



Report

Scoping study in Northern and Southern Laos

Xiengkhouang, Salavan and Xekong Provinces

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INITIATIVE ON
Mixed Farming
Systems

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The Sustainable Intensification of Mixed Farming Systems Initiative aims to provide equitable, transformative pathways for improved livelihoods of actors in mixed farming systems through sustainable intensification within target agroecologies and socio-economic settings.

Through action research and development partnerships, the Initiative will improve smallholder farmers' resilience to weather-induced shocks, provide a more stable income and significant benefits in welfare, and enhance social justice and inclusion for 13 million people by 2030.

Activities will be implemented in six focus countries globally representing diverse mixed farming systems as follows: Ghana (cereal–root crop mixed), Ethiopia (highland mixed), Malawi: (maize mixed), Bangladesh (rice mixed), Nepal (highland mixed), and Lao People's Democratic Republic (upland intensive mixed/ highland extensive mixed).

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Introduction

Mixed farming systems (MFS) involves crops and livestock integrated on the same farm and are the backbone of smallholder production in developing countries in tropical regions, which allow farmers to diversify risk from single crop production, use labour efficiently, access to credit and add value to products and there is high potential for increasing system productivity, diversification and sustainability (CGIAR, 2023; Herrero et al., 2010). MFS has many forms depending on external and internal factors, the external factors which farmers are unable control such as weather, market price, politics while the internal factors are related to households characteristics and local soil conditions (FAO, 2001).

Over the past half-century, Southeast Asia has undergone major shifts from predominantly subsistence agriculture to commercialised and modernised agricultural systems and technologies (Alexander et al., 2018; Cramb et al., 2009; Hurni et al., 2017). Over the same period, Southeast Asia has been viewed as “a region of miraculous growth – a development success story and an exemplar region” (Rigg, 2020, p. 1). A long agricultural commodity boom in the early 21st Century has followed rising demand for energy and food staples associated with widespread economic growth (Baffes and Haniotis, 2010), and households in developing countries and emerging economies are increasingly participating in global food and agriculture markets; the exports from these countries now make up more than one-third of global trade in food and agriculture (FAO, 2020b). In these contexts, rural households in Southeast Asian countries have shifted from primarily subsistence to more commercially-oriented agricultural production, for both export and domestic markets. However, as Rigg (2018, p. 169–170) notes:

“Across rural Asia, households – for the moment at least – often embrace livelihoods that are multi-sited, pluri-active and generationally segmented, reflect logics of subsistence as well as commodity production, and embody production, reproduction and re-distribution”.

However, shifting from primarily subsistence to more commercially-oriented agricultural production on mixed farming systems will be needed to achieve global targets such as the Sustainable Development Goals, and sustainable intensification (production of more food on the same piece of land and with the same or less inputs while reducing the negative environmental impact) (CGIAR, 2023).

Scoping study objective

The objective of the scoping study was to identify the current status of, and system drivers, constraints and opportunities for sustainable intensification of mixed crop-tree-livestock systems to deliver more productive and equitable livelihoods of actors in mixed farming systems (MFS) in the intensive uplands and extensive highlands systems in Northern (Xiangkhouang Province) and Southern Laos (Salavan and Xekong Provinces).

Relevant farming and production systems include but are not limited to crop-livestock-tree systems - silvopastoral or agrosilvopastoral systems, cassava-, maize- and forage-based systems, and improved fallow systems.

Scoping study approach

The scoping study utilised a mixture of document review and qualitative field research to explore the following questions:

1. What are the characterisations of agroecological zones, farming systems and farmer types in the study areas?

2. What are pressures, risks, vulnerabilities and trends in MFS related to multiple environmental and socio-economic factors?
3. What are key policies, strategies, and initiatives existing that support farmers in managing their mixed farming systems in a sustainable way?
4. What are opportunities and entry points for co-designing and scaling sustainable intensification, including both technical, socio-economic and environmental innovations?
5. What are the key stakeholders for co-designing and scaling sustainable intensification?

Interviews were conducted with key informants at provincial, district and village levels in Xiengkhouang (10–15 January 2023), Salavan and Xekong Provinces (15-18 December 2022) and with international organisations, including:

- Formal discussion (1.5 hours) with Provincial Agriculture and Forestry Office (PAFO)- Xiengkhouang, Salavan and Xekong Provinces (n=3)
- Formal discussion (1.5 hours) with District Agriculture and Forestry Office (DAFO)- Phoukoud, Kham, LaoNgam and Thateng Districts (n=4)
- Community key informants/Village heads- Xiengkhouang (n=6); Salavan (n= 2) and Xekong (n=3).
- Formal discussion with Clean Project - Winrock International and Wildlife Conservation Society (WCS) (n=2).

Discussions with the Provincial Agriculture and Forestry Office (PAFO) informed the selection of potential districts in which to interview key informants at the village level. The selection of villages within those districts was supervised by the respective District Agriculture and Forestry Office (DAFO). Villages were selected on the basis of having a diverse range of agricultural livelihood activities and crop production, and in consultation with DAFO staff. In addition, field observations were recorded with respect to key informants and within the context of the interviews with DAFO.

Limitations of the study

Due to prioritization, time, budget and logistical constraints, the scoping study was restricted to three provinces (Xiengkhouang, Salavan and Xekong) and four districts (Phoukoud, Kham, LaoNgam and Thateng). As such, there are limitations in extrapolating the data and information collected to other districts, whether nearby or further afield. Meetings took place with all targeted stakeholders and follows ups were done via phone calls and WhatsApp messages. In addition, accessibility, availability, and accuracy/consistency of data at the provincial and district levels are challenging.

Context – Lao government policy on turning land into capital and promoting agriculture commercialisation

The Lao Government has promoted agricultural commercialisation and intensification since the 1990s as a development strategy, encouraging a shift from subsistence to cash crops, for reducing poverty, improving rural livelihoods, creating employment, and lifting Laos out of those countries listed as ‘least developed’ (Alexander et al., 2009; Castella et al., 2013; Ducourtieux et al., 2005). A series of policies have been introduced since the 1980s to influence agricultural commercialisation and rural transformation (World Bank, 2008). The 5th Five-year National Social Economic Development Plan 2000–2005 (5th NSEDP) (MPI, 2000), Land and Forest Allocation Program (Fujita & Phanvilay, 2008), and policy of ‘turning land into capital’ (Dwyer, 2007), encouraged private investments in large, state-land concessions for a range of export-oriented commodity crops such as sugarcane and industrial tree plantations (eucalyptus, acacia and rubber plantation). The 6th NSEDP (2006–2010) continued the promotion of agricultural commercialisation but shifted the focus from large-scale concessions to small-scale contract farming due in part to the negative impacts of concessions on the livelihoods of affected local communities (Fullbrook, 2007) and the environment. Subsequent NSEDPs have maintained an emphasis on investment in agriculture and the land sector and introduced other important policies. The 7th (2011–2015), 8th (2016–2020) NSEDPs and 9th (2021–2025), for example, emphasised ‘green development’ and the Government’s aim to increase forest cover and promote sustainable development (MPI, 2016, 2020).

Furthermore, the current Agricultural Development Strategy 2025 and Vision to 2030 (MAF, 2015a) continues Laos’ aspirations for agricultural commercialisation and modernisation for “ensuring food security, producing comparative and competitive potential agricultural commodities, developing clean, safe and sustainable agriculture and shift gradually to the modernization of a resilient and productive agriculture economy, linking with rural development contributing to the national economic basis” (MAF, 2015a). The Development Strategy of the Crop Sector 2025 and Vision 2030 (MAF, 2015b) elaborated on elements of this ambition, namely “crop production by focusing on modernisation, clean, safety, quality, stability, sustainability and commercialisation”. The goals continue to focus on transforming subsistence production to modern, commercial agriculture and move further towards large-scale farming. However, smallholder agricultural households in Laos have been a focus of the last three National Socio-Economic Development Plans. These households have also been centrally involved in ongoing processes of land reform, market integration and agricultural commercialisation since the 1980s. During this time, the Lao Government has re-characterised Laos from being ‘land-locked’ to ‘land-linked’ (Souvannavong, 2013); for example, the Socio-Economic Development Strategy 2001–2010 aimed to “Develop our country to become the central point of transit of the region in the future” (Noonan & Noonan, 2021), and the resource frontiers that were at the geographical periphery of Laos have similarly been reinterpreted as geographically proximate to the growing markets of China, Thailand and Vietnam. Households in these regions have been offered opportunities to participate in a series of commodity crop booms and their livelihoods have changed, both positive and negative, including their cropping and livestock rearing systems e.g. the expansion of cassava and planted forages (see Mienmany, 2022).

