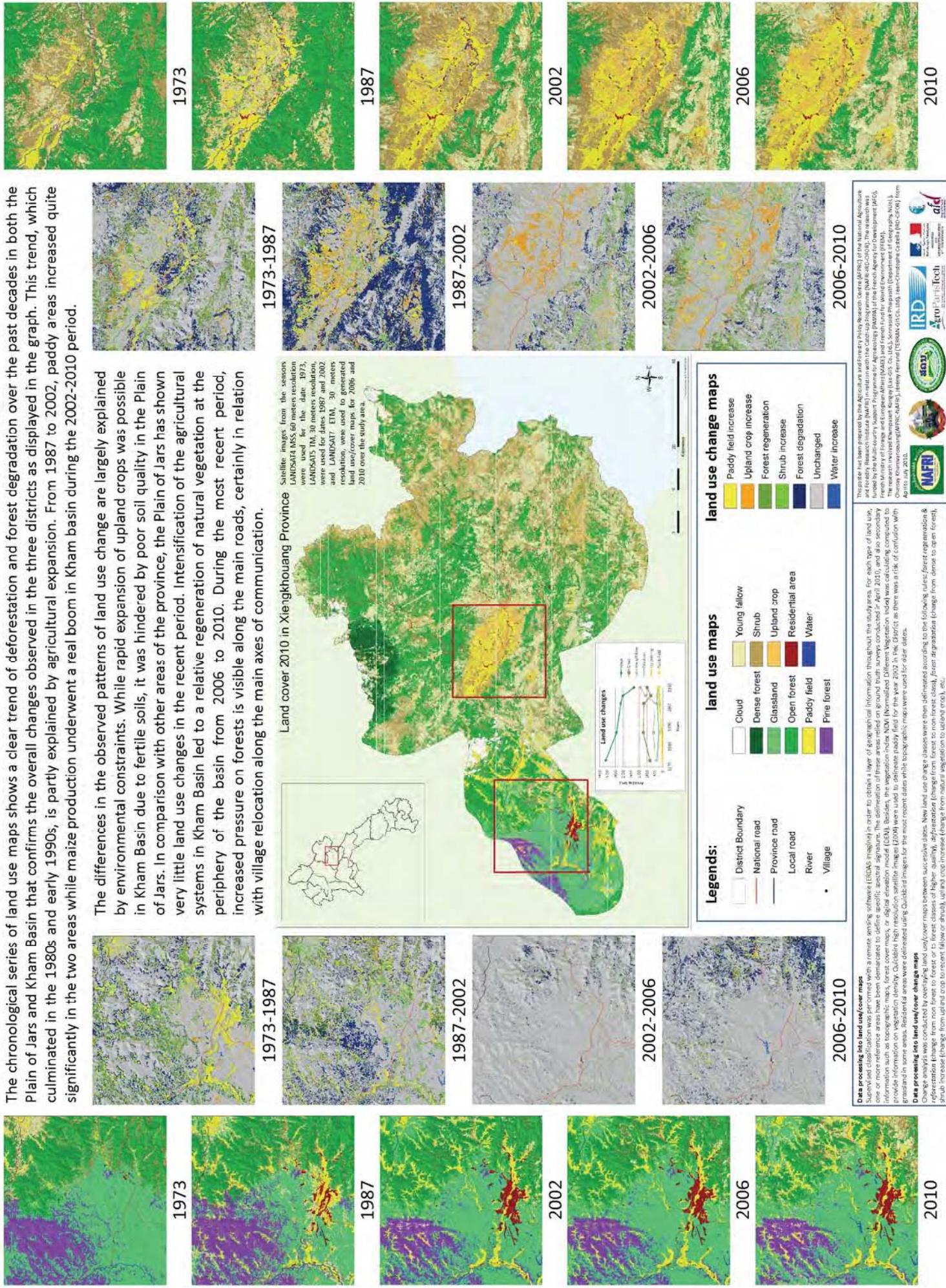
7. Mr. Thongchanh BOUNTHALA (PROSA Project) did comment on adoption of PRONAE technique and the result of PROSA's continuing activities on DMC. He also reminded 3 principles of DMC: no tillage, weed control by mulching with crop residues or cover crops. This technique can be considered as conservation agriculture but not the application of chemicals. At the initial stage it might use high capital but after 3 years it may use less depending on the quantity of weeds and the quantity of mulch that can be produced.
8. Mr. Khamphiou (Xoynafa village chief) reported about DMC adoption in his village during the previous period with approximately 11 households of Xoynafa village which was able to operate it with good success and showed unanimous satisfaction of DMC technique. He also pointed-out the situation of cow fattening which was able to sold-out with totaling amount of 7.5 million kip /3 head of cows: profit about 500.000 to 700.000 kip/cow with rotation of 3 times fattening cow /year.

Report prepared by Khamla NANTHAVONG and reviewed by Soulivanthong KINGKEO and Jean-Christophe CASTELLA

# Land use change analysis in Xieng Khouang Province, Lao PDR, 1973 - 2010

The chronological series of land use maps shows a clear trend of deforestation and forest degradation over the past decades in both the Plain of Jars and Kham Basin that confirms the overall changes observed in the three districts as displayed in the graph. This trend, which culminated in the 1980s and early 1990s, is partly explained by agricultural expansion. From 1987 to 2002, paddy areas increased quite significantly in the two areas while maize production underwent a real boom in Kham basin during the 2002-2010 period.

The differences in the observed patterns of land use change are largely explained by environmental constraints. While rapid expansion of upland crops was possible in Kham Basin due to fertile soils, it was hindered by poor soil quality in the Plain of Jars. In comparison with other areas of the province, the Plain of Jars has shown very little land use changes in the recent period. Intensification of the agricultural systems in Kham Basin led to a relative regeneration of natural vegetation at the periphery of the basin from 2006 to 2010. During the most recent period, increased pressure on forests is visible along the main roads, certainly in relation with village relocation along the main axes of communication.



Land cover 2010 in Xiengkhouang Province

Satellite images from the sensors LANDSAT4 MSS, 40 meters resolution were used for the date 1973, LANDSAT5 TM, 30 meters resolution, SPOT4 HRVIR, 10 meters and LANDSAT ETM+ 30 meters resolution were used to generate land use/cover maps for 2006 and 2010 over the study area.



**land use maps**

- Young fallow
- Shrub
- Upland crop
- Residential area
- Water

**land use change maps**

- Paddy field increase
- Upland crop increase
- Forest regeneration
- Shrub increase
- Forest degradation
- Unchanged
- Water increase

**Legends:**

- District Boundary
- National road
- Province road
- Local road
- River
- Village
- Cloud
- Dense forest
- Glassland
- Open forest
- Paddy field
- Pine forest

This study has been carried out within the framework of the National Agricultural and Forestry Research Institute (NAFRI) in relation with the catch-up program (MAP-AC-2008). The research was funded by the Multi-country Support Programme for Agriculture (PMMA) of the French Agency for Development (AFD), French Ministry of Foreign and European Affairs (MFA) and French Institute for World Environment (IFREMER, Paris, France). Chinese Economic and Agricultural Affairs, Ministry General (TIBAOH-QI-103, Xian-Christiane Gastes (IRC-CR08), from April to July 2010.

**Data processing into land use/cover maps**  
A remote sensing software (ERDAS IMAGINE) in order to obtain a layer of geographical information throughout the study area. For each type of land use, one or more reference areas have been demarcated to define specific spectral signatures. The delineation of these areas relied on ground truth surveys conducted in April 2010, and also according to information such as topographic maps, forest cover maps, forest cover maps, or digital elevation model (DEM). Besides, the vegetation index, NDVI (Normalized Different Vegetation Index) was calculated to provide information on vegetation density. QuickBird High resolution satellite images (2009) were used to delineate paddy fields for the year 2007 in the District, as there was a risk of confusion with grassland in some areas. Residential areas were delineated using QuickBird images for the most recent dates while topographic maps were used for older dates.

**Data processing into land use/cover change maps**  
Change analysis was conducted by overlaying land use/cover maps between successive dates. New land use change classes were then delineated according to the following rules: forest regeneration & regeneration (change from non forest to forest or to forest classes of higher quality), afforestation (change from forest to non-forest class), forest degradation (change from dense to open forest), shrub increase (change from upland crop to recent fallow or shrub), upland crop increase (change from maize vegetation to upland crop), etc.



# Socioeconomic and agricultural characteristics of Pek, Kham and Nonghet districts, Xieng Khouang province, Lao PDR

## Kham district - central basin

Characterized by a warm temperate, fertile soils and a good accessibility, the Kham basin allows for an important diversity of commercial productions (e.g. fruit trees, vegetables, chili, maize).

Five villages and a total of 175 households were surveyed in the area (see central map). Survey data shows that households are in a process of agricultural intensification, especially in rice, upland cashew, rubber, maize, and other crops. However, a large majority of villages have not pursued other primary crops. Three villages – Houat, Dokkham and Phorabham – have been recently connected to the electric grid leaving one third of the population without access to electricity and 40% of the population without access to mobile phones. The population of the study area is still very young, with 40% of the population under 15 years old. The population is still very young, with 40% of the population under 15 years old. The population is still very young, with 40% of the population under 15 years old.

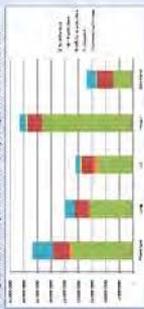
At the exception of Ban Dokkham with more than one hectare of paddy per household on average, a majority of households (75%) are self-sufficient in rice. Upland cultivated areas were expanded very significantly from an average of 1.5 hectares per household in 2005 to 2.5 hectares in 2009. The population of the study area is still very young, with 40% of the population under 15 years old. The population is still very young, with 40% of the population under 15 years old. The population is still very young, with 40% of the population under 15 years old.

Altogether, 65% of the population of the study area is engaged in crop and/or livestock production. The population is still very young, with 40% of the population under 15 years old. The population is still very young, with 40% of the population under 15 years old. The population is still very young, with 40% of the population under 15 years old.