The following sections of this report explored cropping systems in the Northern hub (Xiengkhouang Province) and Southern hub (Salavan and Xekong Provinces). Then, it provided key stakeholders analysis in mixed farming systems in the two hubs. Followed by the analysis of policies, strategies, institutions, and technical guidelines at the national level and at the scoping study areas. Then, the report finished by providing key opportunities and entry points for co-designing and scaling sustainable intensification of mixed farming systems in Laos.

Northern Laos – Xiengkhouang Province

Xiengkhouang Province is located in the northeast of Laos, about 380 km from Vientiane Capital. The total area of the province is 15,992 km², with 90% of the area being mountainous with the altitude more than 1,200 meters above sea level and the low-lying basin (Kham District) is 600 meters above sea level; average rainfall 1,286 mm/year (June-Sep) and the temperature in the dry season reach lowest to -1°C and the maximum 17°C (PPI, 2020). Xiengkhouang borders Vietnam to the east, Luang Prabang and Xaysomboun Provinces to the west, Huaphanh to the north and Bolikhamxay to the south. Xiengkhouang is divided into 7 districts, 53 village clusters and 477 villages. In 2018, there were 47,161 households with a total population of 264,000 people, with 130,000 women and 80% of the population being farmers (PPI, 2020).

The province has approximately 610,000 ha of agricultural land, representing 38% of its total area, of which 60,000 ha is cropland and 550,000 ha is pasture (of which improved forages are approximately 22,000 ha; the varieties of forages are Napier (*Cenchrus purpureus*), Ruzi (*Urochloa ruziziensis*), Israel sweet grass and Pangola (*Digitaria eriantha*). In addition, forest areas comprises approximately 34% of the total area of the province (PPI, 2020). The National Park Nam Et Phou Lei is 10,268 ha, National Protected Forest is 149,030 ha, the Provincial Conservation Forest is 101,737 ha, the Provincial Protected Forest is 708,942 ha and the Production Forest is 245,492 ha (PAFO, 2021). The Province has started the pine plantation forest for saw/oil. Tree plantation area (no specific species but mentioned overall for planted species are pine, eucalyptus, acacia and teak) by companies is 57 ha and smallholders 20 ha (PAFO, 2020).

Agricultural zones and farming systems in Xiengkhouang Province are classified based on the geographical conditions of each district. For example, Nonghet and Mok Districts are remote and mountainous areas close to the Vietnam border; the farming system mainly focuses on livestock and Non-Timber Forest Products (NTFPs) such as Tao or Chok (*Arenga pinnata*), bamboo shoots, cardamom, broom grass, for household consumption and for sale. While Pek, Phaxay, Phoukoud and Khoun Districts are upland areas, farming systems mainly focus on rice, vegetables, large livestock (cattle and buffaloes), coffee, maize, cassava and other commercial crops (see Figure 1).

MFS in Xiengkhouang Province has been practised for many generations as a traditional practice. Farmers in this province started applying chemical fertilisers in the mid-2000s when the commercial crops expanded. The Ministry of Agriculture and Forestry (MAF), in collaboration with PAFO and DAFO and the private sectors and development agencies, has been supported agroecology practices as green manure, cover crop and intercropping with legumes (red beans, soybeans and peanuts) to improve soil quality. For instance, the direct seeding mulch-based cropping system (DMC) principles under the Lao National Agro- Ecology Programme (PRONAE) (2004-2008) supported by the French agricultural research and international cooperation organization (CIRAD); the Agro-Biodiversity Initiative (TABI) Project (2009-2020) on Participatory Forest and Land Use Planning, Allocation and Management (FALUPAM); Sustainable Agriculture and Environment Development Association (SAEDA) - COFI project (2019 – 2023) has supported organic rice and vegetables and produced organic fertilisers (PAFO, 2020; DAFO2019). Currently, there are pilot studies in improving soil quality (cover crop, intercrop with peanuts, soybean and red beans) with a total area of 1,200 ha in three districts (Kham, Phaxay, Phoukoud and Pek). In addition, the established organic fertiliser factory (by Mr Phom Thipphavone) has successfully supplied organic fertilisers of over 1,000 tonnes to 7 districts (PAFO, 2020).



Figure 1: Characterisation of agricultural zones in Xiengkhouang Province

Phoukoud District

Phoukoud is located 30 km northwest of Phonesavanh, the capital of Xiengkhouang Province, with a total area of 3,096 km² of which 85% is mountainous and upland. Phoukoud has approximately 5,000 households with a total population of 27,000 people (13,000 women). The main ethnic groups are Lao-Tai (61%), Khmu (20%) and Hmong (19%). In terms of forested lands, the district has Protection Forest¹ (28,000 ha), Conservation Forest (Protected areas)² (40,000 ha), National Production Forest³ (67,000 ha) and forest plantation (70 ha).

Phoukoud District's 5-year Socio-Economic Development Plan 2020-2024 (SEDP) states that the first priority for the district's agricultural development is livestock rearing and crop production for household consumption and for commercial (DPI, 2019). The second priority is agricultural and Non-Timber Forest Products (NTFPs), food processing e.g. maize, dried tea, dried mushrooms, white sesame, dried garlic and chilli and local handicrafts such as silkworm and mulberry trees, broom grass and umbrella made from leaves, and the third is tourism and services. The SEDP prioritises 2 crops - paddy rice (2,900 ha), maize (5,900 ha) and cattle (29,000 head) and water buffalos (7,500 head). SEDP also identifies the area of natural pasture at 8,500 ha, the planted forages by smallholders at 1,000 ha, and the grazing land by private sector/enterprise at 200 ha. Furthermore, the SEDP plan to classify areas for forest restoration as 31 ha and provide 200,000 seedlings, including 30 kg of seeds for sowing (DAFO, 2019).

¹ Protection Forests are forest classified for maintaining water sources and preventing soil erosion, strategic areas for national defence and security and providing environmental protection (Forestry Law, 2019)

² Conservation Forests are forest classified for the purpose of conserving nature, preserving and propagating plant species, aquatic animal and wildlife species, historical and cultural, touristic, environmental and education values.

³ Production Forests are forest including natural forest and planted forests designed for the supply of wood and Non-Timber Forest Products (NTFPs) as commodities to fulfil requirement of national socio-economic development and people's livelihoods.

The district has only two sources for households to access credit. The first is the Nayobaiy Bank, which provides household loans; the other is the Nam Ngum River Basin Development Project, which provides loans of around 1 billion Lao Kip (LAK) to farmers for supporting agricultural cooperation activities.

Scoping study villages

This scoping study targeted three villages in Phoukoud District: Lungjong, Longhang and Longkhan. Land in all three villages is classified according to forest area, agricultural land (including paddy, upland rice, pasture and fallows), and residential and cultural areas. Household land ownership is evidenced through land use titles with land tax records/receipts. In order to avoid paying land tax, reported land ownership is generally much lower than actual land ownership. While some households own up to 30 ha, most report approximately 3 plots (6 ha) per household.

Households in these villages were mainly focused on upland rice and paddy rice (lowland) until maize was introduced to the village in around 2010. Maize became a 'boom crop' in 2015, and later in 2017, farmers began cultivating forages (Napier, Ruzi) for their large livestock rearing. Farmers do not apply any fertilisers or manure, but they started to use herbicides at the time maize became a boom crop. Farmers do not apply fertilisers because of the cost of inputs and labour. While maize production used to be 5 tonnes/ha (around 2015), current production reaps only 20% of past production levels at approximately 1 tonne/ha. Current cropping systems in these villages mainly focus on maize and forages for large livestock. The details of the villages are as follows:

Lungjong Village is located approximately 25 km from Phoukoud town via an unmade road. The total area is 10,154 ha, with 6,500 ha of forest land and 3,700 ha of agricultural land, including young and old fallows.