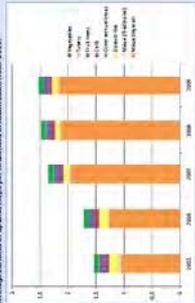
Household level socioeconomic characteristics in Kham district (2009)

Average household structure	4 members (3 women, 1 man)
Ethnicity	70% Laotian (28% Hmong, 42% Khmer)
Illiteracy	10% (men) / 17% (women)
Access to electricity	33% (men) / 20% (women)
Access to mobile phone	17% of the population
Average rice self-sufficiency	2 months

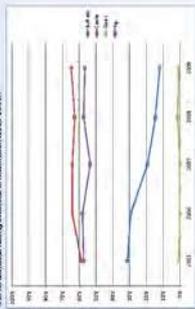
Average annual income per person in the study village of Houat in Kham district (2009)



Average structure of upland crops per household in Kham district (2005-2009)



% of households using livestock in Kham district (2005-2009)



## Pek district

The agroecology of Pek districts characterized by a vast altitude plain (The Plain of Laos) with particularly acid and infertile soils. The population is still very young, with 40% of the population under 15 years old. The population is still very young, with 40% of the population under 15 years old. The population is still very young, with 40% of the population under 15 years old.

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With an average of one hectare of paddy per household, a very large majority (88%) of households are self-sufficient in rice. Upland agricultural production has remained quite diversified over the past 5 years, with crops like maize, traditional vegetables, chili, garlic, and other crops. The population of the study area is still very young, with 40% of the population under 15 years old. The population is still very young, with 40% of the population under 15 years old. The population is still very young, with 40% of the population under 15 years old.

In average, more than 60% of the households in the study area are engaged in cattle breeding and small-scale pig farming and 43% of the population have been widely established in corn, villages like Ban Bhai and Xoy Nakh (23-30% of the villages in 2006) and to a lesser extent Ban My Phouabham and Dong (7-13% of the villages in 2009).

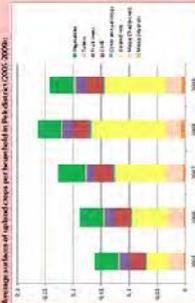
Household level socioeconomic characteristics in Pek district (2009)

Average household structure	4 members (3 women, 1 man)
Ethnicity	98% Laotian (98% Hmong)
Illiteracy	40% (men) / 40% (women)
Access to electricity	70% (men) / 70% (women)
Access to mobile phone	10% of the population
Average rice self-sufficiency	10 months (10 months)

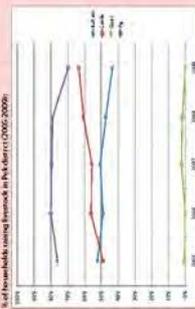
Average annual income per person in the study village of Ban Bhai in Pek district (2009)



Average structure of upland crops per household in Pek district (2005-2009)



% of households using livestock in Pek district (2005-2009)

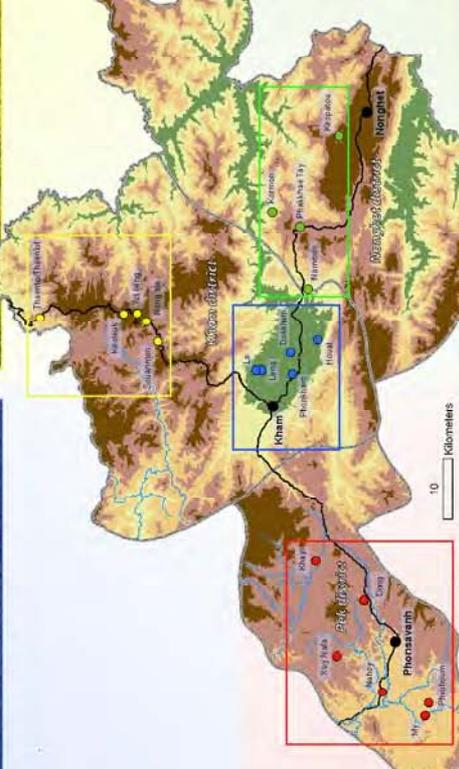
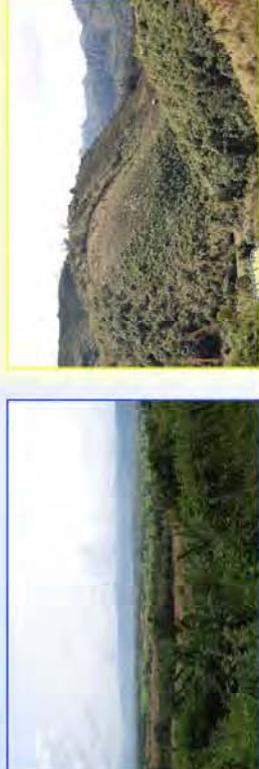


## Agrarian transition in Xieng Khouang province

Over the past decade, Xieng Khouang province has undergone a rapid transition from subsistence to commercial agriculture. With a 15% increase in GDP, the province has seen a significant increase in agricultural production. The population is still very young, with 40% of the population under 15 years old. The population is still very young, with 40% of the population under 15 years old. The population is still very young, with 40% of the population under 15 years old.

market demands, especially in relation with livestock development both through the expansion of animal raising and maize cropping as animal feed sent to Vietnam. Depending on local conditions – i.e. the four agro-ecological environments identified as Kham, Kham basin, Kham mountains and Nonghet, this transition has taken the form of: (1) maize expansion in the Kham basin, (2) maize expansion in the Kham mountains, (3) maize expansion in the Kham basin, (4) maize expansion in the Kham mountains. The population of the study area is still very young, with 40% of the population under 15 years old. The population is still very young, with 40% of the population under 15 years old. The population is still very young, with 40% of the population under 15 years old.

observed in 2010 – i.e. improved livestock systems in the Kham mountains, maize expansion in the Kham basin and Nonghet. The population of the study area is still very young, with 40% of the population under 15 years old. The population is still very young, with 40% of the population under 15 years old. The population is still very young, with 40% of the population under 15 years old.



## Research methodology

From September 2009 to April 2010, a diagnostic study on land-use change, farming systems and livelihoods was conducted in Kham, Kham basin and Nonghet districts of Xieng Khouang province by an interdisciplinary research team. A combination of chronological series of remote sensing data, topographic, climate and soil data, and household surveys were conducted in the three target districts. Rapid surveys were conducted with 600 randomly selected households (20 per village). Then 10 households per village were selected to conduct in-depth interviews on technical aspects of the recent agricultural changes. Finally, focus group discussions and general statistical data were used to document the history of the villages, the diffusion and adoption of agricultural innovations and the structure issues in relation to crop and pasture expansion in the uplands.

This project has been supported by the Agricultural and Forestry Policy Research Centre (AFRC) of the National Agriculture and Forestry Research Institute (NARES) in relation with the Cambodia Programme (NARS-FCRDI). The research was funded by the Multi-country Support Programme for Agroecology (MAMSA) of the French Agency for Development (AFD), the French Ministry of Foreign and European Affairs (MARE) and the French Fund for World Environment (FFEM).

July 2010



## Kham district - northern mountains

Characterized by a hilly topography and relatively important distances to the main economic centres of the province, agriculture in the Kham district is still very young, with 40% of the population under 15 years old. The population is still very young, with 40% of the population under 15 years old. The population is still very young, with 40% of the population under 15 years old.

Five villages and a total of 175 households were surveyed in the area (see central map). Survey data shows that households are in a process of agricultural intensification, especially in rice, upland cashew, rubber, maize, and other crops. However, a large majority of villages have not pursued other primary crops. Three villages – Houat, Dokkham and Phorabham – have been recently connected to the electric grid leaving one third of the population without access to electricity and 40% of the population without access to mobile phones. The population of the study area is still very young, with 40% of the population under 15 years old. The population is still very young, with 40% of the population under 15 years old. The population is still very young, with 40% of the population under 15 years old.

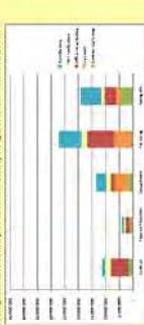
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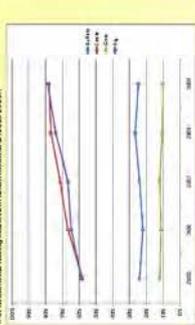
Household level socioeconomic characteristics in Kham district (2009)

Average household structure	4 members (3 women, 1 man)
Ethnicity	70% Laotian (28% Hmong, 42% Khmer)
Illiteracy	10% (men) / 17% (women)
Access to electricity	33% (men) / 20% (women)
Access to mobile phone	17% of the population
Average rice self-sufficiency	2 months

Average annual income per person in the study village of Houat in Kham district (2009)



% of households using livestock in Kham district (2005-2009)



## Nonghet district

Despite a hilly topography, the agricultural lands of Nonghet district are fairly productive. Agricultural production is diversified, still mainly oriented towards subsistence but rapidly evolving towards intensive commercial production. The population is still very young, with 40% of the population under 15 years old. The population is still very young, with 40% of the population under 15 years old. The population is still very young, with 40% of the population under 15 years old.

50 villages and a total of 200 households were surveyed in the area (see central map). Survey data shows that households are in a process of agricultural intensification, especially in rice, upland cashew, rubber, maize, and other crops. However, a large majority of villages have not pursued other primary crops. Three villages – Houat, Dokkham and Phorabham – have been recently connected to the electric grid leaving one third of the population without access to electricity and 40% of the population without access to mobile phones. The population of the study area is still very young, with 40% of the population under 15 years old. The population is still very young, with 40% of the population under 15 years old. The population is still very young, with 40% of the population under 15 years old.

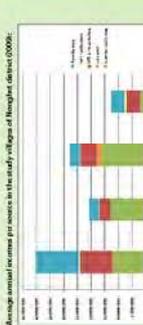
With an average of one hectare of paddy per household, a very large majority (88%) of households are self-sufficient in rice. Upland agricultural production has remained quite diversified over the past 5 years, with crops like maize, traditional vegetables, chili, garlic, and other crops. The population of the study area is still very young, with 40% of the population under 15 years old. The population is still very young, with 40% of the population under 15 years old. The population is still very young, with 40% of the population under 15 years old.

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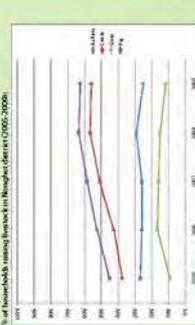
Household level socioeconomic characteristics in Nonghet district (2009)

Average household structure	4 members (3 women, 1 man)
Ethnicity	98% Laotian (98% Hmong)
Illiteracy	40% (men) / 40% (women)
Access to electricity	70% (men) / 70% (women)
Access to mobile phone	10% of the population
Average rice self-sufficiency	10 months (10 months)

Average annual income per person in the study village of Houat in Nonghet district (2009)



% of households using livestock in Nonghet district (2005-2009)





## Assessing the socio-economic impact of conservation agriculture in Xieng Khouang Province

Anousith Keophosay  
Khamla Nanthavong  
Chansay Khamvanseuang  
Etienne Jobard  
Guillaume Lestrelin  
Jean-Christophe Castella



Xieng Khouang PAFO - 15 July 2010

## The PAMPA Network

### History of PAMPA Network

- 1980s - 1990s - experiences of CIRAD in Brazil, Vietnam, Madagascar on development of conservation agriculture,
- Early 2000s - French donor agencies (MAE, FFEM et AFD) promote concerted actions to support agroecological techniques in 5 pilot countries: Madagascar, Tunisia, Cameroon, Mali and Laos.
- In 2007, AFD - FFEM – MAEE launch the Multiple countries action program for agroecology (PAMPA) for a 5 years period
  - Africa : Tunisia, Cameroon, Mali, Burkina, Madagascar
  - America: Brazil
  - Asia: Cambodia, Vietnam, Laos, China

### Objectives of PAMPA Network

- Support the diffusion of agroecological techniques through:
  - networking activities between agroecology projects
  - knowledge capitalization across multiple countries
  - Impact assessment

## The agroecology project in Laos PRONAE 2003 - 2009

### Two pilot sites

- Southern Sayabouri (4 districts – Botene, Kenthao, Paklay, Thongmixay)
- Xieng Khouang (3 districts – Pek, Kham, Nonghet)

### Diagnostic studies 2003 on both sites

- Landscape analysis, agroecological zoning
- Socio-economic surveys, household typologies
- Action plan on national development of conservation agriculture,

### On farm research on agroecology 2004-2009

- Experimental plots
- Production groups (support of PASS in Sayabouri)
- Training and dissemination of research results



## PRONAE in Xieng Khouang

### 4 agro ecological zones were identified

**Plain of Jars (Pek)** – Flat land, high altitude, acid soils, infertile savannah

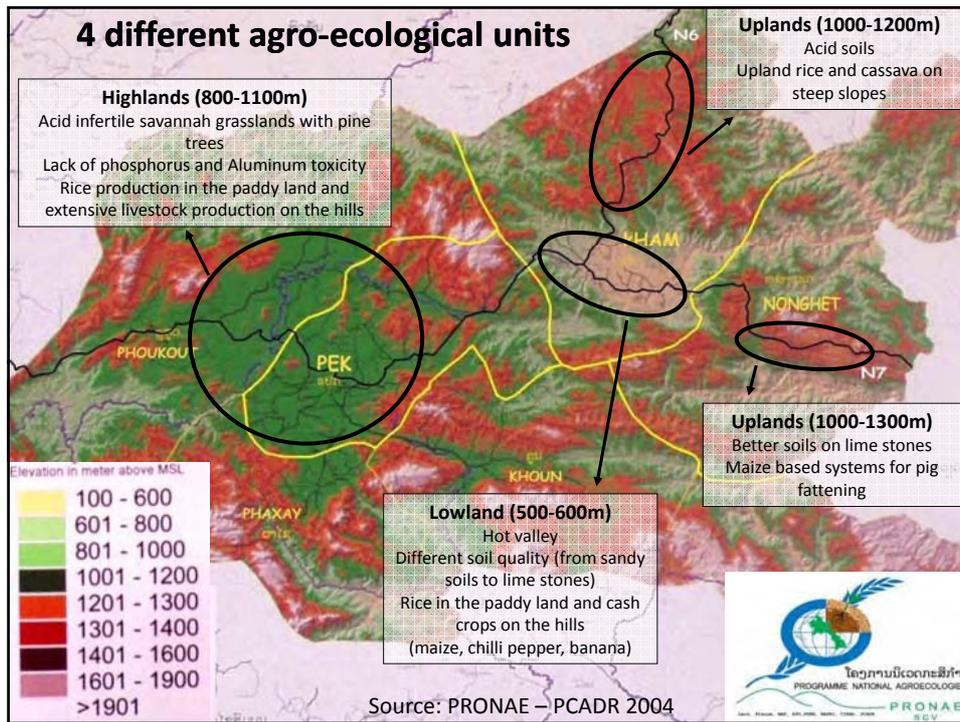
**Kham basin** – Deep fertile soils, undulated low altitude plain

**Northern kham** – Steep slopes, high altitude, acid soils

**Nonghet** – Hillsides with fertile soils from limestones,

**For each agroecological zone specific innovations were proposed to farmers based on 2003 diagnostic study**





## PLAIN of JARS

**Paddy and extensive livestock management: two intimately linked systems**

Paddy rice cultivation

Burning of native pastureland to facilitate pasture re-growth

Extensive livestock system on the uplands - < 0.4 animal / ha

Only 5% of total surface is cultivated  
80% in paddy rice

PRONAE  
PROGRAMME NATIONAL AGROECOLOGIE

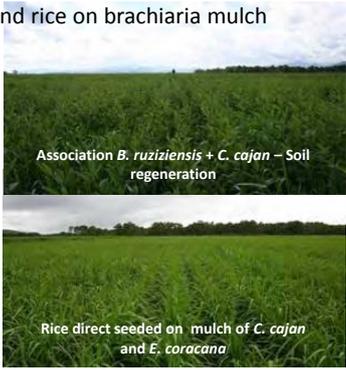
## PLAIN of JARS



**Agricultural intensification in altitude plains through:**  
 Improved pasture systems and livestock fattening,  
 Direct sowing of upland rice on brachiaria mulch



Rice direct seeded on mulch of *B. ruziziensis*



Association *B. ruziziensis* + *C. cajan* – Soil regeneration



Cattle fattening on improved pastureland

PROGRAMME NATIONAL AGROECOLOGIE  
PRONAE  
SDV

## KHAM BASIN & NONGHET



**Expansion of maize monocropping in Kham basin and Nonghet**



Intensive use of herbicides high risk (economic, health, environment)