There are 147 households comprising *Youan* and *Khmu* ethnic groups. The villages' main crops are upland and lowland rice, maize, cassava, chilli and pumpkin. Large livestock comprise 860 cattle and 90 water buffaloes. In addition, the natural pasture area is 110 ha, and the planted forage areas is 56 ha. The planted forage areas are the individual household landholdings.

Longhang Village is located approximately 35 km from Phoukoud town via an unmade road. The total land area of the village is 7,800 ha, with forest areas of 3,000 ha and agricultural land of 4,800 ha, including paddy, young and old fallows. There are 105 households, all of which are *Youan* ethnic group. The main crops are upland rice, maize, cassava, chilli and pumpkin. Large livestock comprise 448 cattle and 70 water buffaloes. In addition, the natural pasture area is 90 ha, and the plated forage area is 74 ha. This village has more planted forage than Lungjong Village which is less land pressure for cattle as well.



Burning maize residue after the harvesting season, paddy rice, Lungjong Village. Photo by S. Mienmany, Jan 2023



Longhang village with a mountain landscape of forage and fallows. Photo: S. Mienmany, Jan 2023

Box 1: Household of Mrs Sengnouan and Mr Buaphan, Langjong Village

Mrs Sengnouan and Mr Buaphan are in their 40s and have two children. One child has finished high school and went to work in the city and the other is in secondary school. The wife and husband are therefore the family's main source of labour. They have approximately 20 ha of agricultural land. Due to labour constraints, they use only 7 ha, comprising 6 ha for forage and 1 ha for maize. The rest of their lands are fallow. They started cultivating maize in 2008, but did not sell at a reasonable price. With prices improving in 2010, they cultivated more land. However, production progressively declined over 5 years of cultivating maize. In 2016, they started planting forages and converting the maize plots into planted forages in response to a project/government promoting cattle. In 2017, they started to collect and buy maize and became maize traders in the village. They now have 15 cattle. Cattle rearing allowed them to invest their time and capital in maize trading. Furthermore, Mrs Sengnouan now has more time to do weaving and is active on a weaving broker.

Overall, their livelihood activities are mainly focused on maize trading and cattle rearing. Furthermore, after all the agricultural work, Mrs Sengnoune is also a weaving investor and trader in the village.

They have expressed their aspirations for future livelihoods:

"We want to have a project that can provide us with techniques for cultivating maize and forages; we have plenty of lands, we need someone to take the lead first, and then we will follow. For example, we saw people plant rubber, but it requires too much labour for tapping".

In summary, this household's aspiration for their livelihood is focusing maize and weaving entrepreneurs and future to invest in tree plantation that has low labour requirements. This will be a good opportunity for development projects to support the villagers.



Smallholder interview at Lungjong Village
Photo: S. Mienmany, Jan 2023

Their agriculture practices are still conventional and reliant on rain and climate. However, they have been using herbicides for almost five years.

Challenges in their cropping system and livelihood activities include:

- Insufficient family labour
- Lack of skills and techniques for effective and efficient cropping systems
- Competition from other maize traders from other villages.

Longkhan Village is located approximately 80 km from Phoukoud town via an unmade road. The total land area of the village is 11,500 ha, with forest area of 8,900 ha and agricultural land of 2,600 ha, including paddy, young and old fallows. However, half of the agricultural land is rocky.

There are 131 households comprising *Lao-tai*, *Khmu* and *Hmong* ethnic groups. The main crops in the village are paddy and upland rice, maize, cassava, garlic and pumpkin. Large livestock comprise 2,800 cattle and 40 water buffaloes. In addition, the natural pasture area is 60 ha and the planted

forage area is 55 ha. The grazing areas for large livestock in this village are relatively small. As a result, most farmers leave their large livestock in paddy and maize fields after harvesting seasons (around Oct – May). However, this practice is only for farmers who do not use the land to cultivate vegetables (garlic and pumpkin). For those households who do not have enough feed for their livestock, they need to sell some of their livestock or leave them skinny.



Longkhan village with a mountain landscape of forage, fallows, and cattle along the Numkhan River.
Photo: S. Mienmany, Jan 2023

Pressures/ risks/ vulnerabilities

- Insufficient family labour
- Lack of technical skills in cropping systems and innovation
- Competition with traders from outside (for local village traders)
- Maize prices manipulated by maize traders (government officers do not come to the village to regulate maize prices)
- Farmers have encountered shorter cycles of crop rotation for their maize and rice (only 1-2 years rotation) due to limited agricultural lands for households, especially young couples - newly married and moved out from parent households.
- Very low and declined crop yields i.e. maize
- Limited land for grazing and cultivating crops in Longkhan village (half of the current agricultural land is rocky, and government precludes further opening up of forested lands).

Projects/organisations in Phoukoud District:

Two projects relevant to Phoukoud District have been implemented and recently completed by the Adventist Development & Relief Agency (ADRA) International Organisation. The first project is the Phoukoud Integrated Climate Resilience Agriculture and Improved Livelihoods (PICRAIL), which was implemented in 16 villages from 2019 to 2022. It aimed to increase agricultural production and income for households in the 16 villages. In addition, it provided significant training and capacity building opportunities for the Lao Government counterparts. The project activities focused on conducting social inclusion awareness events, improving water assets and establishing village water committees for agriculture/livestock use, conducting clean agriculture, animal raising, and aquaculture training, village veterinarian training, and establishing and supporting producer groups to market. The second project is the Enhanced Nutrition and Health for Upland Phoukoud (ENHUP), which was implemented in 2017-2020 to improve nutrition for household members in 16 villages, particularly pregnant and lactating women and children under two years old (ADRA, 2021; DPI, 2019).

There are also a number of ongoing projects. The Laos Micro Enterprises project is supported by the United States Agency for International Development (USAID) partnered with ACDIVOCA organisation. The project (2019-2023) aims to strengthen the competitiveness of agricultural microenterprises in Laos by providing capacity building to respond to market needs and access to technology and facilities, and to assist microenterprises in reducing operations costs. For examples, the project provided half of the investment costs when farmers purchase any machines for maize production, rice mills, and tractors for soil preparation (ACDIVOCA, 2023; DAFO, 2020). The Agroecological and Safer food System Transitions (ASSET) project is funded by the French Development Agency (AFD), the European Union (EU) and the French Facility for Global Environment (FFEM) and is implemented by Group For Research and Technology Exchanges (GRET) and The French agricultural research and international cooperation organization working for the sustainable development of tropical and Mediterranean regions (CIRAD). The project (2020-2025), covering four countries (Cambodia, Laos, Myanmar and Vietnam), aims to make food and agricultural systems in the region more sustainable, safer and inclusive by harnessing the potential of agroecology to transform them. In addition, the project will develop and promote a shared vision of 'agroecology and safe food system transitions' (ASSET, 2023; DAFO, 2020). See activities of the ASSET project in Xiengkhouang <https://www.asset-project.org/flagship-sites/xiengkhouang>

Kham District

Kham District is located 60 km northeast of Phonsavan District. Its total area is 2,099 km². There are 90 villages in Kham District with a total population of 51,800. Kham has the potential to cultivate food crops. The district has 26,000 ha of agricultural land. Priority crops are rice (6,400 ha), maize (12,300 ha) and other crops like Job's Tears⁴ (1,200 ha), canna root-African arrowroot⁵ (550 ha) and garlic (320 ha). Kham District is one of the highest cultivators of maize in Xiengkhouang Province. It also supports large livestock (28,000 cattle and 3,200 water buffaloes), and grazing (506 ha). The total forest area is 154,000 ha, with Protected Forest 83,000 ha, Production Forest 39,000 ha, Conservation Forest 32,000 ha and Forest Plantation 8,500 ha. There is no specific species mentioned in for forest plantation, but the district report provides general information such as pine trees, eucalyptus, acacia, teak, rosewood (*dalbergia tonkinensis*) and Sappanwood (*biancaea sappan l. Tod*).