Open fields situation in Kham district deforestation and biodiversity loss



Storage of maize harvest



Land preparation mainly based on ploughing

PROGRAMME NATIONAL AGROECOLOGIE  
PRONAE  
SDV

## KHAM BASIN & NONGHET

**Diversification of maize-based production systems and cover crops**



Maize on residues



Association Maize –  
*Vigna umbellata*



Maize + Common bean

PROGRAMME NATIONAL AGROECOLOGIE  
PRONAE  
SDV

## NORTHERN KHAM

**Deforestation, high pressure on natural resources, high poverty**



diverse farming systems integrating  
crops, livestock and NTFP collection



swidden system on the slopes

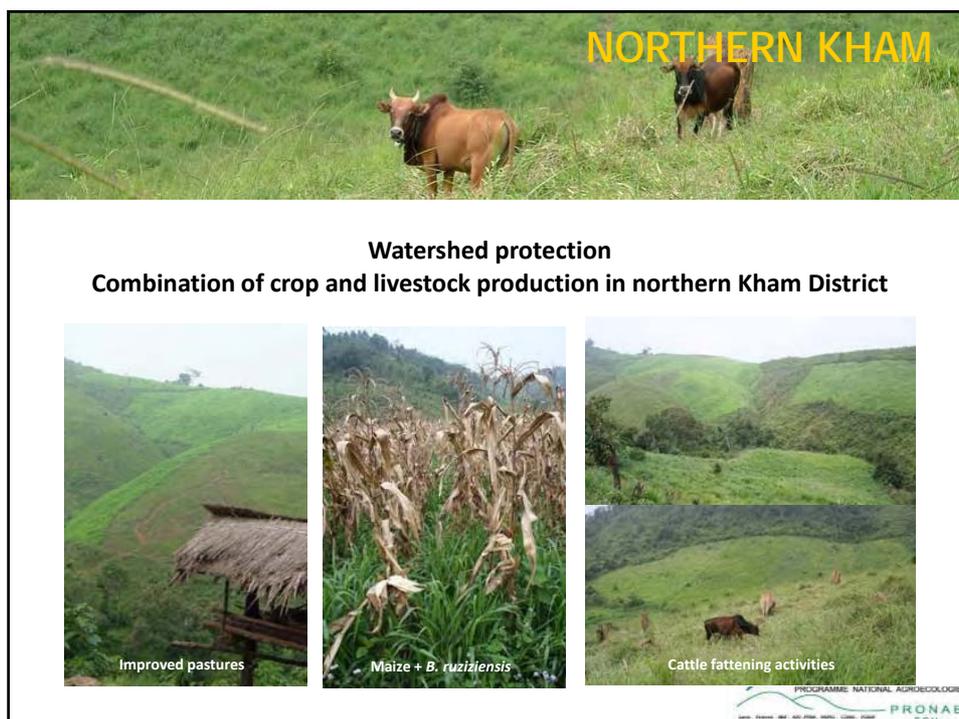


forest degradation related to slash and burn



rapid expansion of agricultural land

PROGRAMME NATIONAL AGROECOLOGIE  
PRONAE  
SDV

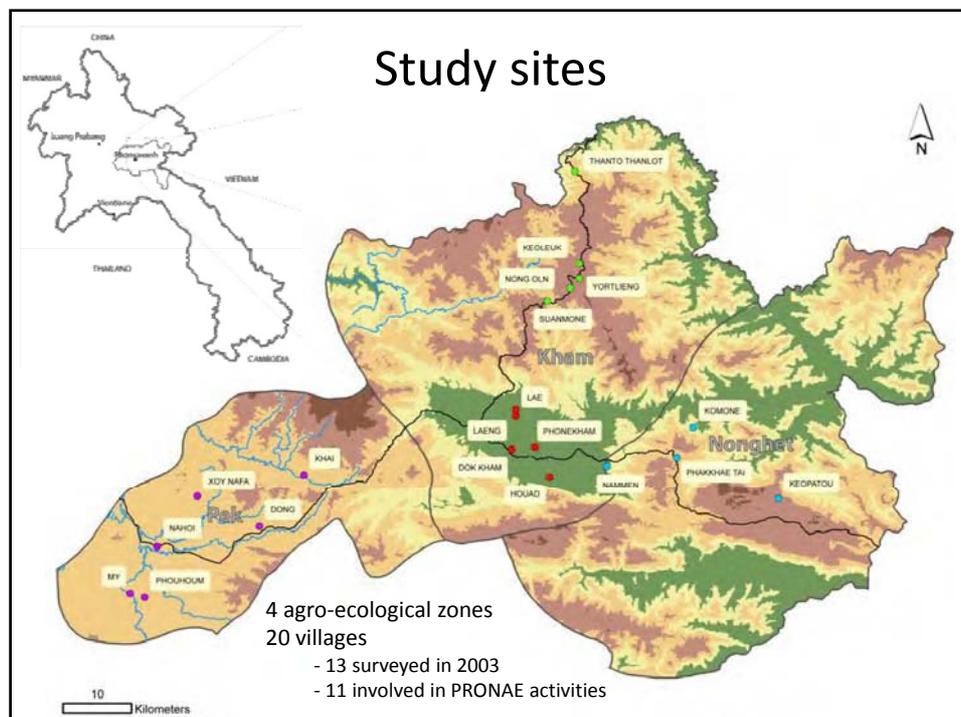


## Assessing the impact of conservation agriculture on Landscapes and livelihoods

- Objectives : informing and providing recommendations to policy and decision-makers, managers of research and extension agencies as well as research/extension practitioners about Conservation Agriculture :
  - adoption of by the farmers
  - potential for further dissemination.
- Sayabouri: March to July 2009 - study conducted by two international consultants with the support of the PCADR, PASS and PRONAE project teams,
- Xieng Khouang: October 2009 to April 2010 – study conducted by the Policy Research Center of NAFRI in partnership with IRD with the support of PRONAE team members.

## Assessing the socio-economic impact of conservation agriculture in Xieng Khouang

- Methodology
  - Research sites
  - Data collection
  - Data analysis
- Results to be reviewed/discussed during this workshop
  - 3 Reports analyzing the changes during the last decade (2000-2010)
    - Diversified patterns of land use changes in Xieng Khouang province and diffusion of conservation agriculture practices,
    - Impact of socio-economic changes on farming systems and production strategies
    - Adoption of conservation agriculture practices and constraints to adoption
  - 3 NAFRI Policy briefs
    - Improved pastures and DMC-based upland rice cultivation: Two solutions to intensify land-use in Pek district
    - Enhancing land productivity while preserving natural resources in the mountains of northern Kham district
    - Accompanying the 'maize boom' in the Kham basin and Nonghet district
  - 2 Posters
    - Land use maps and land use change maps
    - Socioeconomic and agricultural characteristics



## Methodology: multi-scale analysis

- National & province
  - Review of project documents
  - Literature review
- District
  - Land use maps from remote sensing data (1973, 1987, 2002, 2006, 2010)
  - Statistics and secondary data
- Village
  - Census (20 villages - 1472 households)
  - Interviews and focus groups: participatory village mapping, village histories, land tenure issues, management of natural resources, etc.
- Household
  - Rapid survey on farming systems 2009 (600 households, 20 villages = #30 household/village, random sampling),
  - Detailed household surveys 2009 (180 households, 18 villages = # 10HH/village, stratified sampling (15 households that were surveyed in 2003 by PRONAE team were resurveyed in 2009 to assess changes in their farming system).

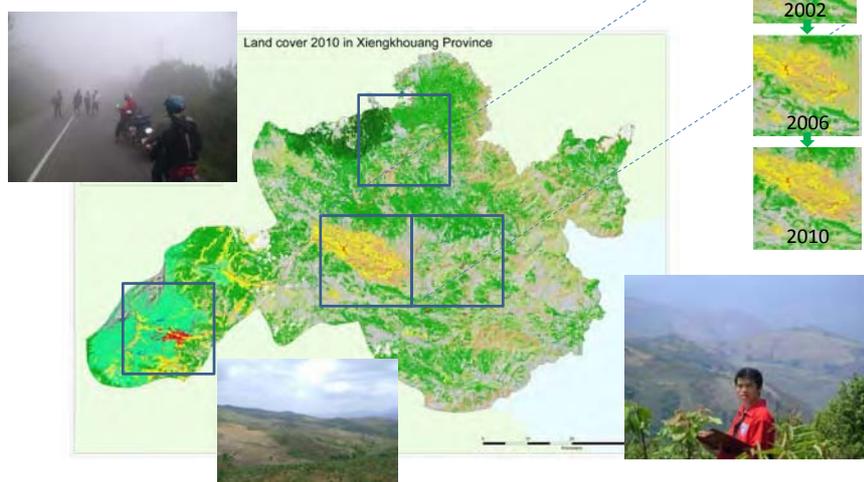
## Data collection

- ⊙ Exhaustive village census (1472 households, 20 villages) – (household composition, land, labor, capital, equipment, etc.),
- ⊙ Rapid survey on farming systems 2009 (600 households, 20 villages = #30 household/village, random sampling), data on household income and adoption of conservation agriculture,
- ⊙ Detailed household surveys 2009 (180 households, 18 villages = # 10HH/village, stratified sampling, technico-economic survey (cropping and livestock systems, return on land and on labor).  
*NB. 15 households that were surveyed in 2003 by PRONAE team were resurveyed in 2009 to assess changes in their farming system.*



## Land use maps from remote sensing data

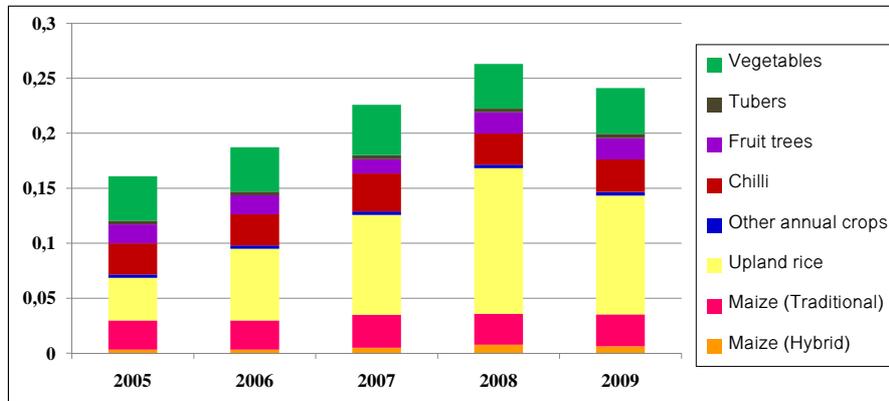
- Landsat satellite images from 1973, 1987, 2002, 2006, 2010 to generate land use maps and land use change maps
- Ground truth survey conducted in April 2010



## Results

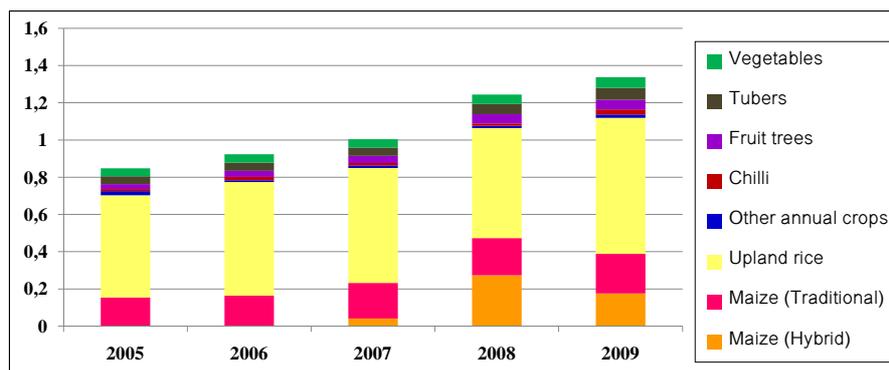
## 1. Changes in upland crop areas 2005 – 2009

### 1. Average of cropped areas (ha/hh) for **Pek district**.



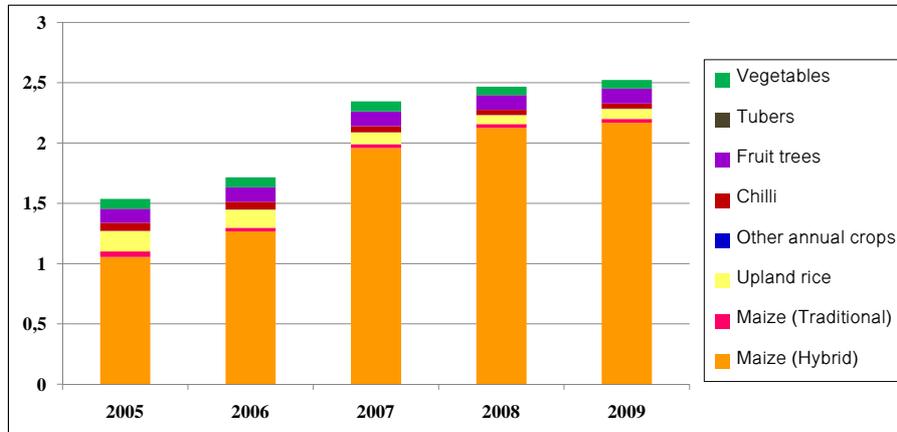
- Limited upland agriculture in Pek district: >0.3 ha per household
- Only upland rice is evolving

### 1.2. Average of upland crops ( ha/hh ) in the studied village of **Kham Northern** from 2005 – 2009



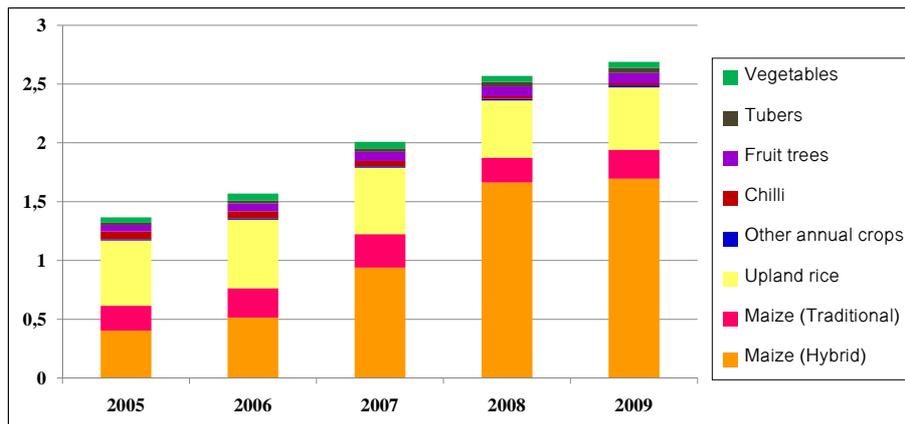
- The average of area per household increased approximately from 0.85 ha / hh in 2005 to 1.35 in 2009.
- Upland rice represents the major part of all crops, constant over time due to its importance in food security
- From 2007: new variety of maize as cash crop.

**1.3. Average of upland crops ( ha/hh ) in the studied village of Kham Basin from 2005 – 2009**



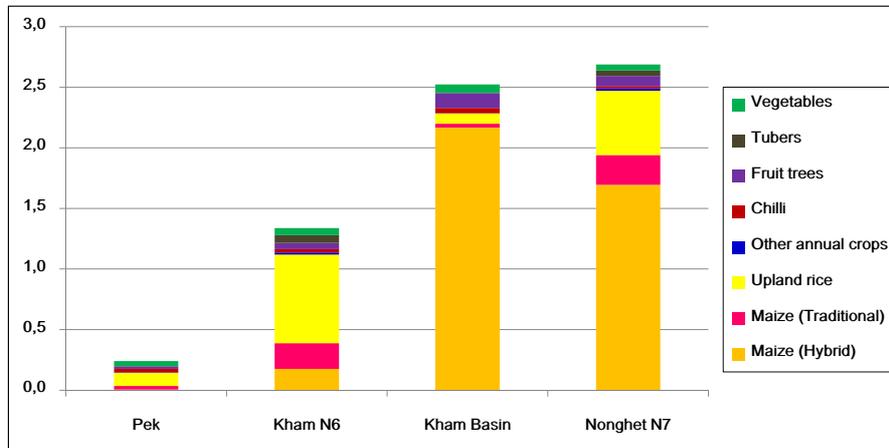
- The average of upland areas cropped per household is extremely high if compared with other areas ( 1.5 – 2.5 ha / hh )
- 2007: brutal increase of hybrid maize

**1.4. Average of upland crops ( ha/hh ) in the studied village of Nonghet from 2005 – 2009.**



- Similar pattern with lower maize figures

## 2. The different of average upland crops surface (ha/household) of study areas in 2009.

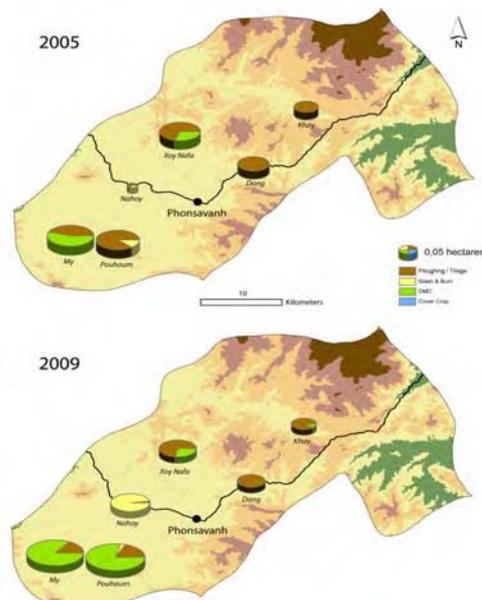


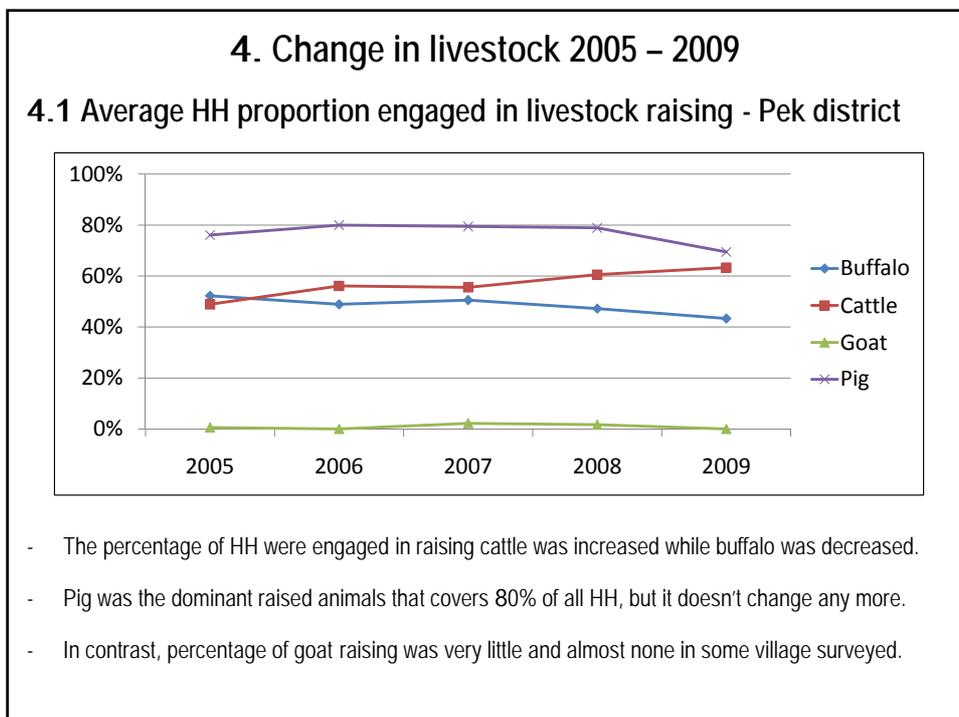
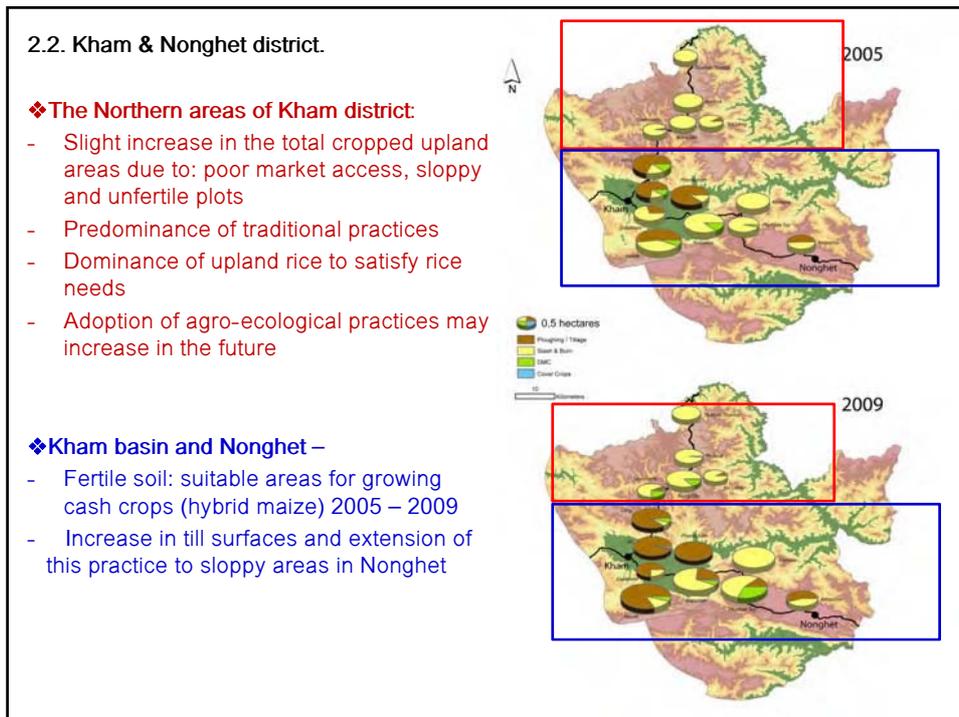
- Comparatively, Pek has the smallest areas of upland crops (<0.3 ha/hh)
- Highest surfaces for Kham Basin and Nonghet, respectively 2.5 and 2.7 ha/hh. Upland crops are dominated by hybrid maize plantations