Kham District's 5-year Agriculture and Forestry Development Plan 2020-2024 aims to increase rice production, especially in the rainy season, expand local rice species (small chicken-*Khao kai noy*), and reduce the area of upland rice from 1,700 ha to 1,000 ha (DAFO, 2019). In addition, the district also aims to increase commercial crops (maize, garlic, watermelon and vegetables) and large livestock, especially cattle to 29,200 head and water buffaloes to 6,700 head. DAFO, with the Strategic Support for Food Security and Nutrition Project (SSFSNP) provided 3 tonnes of forage seeds (Napier, Ruzi) to 15 villages, together with training on cultivating crops and rearing cattle (DAFO, 2019).

Scoping study villages

This scoping study was conducted in two villages in Kham District: Samphanhaxay and Namhom. Household land ownership is evidenced through land use titles with land tax records/receipts. In order to avoid paying land tax, reported land ownership is generally much lower than actual land ownership. While some households own up to 20 ha, most report approximately 3 plots (6 ha) per

⁴ Edible varieties are consumed in different forms, also used for jewelry and embroidery, traditional medicine, animal feed <https://www.pha-tad-ke.com/jobs-tears/>

⁵ starchy root <https://npgsweb.ars-grin.gov/gringlobal/taxon/taxonomydetail?id=8858>

household. Some young households are landless and have to rent land from households with excess land.

Samphanxay Village is located approximately 35 km north of Kham town via an unmade road. Its total land area is 2,000 ha. There are 198 households of mainly *Hmong* ethnic group. The main commercial crops in the village are upland and lowland rice, maize and peanut. The village also supports large livestock comprising approximately 1,200 cattle and 100 water buffaloes.

Households in these villages were mainly focused on upland and lowland (paddy) rice until maize was introduced to the village in around 2006. Maize became a ‘boom crop’ in 2010. In 2015, farmers began cultivating forages for rearing large livestock. Farmers do not apply any fertilisers or manure for maize cultivation, but have been using herbicide since 2010. When asked about their production, farmers reported that their maize production had declined, e.g. 25% of production compared to the first time they adopted maize. The livelihood activities for households in the village mainly focus on maize production and large livestock while they depend on/follow market trends.



Samphanxay village with a mountain landscape of forage and fallows. Photo: S. Mienmany, Jan 2023

Namhom Village is located approximately 20 km north of Kham town via an asphalt road. The total land area of approximately 800 ha, agricultural land 500 ha, with 327 ha of maize, 200 ha of planted forages (Napier, Ruzi) and 36 ha of paddy rice. The village protected area is 3 ha.

There are 118 households, all of which are *Lao-tai* ethnic group. The main commercial crops in the village are lowland rice, maize and garlic. The village also supports large livestock comprising approximately 1,000 cattle and 50 water buffaloes. Since 2022, many households have expanded their planted forage (Napier, Ruzi) because the price of maize has decreased. A farmer expressed that:

“People converted their maize plots to planted forage because maize price is low while cattle price is good and in high demand; and also because the soil is less fertile after cultivating maize for many years”. (Fieldnotes, Jan 2023)



Namhom village with a mountain landscape of paddy rice, maize, forage and fallows. Photo: S. Mienmany, Jan 2023

A few households in this village own up to 10 ha of maize land and up to 15 ha of forage land. On average though, households own around 6 ha, and the minimum landholding is 1 ha. Households with little land can rent from other households with excess land, or they can rent from households in nearby villages. With the demand for land for commercial crops (booms for maize and forage for rearing cattle), households continue to illegally open/clear the district protected forests.

Pressures, risks, vulnerabilities

- Farmers have observed drought for four years already, affecting their cropping calendar.
- Insufficient forage seeds and difficulty with accessing seeds.
- Soil quality decline
- People opened/cleared more forest lands (despite warnings from the village head not to do so)

Projects/organisations in Kham District:

Sustainable Agriculture and Environment for Development Association (SAEDA) has supported a COFI project (2019 – 2023), which promoted cultivating organic vegetables and rice and organised training to produce organic fertilisers. The project covered 13 villages with 280 households involved in the project.

The Strategic Support for Food Security and Nutrition Project (SSFSNP) (2016 – 2023) has recently been completed. It aimed to expand and intensify the production of nutritionally rich plant-based foods, and the production and promotion of animal-based protein for household consumption; to improve post-harvest handling and food processing to strengthen year-round food security; and to promote income-generating activities, with a focus on women. In Xiengkhouang, the project was implemented in Kham and Nonghet Districts. In Kham District, the project covered 32 villages (see Appendix 2 for the village name list). The project has improved road access to crop fields, improved irrigation systems and assisted farmers with making fences for their cattle. Furthermore, the project supported a greenhouse for farmers to cultivate vegetables and provided forage seeds (Napier, Ruzi) to 12 villages – 324 households which can be cultivated for 134 ha. In addition, the project assisted in establishing the Agricultural Production Groups in 17 villages with 28 groups this group can also function as village saving fund.

Southern Laos – Salavan Province

Salavan is located in Southern Laos, 700 km from Vientiane. Its total area is 10,691 km², with a total population of 442,000 people. Salavan borders Savannhaket Province to the north, Vietnam to the east, Xekong and Champasack Provinces to the south, and Thailand to the west. Salavan Province is divided into 8 districts: Salavah (the capital of the Salavan Province), Ta Oy, Toumlane, Lakhonepheng, Vapy, Khongsedon, Lao Ngarm and Sa Mouay Districts. The agriculture land is 298,000 ha with 83% of the land classified as low quality, 15% medium and only 2% is classified as a good quality (PAFO, 2022).

Salavan Province has three agricultural zones: highland (Ta Oy, Sa Mouay and Toumlane), upland (Lao Ngarm) and lowland (Salavan, Khongsedon, Lakonepheng and Vapy). Based on the province's agriculture strategy in the 1990s, the mountainous area was allocated for orchards and livestock rearing. In contrast, the upland area was mainly focused on commercial crops such as coffee, vegetables, maize and cassava, and the lowland area was mainly for paddy rice (see Figure 2). This system of classification continues to be used or referred to in the current day. However, farmers are cultivating crops in response to market demand and prices (e.g. cassava), so these agricultural zones may now include mixed farming systems.

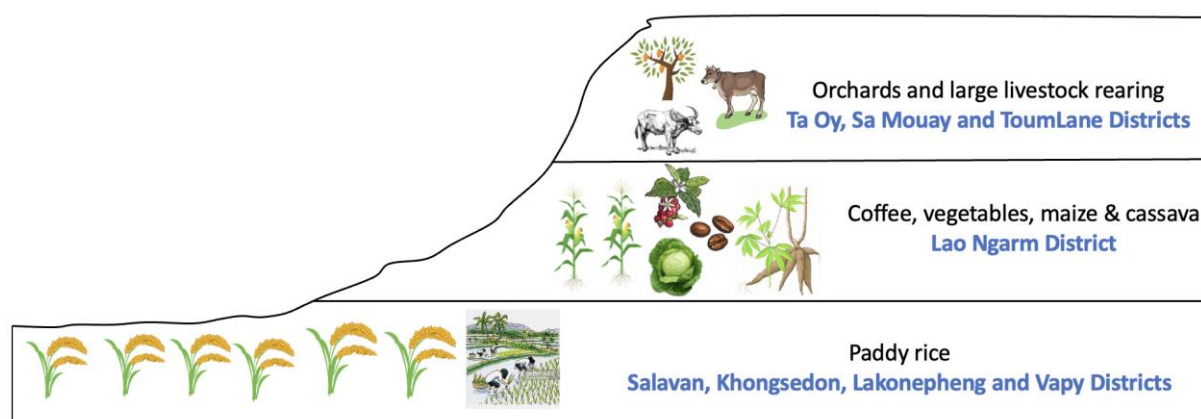


Figure 2: Agricultural zones in Salavanh Province

Lao Ngarm District

Lao Ngarm is located 50 km southwest of Salavan Province's capital city. It has approximately a total area of 135,000 ha, of which 46,000 ha is forest area and the rest is agricultural land and residential areas. the agricultural lands have been classified as cultivated for consumption (13,000 ha) such as rice, vegetables, pumpkin, cucumber and sweetcorn and commercialisation (70,000 ha) such as cassava, maize, rice coffee, peanuts, sweet potatoes. The maize commercial crops such as cassava 15,000 ha while the coffee area is 16,500 ha. There are 97 villages. The large livestock – cattle 3,300 head and buffaloes 3,300 head.

The priority commercial crops are cassava and coffee, rice, followed by sweet potatoes and local bananas. The area of cassava crops covers 14,000 ha, which is slightly less than for coffee at 15,700 ha but much more than rice at 3,200 ha. The total number of large livestock in Lao Ngarm is 27,000 cattle and 10,150 water buffaloes (DAFO, 2022).

Since 2018, DAFO officers have introduced intercropping in Lao Ngarm District through a project supported by Asian Development Bank (ADB), International Fund for Agricultural Development (IFAD), Oxfam and the Agriculture Creating Linkages for Expanded Agricultural Networks (CLEAN) project. The project has introduced intercropping systems like cassava + peanut, cassava + melon, and cassava + pumpkin. It has also introduced cultivating bean or sweet potatoes for the first two years of banana plantations or the first three years of durian plantations. These practices have been adopted by half of the farmers in the district, while the other half have yet to practice any crop rotations due to labour and time consumption. For livestock rearing, farmers still mainly adopt a conventional system with natural pasture. Farmers graze their livestock in their own fields and sometimes in open grazing/ along roads and some farmers leave their large livestock to graze in the forests. Also, farmers graze their livestock in maize and paddy rice fields after harvesting season. Forage crops are new in this area and planting materials are difficult to find. Farmers reported not knowing where to get forage seeds and what are costs and benefits of investing in cultivated forages and techniques to cultivate and feed livestock (Fieldnote, Dec 2022).

Scoping study villages

This scoping study targeted two villages in Lao Ngarm District: Phonnouane and Datsiaphonhin. Phonnouane Village is approximately 10 km from Lao Ngarm town via an asphalt road, while Datsiaphonhin Village is approximately 15 km from Lao Ngarm town via an unmade road. These villages are located close to National Protection Areas (Nam Set), and villagers have cleared forests for commercial crops, especially due to the recent cassava boom. Landholdings in the two villages is relatively similar. Households own up to 15 ha, while the minimum landholding is 2 ha/household. The majority of households (80%) own around 6 ha. The details of the two villages are as follows:

Phonnouane Village is located approximately 10 km from Lao Ngarm town via an asphalt road. The total land area is approximately 700 ha with a forest area of approximately 200 ha and agricultural land of 470 ha with the main crops are cassava (460 ha) and paddy rice (10 ha). The village has 182 households. There are only 30 cattle in this village and most farmers leave them close to their cassava and paddy fields and some households keep them near their house. Feed sources is open grazing around their agriculture field, along rivers, and roads during the cropping season but after harvesting season farmers leave cattle in their crop fields. This village's cropping system mainly focuses on cassava, peanuts, sweet potatoes, paddy rice, bananas and coffee. Cassava was introduced in the village in 2015 and became a boom crop in 2018 and 2019. As a result, many coffee growers cut down their coffee and replaced it with cassava. Farmers in this village do not apply chemical fertilisers, manure and herbicides due to high cost and are unfamiliar with the practice and reluctant to try.

Access to credit in the village is mostly from traders (for cassava), and for other agricultural investments, villagers can access credit via Bank. Find out more detail about the mixed farming system from a household interview Box 2 (below)

Box 2: Household of Mrs Pouane and Mr Dom, Phonnouane Village

Mrs Pouane and Mr Dom are in their 40s and have three children. The eldest has just finished high school and is about to start a bachelor's degree in Vietnam. The other two are in secondary school. The wife and husband are therefore the family's main source of labour. They have approximately 6 ha, of which 5 ha is for cassava and 1 ha is for paddy, banana and other vegetables. They started cultivating cassava in 2015, at the same time as other villagers. They started with 3 ha and then increased to 5 ha in 2020. They cut down coffee trees to be replaced with cassava. In 2022, they rented 3 ha more to grow cassava. During the interview for this scoping study, they were clearing a small plot of land next to their house (around 0.5 ha) previously used for growing bananas, but now they plan to use it for cassava. They reasoned that:

"Coffee provides 30 million LAK/ha while cassava provides 70 million LAK/ha. We are thrilled with our returns from growing cassava".

The household has five cattle and do not grow forages. They leave their cattle to graze near paddy fields and open grazing (along roads and rivers) during cropping season and then in paddy fields after harvesting season. Their livelihood mainly focuses on cassava. They have been practising intercropping cassava with peanut and sweet potatoes to improve soil quality and to generate additional income. They know about these techniques from their interactions with DAFO.



Smallholder interview at Phonnouane Village
Photo: S. Mienmany, Dec 2022

The household's livelihood aspirations are to continue growing cassava, although they also wish to do more with livestock. Although they would like to grow forages, they appreciate that it would require more labour than the household currently has.

Datsiaphonhin Village

The village has a total land area of 6,800 ha, of which 1,700 ha is agricultural land. There are 383 households, all of which are *Souay* ethnic groups. The main crops in the village are cassava (580 ha), coffee (300 ha), cardamom (50 ha), peanuts (100 ha) and bananas (50 ha) and vegetables. Livestock rearing is also significant; this village is one of the targeted villages for Village Fund for large livestock rearing. However, livestock rearing is mainly conventional and yet to start cultivating forages. Most feed sources are open grazing in their agriculture field, along roads, rivers and in the protected forests.

Like Phonnouane Village, farmers started cultivating cassava in 2015. In 2020, many farmers chopped down their coffee trees to grow cassava due to the falling price of coffee and the high price and high demand for cassava. However, in 2021, farmers returned to growing coffee again because the coffee price increased.

Generally, farmers in this village are practising or growing similar crops or mixed farming systems, i.e. every household has more than one crop; most grow cassava, coffee, peanut, bananas and paddy rice. However, farmers in this village do not practice intercropping but rather crop rotation. They expressed that:

"Our cropping systems have no zoning or intercropping; we just do the same as our parents did for many generations. We want to know other techniques too. Some district staff came to our village with company staff to sell and promote fertilisers for coffee, cassava and paddy rice and then provide techniques, but we have not decided to use fertilisers yet because our soil is still good".



Datsiaphonhin village with national protected areas and cassava fields. Photo: S. Mienmany, Dec 2022

Villagers' aspirations for their livelihoods are to return to coffee, but focus on Timor Coffee (small beans) which has a better price (12,000 LAK/kg) and high yield (25-30 tonne/ha) with better crop management (e.g. adding fertilisers and irrigation); and to continue cultivating cassava intercrop with peanuts. The villagers are keen to learn about sustainable mixed farming systems. They expressed a desire for government staff and/or projects to operate in and support their village.

Pressures/ risks/ vulnerabilities

- Soil quality decline
- Climate change (warmer and changes to the rainy season)
- Input costs have increased (e.g. fertilisers and fuel price fluctuations) as well as access difficulties
- Labour shortage, especially during the rainy season (when many farmers focus on transplanting rice)
- Drug addiction among (young) men in the village (Datsianahin Village)
- Since 2017, villagers are continuing to open more forest in the conservation areas due to the cassava boom, and illegal logging remains in some areas

- Farmers currently focus on expanding cassava production and abandoning their paddy, which the provincial government expressed concerns about
- High input costs for paddy so cassava provides better returns.
- Lack of coordination and deep understanding among rural development providers in delivering village-based activities

Projects/organisations in Lao Ngarm District:

- Agriculture Creating Linkages for Expanded Agricultural Networks (CLEAN) project in collaboration with Cassava Cooperation has organised training for farmers on Green Agriculture Practices (GAP) and Integrated Pest Management (IPM) for cassava, coffee and cabbage in the areas of 1,000 ha.
- World Vision Laos support vegetable farmers.
- Microfinance in rural areas – Access to Finance for the Poor (AFP) project is funded by German Federal Ministry for Economic Cooperation and Development (BMZ), co-financed by the Australia Federal Department of Foreign Affairs and Trade (DFAT). The project covers 6 provinces (Attapue, Champasack, Luang Namtha, Salavan, Savannakhet and Sayabouly) and Vientiane Capital. The Project was implemented by the GIZ and Bank of Laos. The common use of microfinance is for agriculture investments such as coffee, cassava, cattle rearing, and other households' needs such as health and education.