## 3. The evolution of cropping and soil preparation techniques.

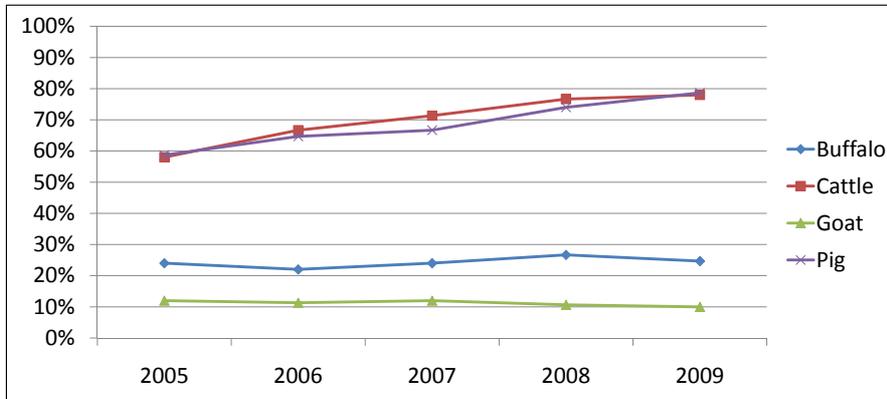
### 3.1. The studied villages of Pek district:

- No change in production areas: terrain, soil fertility & different activities
- Nahoy village: increase in swidden upland rice areas
- Agro-ecological techniques are seldom applied and mainly found in B My and B. Pouhoum



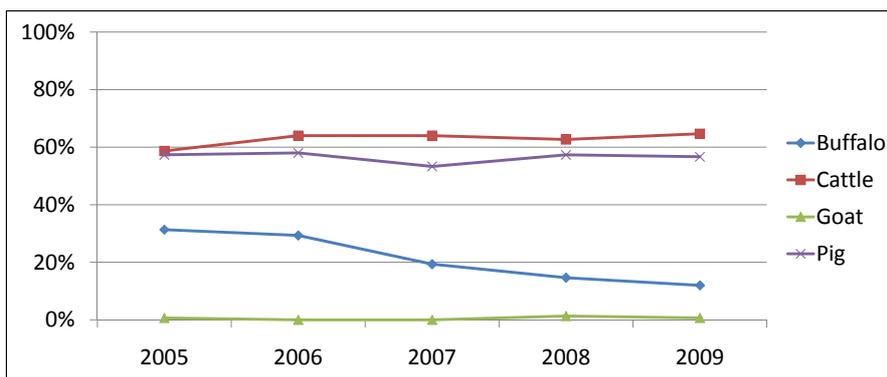


#### 4.2 Average HH proportion engaged in livestock raising – Kham North



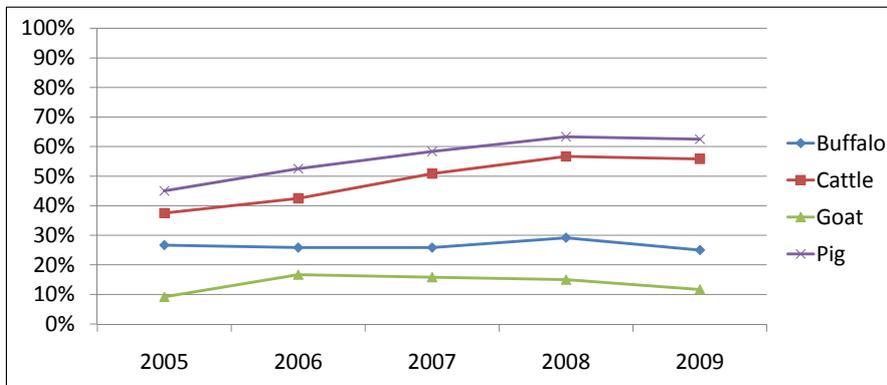
- An increasing of cattle raising was as same as pig raising (60%-80%).
- Most of landscapes in this area are slope and mountainous area. It's difficult for cultivation, so villagers was focused in livestock raising. (ex. Some HH in Yotlieng village had 40 cattle).

#### 4.3 Average HH proportion engaged in livestock raising – Kham basin



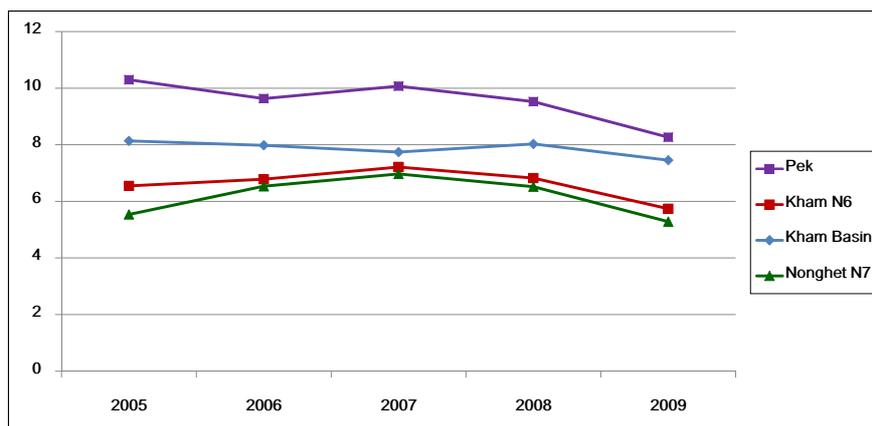
As same as the other zones, percentage of buffalo raising was declined due to most of HH sold buffaloes for buying tractors likewise cattle and pig raising were constant because villagers were focused on commercial crops plantation.

#### 4.4 Average HH proportion engaged in livestock raising – Nonghet district



- The raising of cattle and pig were increasing in each year around 40%-60%, especially in Keopatu village.
- Some of the grass seed was import from Vietnam in previously.

#### 5. Average number of cattle per HH in study areas from 2005-2009



- The amount of cattle per HH was quite stable for that period.
- Eventhough the percentage of HH raising livestock in some area was high but an average of cattle amount per HH was low.
- The highest average number of cattle per HH in 2009 was in the Pek district (8 cattle/HH), Kham basin (7 cattle/HH), Kham north (6 cattle/HH) and Nonghet was lowest only (5 cattle/HH).

## Maize expansion in Kham basin and Nonghet

- From 2005 to 2009, maize imposed itself as the main upland crop in Kham Basin and Nonghet.
- This expansion is accompanied by the development of new cropping practices (mechanical ploughing, herbicides, hybrid varieties), that are often combined with traditional techniques (slash and burn, hand ploughing, hand weeding).

## Hybrid varieties

- The LVN10 hybrid variety has been promoted in the province since 2001 (by the Agriculture Development Program).
- Hybrid varieties are now well spread in Kham Basin and Nonghet (72% of surveyed maize producers)

	2003 (PRONAE)	2009
Sowing density	25-30 kg/ha	26 kg/ha
Yields (Seed)	3 T/ha	4,5 T/ha

- The wide use of hybrid varieties is one reason explaining a mean increase in yields of 1,5T/ha (from 2003 to 2009)



## Tillage



- Companies (from Xieng Khouang or other provinces) are proposing tillage services to farmers (average price in Kham basin and Nonghet : 1 012 000 KIP/ha). This practice fastly spread in Kham basin and is now reaching more slopy zones (in Nonghet). The average tilled surface is 1.4 ha.
- Some farmers also till upland plots, with their own handtractors, ploughing average surfaces of 1ha.

## Herbicides

- Herbicides are spread using handsprayers or even motopumps. The use of herbicides entailed an important reduction in workload for maize weeding activities (the use of herbicides is less common in uplandrice cropping).



Motopump

	2003 (PRONAE)		2009	
	Kham basin	Nonghet	Kham basin	Nonghet
Maize	30-35	35-45	24	27
Upland rice	25-30	45-50	30	41

Time of work (MD/ha) for the 1st weeding

## Herbicides

	Package	Quantity (observed)	Quantity (advised)
Gramoxone		Maize: 8,2L/ha/app Rice: 4,8L/ha/app	1-2 L/ha
Atrazine		3,5 kg/ha/appl	2 kg/ha
Glyphosate		Maize: 6L/ha/appl  Rice : 5,4L/ha/appl	3-4 L/ha

## Maize higher profitability

	2003 (PRONAE)		2009	
	Return on Land (kip/ha)	Return on Labour (kip/ha/d)	Return on Land (kip/ha)	Return on Labour (kip/ha/d)
Maize	2 209 000	17 880	2 933 000	38 800
Upland rice	1 758 000	7 500	2 556 000	13 120
Chilli	3 338 000	9 000	5 665 000	12 880

- Maize has become a more profitable crop as its return on land increased (because of the introduction of more productive hybrid varieties)
- The important incomes provided by maize cropping enabled an intensification of cropping practices (tillage and use of herbicides), increasing its return on labour.
- Upland rice cropping is not competitive with maize, it can maintain only in a context of subsistence farming.

## Economical data on different maize cropping practices

	Slash & burn	Slash&burn + herbicide	Tillage	Slash&burn + tillage	Tillage + herbicide	DMC
Yields (T/ha)	5,3	5	5	4,7	4,5	6
Time of work (MD/ha)	360	90	77	125	98	42
Cost (Kkip/ha)	0	495	1 069	1 717	549	220
Return on labour (kip/ha/d)	15 020	32 420	41 180	35 380	67 480	67 420
Frequency (in Kham basin and Nonghet)	27,5%	20,2%	15,6%	19,3%	8,3%	9,2%

## Kham north

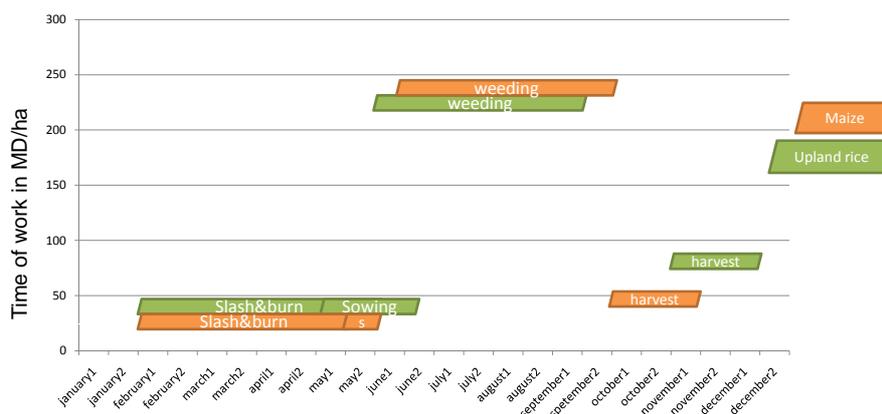
- The northern mountainous zone of Kham district is characterised by the persistence of subsistence agriculture based on upland rice and slash&burn.
- Kham north has not been struck by the « maize boom » yet.