Southern Laos – Xekong Province

Xekong Province is located in Southern Laos, about 780 km from the Vientiane Capital. The province's total area is 7,665 Km², with 85% of the area being mountainous. Xekong Province borders Salavan Province to the north, Vietnam to the east, Attapue Province to the south, and Champasack to the west. Xekong is divided into 4 districts: Lamam, Kaleum, Dakcheung and Thatheng Districts, with a total population of 130,000.

Agricultural zones and farming systems in Xekong Province are classified based on the geographical conditions of each district. For example, Kaleum District is a remote and mountainous area close to the Vietnam border; the farming system mainly focuses on livestock, and the livelihood depends on Non-Timber Forest Products (NTFP); the road to this district is rough, so investors seldom go there. While Dakcheung District is an upland area with a cold climate and is close to the Vietnam border, the farming system mainly focuses on livestock, coffee, bananas and ginseng. Kaleum and Dakcheung Districts are still on Laos's list of poorest districts. While Thatheng District is classified as a plateau area with a cold climate and volcano soil, the farming system mainly focuses on coffee, vegetables and rice, especially cabbages. Lamam District is a lowland area with a warmer climate suitable for paddy rice and cassava (see Figure 3). Therefore, the priority crops of this province are coffee, cabbage and rice. There is limited cassava grown in this province due to the weather being too cold and fertile soil. So, cassava produces many leaves with big stems but few cassava roots (Fieldnotes, Dec 2022).

MFS in Xekong Province has been practised for many generations. However, the intensification by applying chemical fertiliser, particularly for cabbage, has been practised for around 10 years. On the other hand, coffee production is relatively new, and farmers started to apply fertilisers about a couple of years ago because Vietnamese investors have introduced a new coffee variety and crop management techniques that they can produce 25 -30 tonnes/ha. (Fieldnotes, Dec 2022).

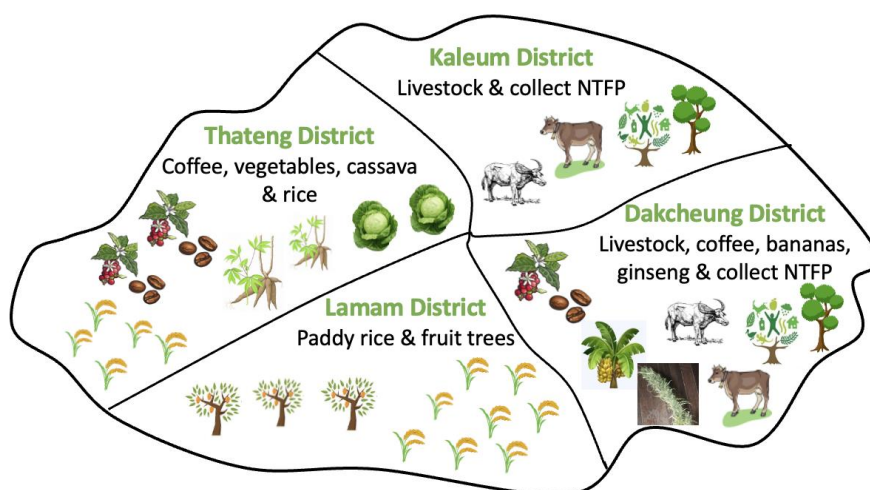


Figure 3: Agricultural zone in Xekong Province

Thateng District

Thateng is located 50 km northwest of the capital of Xekong Province, with a total area of 70,490 ha, with forest land of 23,000 ha (33%) and agricultural land is 24,000 ha (34%) and other land (33%). There are 47 villages with a total population of 44,000 people.

Based on the Agricultural Development Plan and Strategy of the district and Xekong Province, the goal of the agricultural development mainly focuses on food security and nutrition and promoting agricultural commercialisation, especially prioritising growing coffee, maize, cardamom, peanut, cassava, raising pigs and poultry (DAFO, 2022). The district has divided the agricultural zone into 6 zones such as: Zone 1 mainly cultivates coffee (small beans variety) and vegetables, as well as tourism services, Zone 2 grows fruit trees (durian and avocado) and coffee (big beans variety), Zone 3 has rice and small livestock, Zone 4 has rice and medium to large livestock; Zone 5 has fruit trees and large livestock and Zone 6 has coffee, cardamom and fishery. However, farmers are only sometimes following the classified zoning. Farmers in this district, especially those cultivating vegetables, cassava and livestock rearing, are smallholder farmers, while most coffee growers are smallholders (80%) and 20% are investors.

Rice is classified as the top priority crop for food security in the district, with a total area of 4,000 ha with the upland rice of 98 ha. Other food crops for food security are sweet corn (480 ha), taro (203 ha), green beans and other vegetables (550 ha) and fruit trees (1,600 ha). In terms of commercial crops such as coffee (6,000 ha), cassava (8,500 ha), cardamom (630 ha) and vegetables (640 ha), peanut (220 ha) and bananas (430 ha). Regarding livestock rearing, there are 17,300 cattle (5,500 heads sold in the domestic market and 350 heads for export), and 2,700 water buffalos (1,200 heads sold in the domestic market and 210 heads for export). Most large livestock rearing is in conventional system/ natural pasture, while growing forages is new for this area.

Scoping study villages

This scoping study targeted two villages in Thateng District: Huasé and Lakkhao. The households in the villages were mainly focused on paddy rice and coffee for many generations until vegetable cultivation was introduced to the village in around 2006, because of the demand for export market to Thailand. In 2018, farmers began adopting cassava into their cropping system, and later in 2020 farmers began cultivating forages for their large livestock. Farmers do not apply fertilisers or manure for cultivating cassava, but for vegetables, they apply chemical fertilisers. However, some farmers participated in Green Agriculture Practices (GAP). Farmers rarely apply fertilisers in coffee growing; the average coffee product is around 4 tonnes/ha while the coffee growing and managed

by investors or cooperation, the production is higher, almost 10 times more (30 tonnes/ha), as they apply fertilisers and use an irrigation system. Current cropping systems in these villages mainly focus on coffee, vegetables, cassava and forages for large livestock. The details of the villages are as follows:

Huasé Village The village is located approximately 5 km to the east of Thateng town via asphalt road. The total area is around 2,000 ha with 1,500 ha of agricultural land. The main crops are coffee (569 ha), cassava (333 ha) and paddy rice (395 ha). There are 493 households with many ethnic groups, but the majority (70%) is *Laven* and others such as *Talieng*, *Taoiy*, *Katou*. The village has 270 cattle and 60 buffaloes which are mostly left to graze close to their crop fields, in natural pastures and forests. However, around 2020, farmers in this village started planting forages (Napier, Ruzi) introduced by DAFO and farmers know about growing forages from other farmers outside their villages.

Furthermore, almost half of the total households in the village practice sweetcorn intercrop with cassava and a few farmers have started planting coffee mixed with durian. This practice was started by the village headman in 2017 because there is not enough land for him. In addition, in 2005, this village had a rubber concession in an area of about 125 ha.

Box 3: Household of Mr Thongsoun and Mrs Latsamy, Huasé Village

Mr Thongsoun is 53 years old and Mrs Latsamy is 46 years old and they have two children. They are both government officers (primary school teachers). They have approximately 10 ha of agricultural land and 30 cattle.

In the past ten years, they only focused on growing coffee and rice, but now there are many crops they can adopt, and there are markets. They expressed that:

“Mixed farming system can generate income from many sources. Also, when other people have many things or cultivate many things, we also want to do the same”.

There are coffee, cassava and forages in their cropping system. They have grown coffee for 70 years already; inherited from their parents.