## Upland rice

	Return on land (KIP/ha)	Return on labour (KIP/ha/d)	Surface (ha)	Yields (T/ha)
Maize	868 000	4 264	0,55	1,5
Upland Rice	2 809 000	10 930	0,9	2,4

- Maize is not a profitable alternative crop (to low returns on land and labour) and is valorised through pig fattening
- Farmers specialise their upland activities in rice production = subsistence production strategies

## Upland rice & maize cropping sequence



- Weeding and Slashing are time spending activities for both maize and upland rice. This workload could be reduced with the use of herbicides

## Pek

- Rice production mainly based on lowland...
- ... but is extending to the upland thanks to innovative cropping practices.



## Paddy rice : Fertilization

	Frequency	Qty/ha	Time of work (MD/ha)	Yields (T/ha)
Manure	38%	3T	20	3,6
Chemical fertilizer	9%	70kg	5,6	3,7
No fertilization	53%	-	-	3,4

- In comparison to early 2000's practices, there have been no significant evolutions in paddy fertilization
- The common use of manure is linked to rice production and cattle breeding : manure supply is limited by the size of herds.

## Paddy

- Increase in mechanization: from 2003 when 35% of farmers had a hand-tractor to 2009 when 65% of farmers have a hand-tractor.
- Increase in tillage workload (if we compare hand tractor tillage operation): from 7-9 MD/ha in 2003 to an average of 17 MD/ha in 2009, despite the increase in mechanization :
  - Hypothesis : decrease in organic matter contained in soils + less difficult work (mechanization), farmers tend till more than in the past.
  - For 27% of farmers, 3 tilling operations are necessary, and 90% need 2 tilling operations (leading to a petroleum consumption of 40L/ha)
- There have been no significant evolutions concerning weeding and fertilizing activities.

## Upland rice development

	Yield	Average surface	Frequency
DMC	2	1,33	6%
Slash&burn	1,9	0,16	4%
Tillage	0,97	0,95	6%
Paddy	3,7	0,92	100%

- Upland rice plot are still rare in Pek district
- Upland constitutes a potential to increase rice production (especially if productive practices are adopted : DMC)

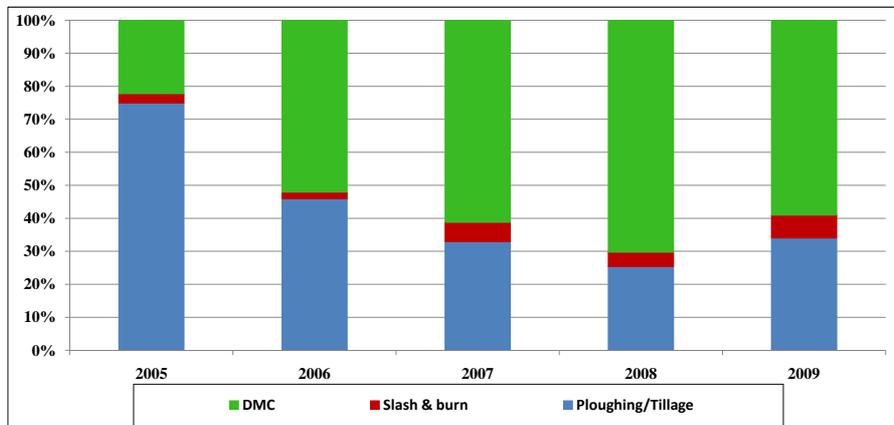


## **Overview**

1. Evolution and relative distribution of cropping techniques
2. Percentage of HH engaged in conservation agriculture
  - Grass plantation evolution in 4 study areas
  - Constraints to the adoption of conservation agriculture practices
  - Recommendations

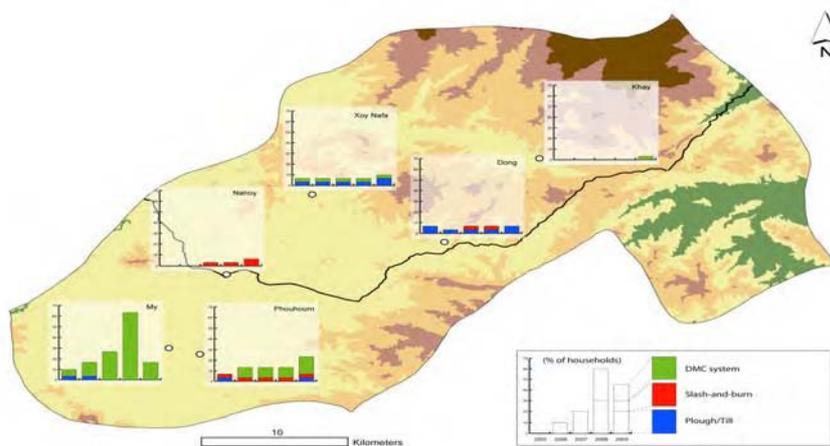
# 1. Evolution and relative distribution of cropping techniques

## 1.1. Distribution of upland cropping techniques in Pek district



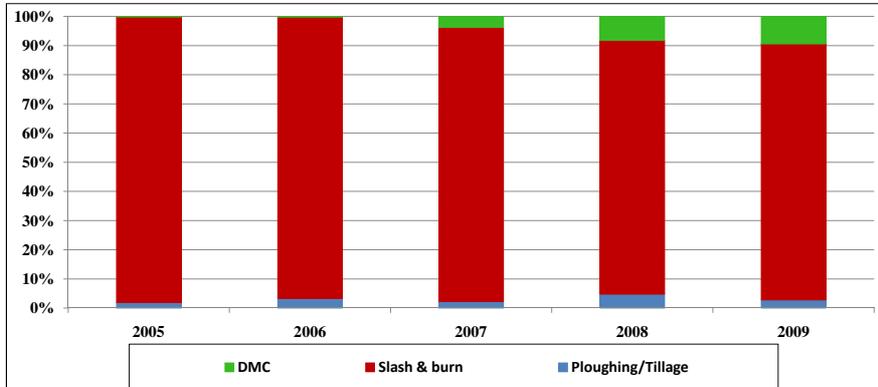
- Adoption of conservation agriculture is increasing every year (from 22% in 2005 to 60% in 2009). Note: However it still represents a small proportion of the total agricultural area
- The slash-and-burn area is decreasing with farmers focusing more on paddy

## Percent of HH engaged in conservation agriculture in the study villages of Pek district



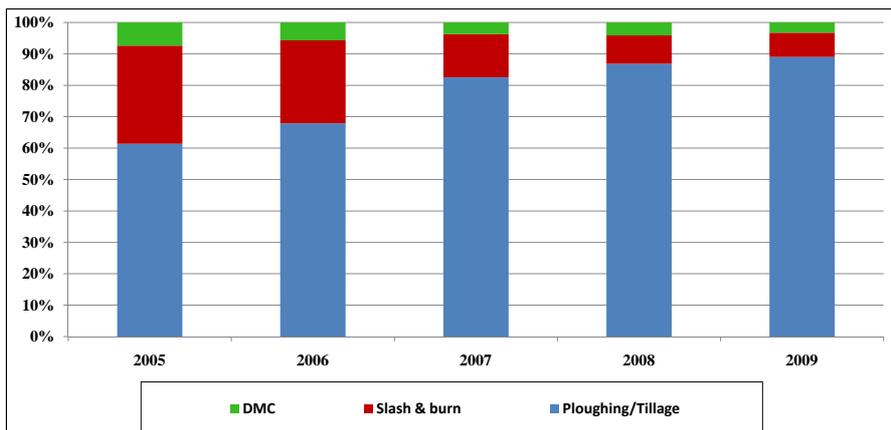
- Most of conservation agriculture is practiced in Ban My & Ban Phouhoum
- Note: no DMC system present in Dong – no project

### 1.2. Distribution of upland cropping techniques in Kham North



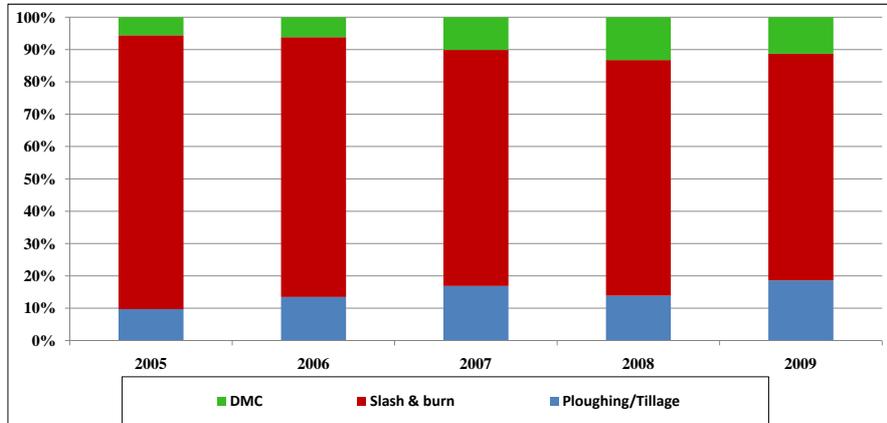
- Most of the Households are involved in traditional slash-and-burn practices: remote and mountainous rural area, lack of experience in using new technique
- Adoption of conservation agriculture started in 2009 in the area of Ban Sounmone & Ban Nong Oln (10%)

### 1.3. Distribution of upland cropping techniques in Kham Basin



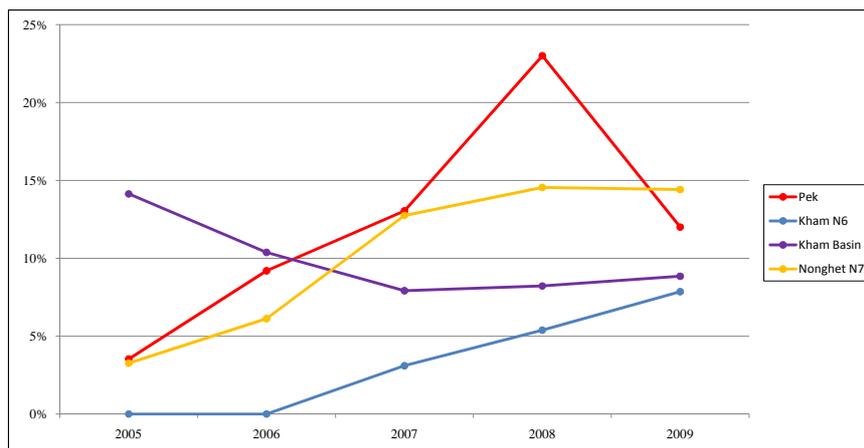
- Till or dig is the most common cropping practice in this area and increased from 60% (2005) to 90% (2009). Suitable land, especially for maize.
- Conservation agriculture is not important here

### 1.3. Distribution of upland cropping techniques in Nonghet district



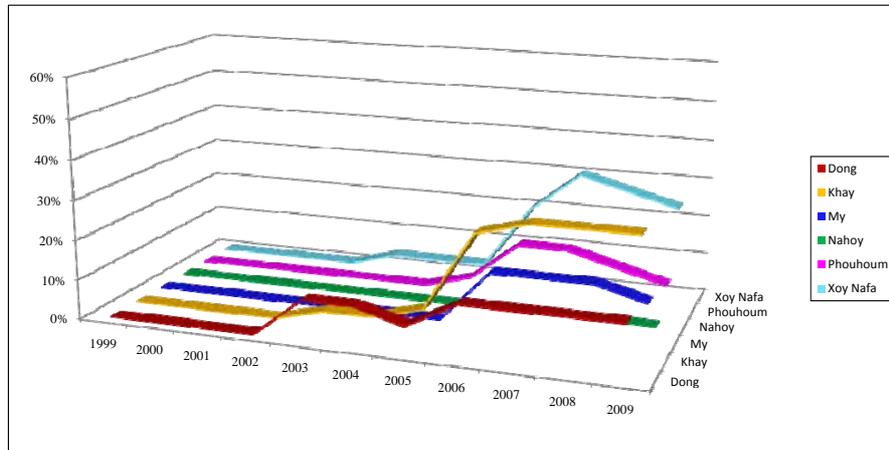
- Slash and Burn is the most common cropping practice in this area. Sloppy land
- Conservation agriculture adoption is more important than in the Kham basin area.
- Tilled area in Nonghet is more important than in Kham North due to tillage ability, fertile soils and income.

## 2. Percentage of HH engaged in conservation agriculture



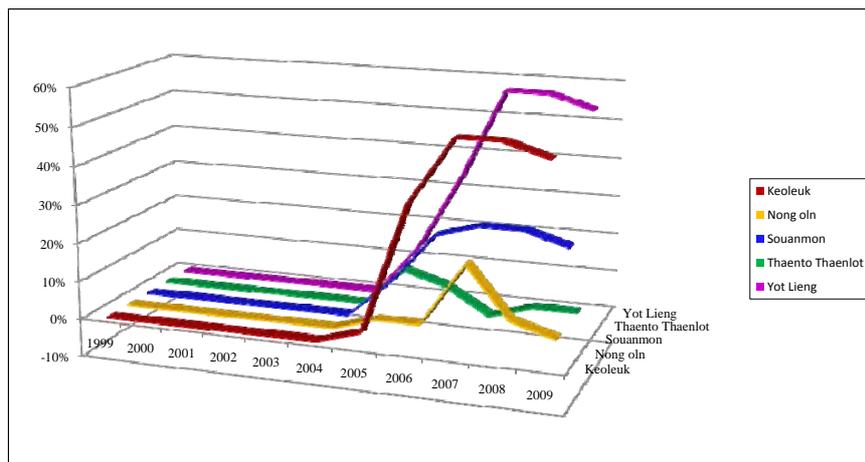
- Conservation agriculture adoption in Pek district fluctuates; it increased by 3% in 2005 reaching a peak (23%) in 2008, but then it declined in 2009.
- The north of Kham experienced an increase from 0%(2005) to 8%(2009) while in Kham basin, it decreased from 14%(2005) to 8% (2009).
- In Nonghet, it increased from 3% in 2005 to 14% in 2009

### Evolution of improved pasture plantations in Pek district



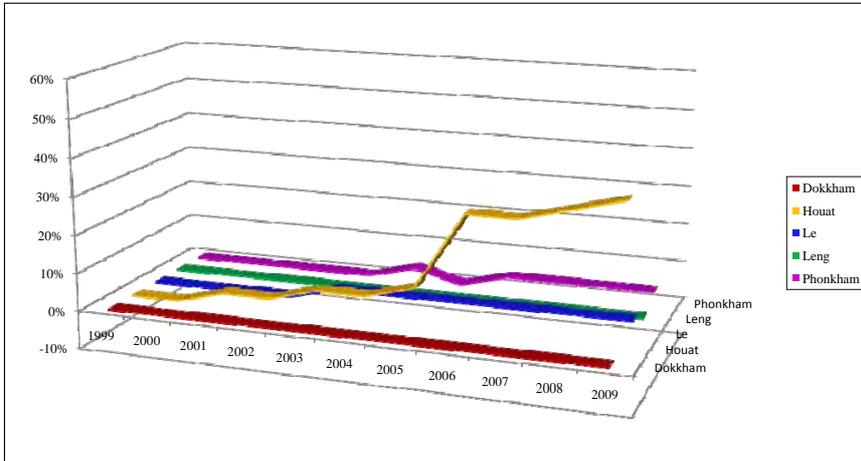
- Adopted by 0% of sampled HH in Khay & Xoy nafa
- While My and Phouhoum have only 7-13% of HH involved in improved pasture

### Evolution of improved pasture plantations in Kham north



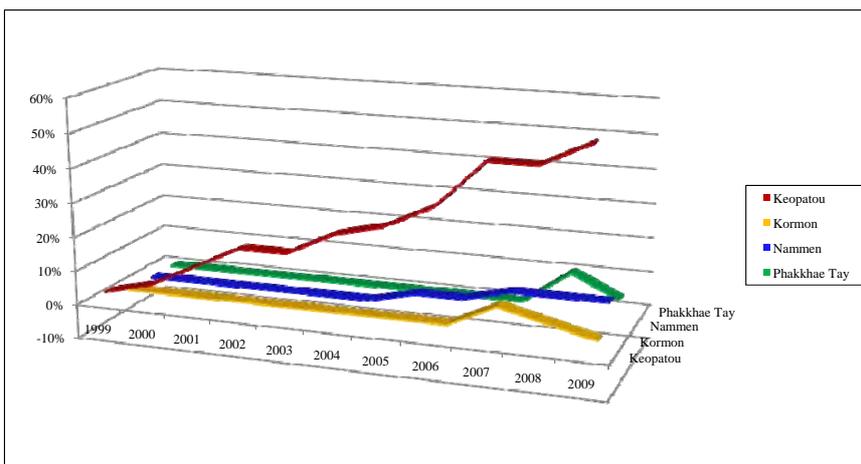
- Almost all of sampled HH (80%) are engaged in livestock raising
- In Keoleuk & Yotlieng, Souanmon, and Tanetohtaneloth; HH are respectively engaged at 50%, 58% & 0%

### Evolution of improved pasture plantations in Kham basin



- Grass planting is not very important because farmers are focusing on planting commercial crops
- Exception in Ban Houat where 37% of sampled HH are involved in improved pasture activities

### Evolution of improved pasture plantations in Nonghet district



- In Ban Keopatoou, 50% of surveyed households practice improved pasture even though it's not the target village of conservation agriculture project. Also 93% of all villagers are engaged in livestock raising.

## Main constraints to adoption

- **DMC Systems**
  - Important financial investments required to establish DMC-based systems (herbicides, etc.)
  - Limited commercial agriculture and low financial capital in Kham mountains
  - Competition for access to land in Pek (DMC completes with pasture, large private concessions and reforestation efforts)
  - No experience and/or perception of environmental degradation linked to ploughing in Kham basin

## Main constraints to adoption

- **Improved pastures**
  - Important financial investment required to establish pasture and fattening activities (fencing, seeds, herbicides and fertilizers, etc.)
  - Limited access to bank credit and too short refund periods in Pek and Kham mountains
  - Poor development of markets for grass seeds
  - Relative disinterest in the maize production zone (Kham basin and Nonghet hillsides) due to important agricultural revenues



## Recommendations

- **Cropping systems**
  - Policy incentives and regulations may be envisaged in order to prevent the rapid spreading of unsustainable practices associated with the maize boom (e.g. ban on mechanical ploughing on steeply sloping lands)
  - Further technical support should be provided by agricultural extension services in order to maintain DMC systems as a possible option (e.g. sowing techniques and crop associations, pesticide dosage and safety precautions)
  - Awareness-raising campaigns could be conducted to inform farmers of the potential environmental downsides of ploughing practices and herbicide use
  - Facilitating access to small equipment (e.g. hand-job and mechanised seeders, manual sprayers) through the establishment of rental service providers and associated credit for equipment purchase/rental could provide higher incentives to farmers

## Recommendations

- **Improved pastures**
  - Local access to credit should be facilitated, with more attractive interest rates and refund periods well adapted to the timeframe of livestock farming activities (i.e. adequate support from fencing to early production would require 3 to 5 year refund periods)
  - A dedicated livestock extension system (operated by AFOs) could encourage livestock farmers to establish production groups for reducing pasture protection costs (management rules, hedged pasturelands)