Smallholder interview at Huasé Village
Photo: S. Saysana, Dec 2022

In 2021, they started grazing. They have 0.5 ha of paddy but only cultivate in the rainy season, the dry season they could not cultivate because they do not have enough water. So, they keep that paddy for their cattle.



Smallholder interview at Huasé Village
Photo: S. Mienmany, Dec 2022

Challenges in their cropping system and livelihood activities are:

- Difficult to find forage seeds;
- Climate conditions, they have to irrigate coffee in order to increase productivity.
- Time to work on their farm is only after office hours.
- Do not have machinery for chopping fodder.

In 2020, they planted new coffee integrated with trees (*Mai manpa* - a local hardwood variety). Also, in the same year, they started cultivating cassava because the price was good.

Their future plan for their livelihood activities is to expand more forages, and they want to try to plant rubber trees. Also, they plan to cultivate cassava for the first 2 years of planting trees (*Mai manpa*). They expressed that:

"We want to buy land or allocated some of our land to plant rubber trees. Our plan is rubber plot will give to our son and coffee for our daughter".

Lakkhao Village The village is located approximately 8 km south of Thateng town via asphalt road. The total area is 1,656 ha, with 200 ha of forest land; the rest is agricultural land, residential areas and other land.

There are 169 households and the villages' main crops are coffee (450 ha), vegetables (105 ha), cassava (50 ha) and paddy rice. In terms of the cropping system, the majority of farmers in the village (55%) practice mixed farming system that have vegetable, coffee and livestock, while about 25% of total household focus only growing coffee, 20% of total households is only cultivate vegetables. In addition, households in this village often practise intercropping by cultivating vegetables in the first year of their coffee growing. Recently, households started cultivating coffee mixed with avocado trees.



Interview Village head and visit his organic cabbage farm, Huasé Village Photo: S. Mienmany, Dec 2022

Farmers apply chemical and organic fertilisers in their vegetable cultivation but not for coffee growing. However, the Village Head expressed that:

"It is still challenging for us to be organic farms because there are no or very few differences between organic and non-organic vegetable prices. So, farmers feel discouraged to be organic farms".

In terms of landownership, 90% of the villagers have permanent land titles (golden certificate) and majority of landholdings in the village is 1 ha/household. In contrast, some households have up to 10 ha. The village also has large livestock, primarily keep them in natural pastures and village forests. However, in 2022, few farmers have started planting forages (Napier, Ruzi).

Pressures/ risks/ vulnerabilities

- Farmers followed market trends and abandoned the government's strategy for crops (particularly coffee);
- Difficult to access forage seeds;
- The market price for organic and GAP products are unattractive;
- Difficult to access input such as fertilisers, pesticides and herbicides and farmers do not know how to use those products properly;
- There is a high cost for agriculture inputs, so farmers do not want to invest and instead keep practising their conventional cropping system, which they have practised for many years.
- Difficult to access microfinance, and no one wanted to take risks; the village had set up a village fund group but failed due to a lack of trust and funding management system;

- Cassava production has declined, and farmers rent land in other villages to cultivate cassava because the land in the village is not suitable;
- Climate change – changing rain pattern, too hot and too cold;
- Theft of livestock and livestock sneaked into the field and destroy crops, e.g. cattle eat damaged durian trees;
- The village opened more village forests to cultivate cassava and coffee.

Projects/organisations in Thateng District:

Several projects have been implemented in Thateng District. Based on the interviews with key informants and from the DAFO annual report (DAFO, 2022), the current projects that are being implemented in the district are:

- The bamboo and rattan harvesting project, which is supported by the World Wildlife Fund (WWF)
- Forest conservation and environmentally friendly project. The project aims to create a Village Protected Area (*HouayPad* Protected Area) at Toum Yor Village. DAFO has done a field survey and village consultation in 2022;
- The crop value chains with environmentally friendly Project that is supported by the Asian Development Bank (ADB). The project mainly focuses on vegetables and applies GAP guidelines and supports the upgrading of vegetable collection and marketing infrastructure clusters with service provision to farmers. The project helped 3 villages in Thateng to create the vegetable group and enhance capacity building for DAFO staff, farmers' skills and cooperation management;
- The Korea International Cooperation Agency (KOICA) provided funds to farmers in Thateng District to improve infrastructure (roads, village meeting hall, markets and landfill) and income generation for households, such as cultivating vegetables in greenhouses, orchards, forages, cooling stations, and coffee processing.
- Similar to Lao Ngarm District, the CLEAN Project is also implemented in Thateng District. The project support GAP and organic coffee production, cabbage and cassava products.

Analysis and maps of key stakeholders

The key stakeholders in sustainable agriculture development and the potential for co-designing and scaling up the Sustainable Food Intensification on Mixed Farming Systems in Laos are the Ministry of Agriculture and Forestry (MAF), Ministry of Natural Resources and Environment (MONRE), Ministry of Planning and Investment (MPI), Ministry of Finance (MOF) and Ministry of Industry and Commerce (MOIC) (see Figure 4). Each ministry presents in all provinces through its own provincial office (Provincial Agriculture and Forestry Office (PAFO), Provincial Office of Natural Resources and Environment (PONRE), Provincial Office of Planning and Investment (PPI), Provincial Office of Finance (POF), Provincial Office Industry and Commerce (POIC), respectively), and all districts through its own district office (District Agriculture and Forestry Office (DAFO), District Office of Natural Resources and Environment (DONRE), District Office of Planning and Investment (DPI), District Office of Finance (DOF) and District Office of Industry and Commerce DOIC, respectively). However, the most powerful and have a high interest in improving their agriculture sector is MAF and the National Agriculture and Forestry Research Institute (NAFRI) because of their roles and responsibilities for all aspects of food production with the Agriculture Development Strategy to the year 2025 and Vision to the year 2030 (MAF, 2015a). Furthermore, NAFRI plays a significant role in agricultural research partnerships with local and international organisations and has a crucial role in implementing research activities at the national, provincial, district and village levels. The irrigation sector also has a significant role in agriculture development but mainly in cropping systems that access irrigation, especially rice cultivation.

The ministry operates under laws and regulations of the Agriculture Law, the Forestry Law, the Law on Aquatic Resources and Wildlife, the Law on Livestock and Veterinary Services, the Plant Protection Act, the Fisheries Act and the Irrigation Law (Bouapao et al., 2016).

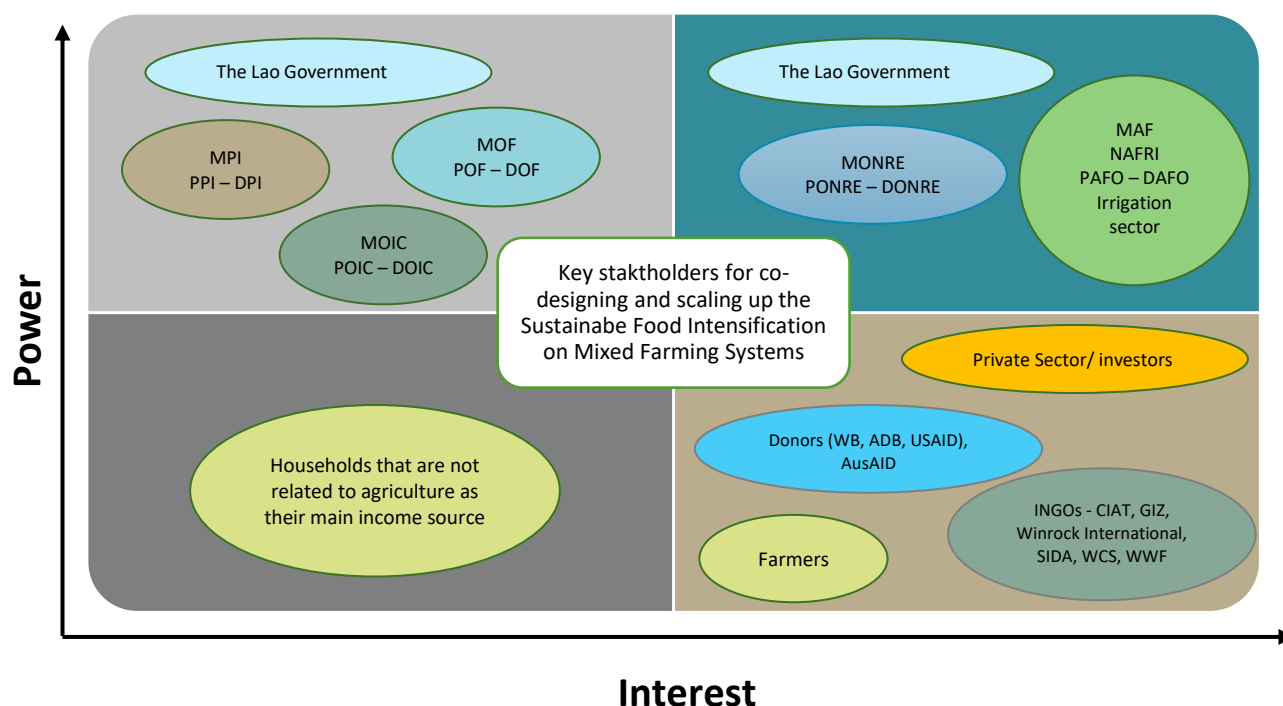


Figure 4: Key stakeholder matrix

The second most powerful and has a high interest is MONRE. The ministry was created in 2011 by amalgamating the Water Resource and Environment Administration (WREA) with departments of the National Land Management Authority (DALAM), the Geology Department, the Department of Forest Conservation, divisions of the Ministry of Agriculture and Forestry, and the Lao National Mekong Committee (LNMC). This ministry is responsible for developing and implementing several policies, plans and guidelines related to natural resources, including land, water, forest, environment, ecosystems, climate change and quality monitoring (Bouapao et al., 2016; MONRE, 2021). In terms of agriculture, MONRE plays a significant role and works closely with MAF in agriculture land and forest allocations. One of the PAFO staff mentioned that:

“if we talk about land, we need to work closely with PONRE especially farmers have been opened more forest land” (Fieldnote, Dec 2022).

While the Lao Government is still the most powerful actor, not all government sectors are highly interested in the agricultural sector. MPI has high power but low interest in agriculture production. MPI is responsible for managing macro-level investments and strategic planning, including the 5-year Socio-Economic Development Plans (SEDP), the most recent is the 9th SEDP (2020-2025) and economic policies, international economic cooperation and domestic and foreign investments (Bouapao et al., 2016; MPI, 2020). This ministry may have low interest in the agricultural sector because of its role in overseeing investments at the macro level, but the majority of Lao households' livelihoods are based on agriculture activities, so this agriculture sector remains one of the key priorities for the country's socio-economic development. However, it depends on investment projects. This interpretation was based on the interview with key stakeholders. Similarly, MOF and MOIC have high power but may have a low interest as they are parts of agriculture investment processes. For example, investors must register with MOIC for business certification while

investment approval also involves MOF. In addition, MOF also has a role and work with the private sector and donor in accommodating and facilitating farmers' access to microfinance.

The stakeholders that have high interest but less power are farmers, private sectors/investors, donors (WB, ADB, USAID), AusAID) and international non-government organisations (INGOs) such as CIAT, GIZ, Winrock International, SIDA, WCS, WWF. These stakeholders are eager to improve households' livelihoods while conserving natural resources and moving toward sustainable farming systems and the Sustainable Development Goals (CGIAR, 2023). However, even though the INGOs may have less power, in some cases, they have high power over the local government sector in designing project activities. For instance, one key informant mentioned that:

"I think some of the agriculture development goals in our province are often based on or followed a project's objectives and activities that the projects have already designed"
(Fieldnotes, Dec 2022).

Finally, the stakeholders with less power and low interest may be those unaffected by and/or not benefit from sustainable agricultural development. These groups may be the households whose primary income source is non-related to agricultural activities.

Analysis of policies, strategies, institutions, technical guidelines

At the central Level: MAF is implementing its Agriculture Development Strategy 2025 and Vision 2030 with the aims to ensure food security, produce competitive commercial agricultural commodities, develop clean, safe and sustainable agriculture, and shift gradually to the modernisation of a resilient and productive agriculture economy linking with rural development contributing to the national economic basis (MAF, 2015). While the strategy emphasises agricultural commodity production, it also promotes the integration of quality food production within agro-ecological zones and green agricultural practices (GAP) and climate smart agriculture and focuses on smallholders (Bouapao et al., 2016; MAF, 2015a). Furthermore, at the central level, the Lao Government announced the National Agendas for 2021-2023 on economic and financial recovery, ensuring recovery from COVID-19, increasing investments in human capital, and financing environmental management and climate challenges (Vientiane Times, 2021).

In terms of trade agreements, Laos has been a member of the World Trade Organisation (WTO) since 2013 and continues to integrate with the Association of Southeast Asian Nations (ASEAN) neighbours through the ASEAN Economic Community, which several trade agreements have with all nine other members of ASEAN. Laos and the United States signed a Trade and Investment Framework Agreement in 2016. Moreover, Laos has also signed various bilateral agreements with Vietnam, China, Cambodia, Burma, Thailand, North Korea, Mongolia, Malaysia, Russia, India, Belarus, Argentina, Kuwait, and Turkey. In addition, Laos is a member of the Regional Comprehensive Economic Partnership (RCEP), which took effect in January 2022 (International Trade Administration, 2022).

In terms of the cross-border vegetable trade in Southern Laos, there is an informal agreement with Thailand with a semi-formal trade relationship between the Champasak province and Oubon Rachatani province in 2005, culminating in the 1st Contract-Farming agreement, in accordance with the Ayeyawady– Chao Phraya-Mekong Economic Cooperation Strategy established in 2013 (ADB, 2018)

In terms of the coffee trade in Laos, there is a component of the EU-funded project named ASEAN Regional Integration Support (Laos-ARISE Plus) offers insights into building resiliency in the face of the COVID-19 pandemic and contributes to the integration of the Lao economy into global production chains through the involvement of both public and private sectors and focused on

smallholders and small and medium enterprises (SMEs). Furthermore, the Lao Coffee Association improvement roadmap will be implemented within a new project for the coffee sector financed by French Development Agency (AFD), starting in mid-2021 (UNDP, 2021).

At scoping study areas: Xiengkhouang's 5-year Socio-Economic Development Plan 2020-2024 (SEDP) states that the priority for the province's agricultural development is livestock rearing. The second priority is tourism and services; the third is agricultural and natural products processing (PPI, 2020). In order to achieve the SEDP, a series of factors and activities have been promoted and implemented over the past five years of SEDP (2016-2020). Firstly, the province has 3 centres: 1) *Nahoi* Livestock Breeding Centre which focuses on enhancing the staff's and farmers' knowledge and skills in livestock such as improved nutrition and techniques that promote large livestock for market-oriented, not only for subsistence. The provincial government signed an agreement to hand over this centre to the Vietnamese Milk enterprise in 2018 but there has been no progress, so currently the centre remains managed by the Lao Government (mainly PAFO). The other two centres are the Crop and Livestock Breeding Centre which focuses on fish breeding and fruit trees (e.g. mango, longan and so on) and the Laos-Vietnam Technical Centre for Agriculture which is the main centre that provides training to staff and villagers. These two centres remain functioning and continue to support staff and local villagers. Furthermore, the province has increased agricultural extensions from 18 to 20 extensions. Secondly, land use planning has been developed and improved in 5 districts (80 villages). Thirdly, there was research on improving soil quality and agroecology by cultivating legumes and improving irrigation systems. Fourthly, the province also promotes production groups and cooperation with 551 groups, with two-thirds (374 groups) being livestock groups in 7 districts (Pek, Kham, Nonghet, Mok, Khoun, Phoukoud and Phaxay Districts).

In addition, there has been increasing agricultural investments from domestic and foreign investments. The province clearly mentioned that improving techniques and technology in the cropping system is still challenging particularly in the bio-technology and sustainable and effective and efficient mixed farming system (PAFO, 2020). Moreover, as large livestock is the province's first priority for their socio-economic development plan, the province has promoted the livestock rearing system associated with forest conservation and water resources management by integrated silvopastoral. Also, the province has set a goal to increase forest cover to 60% of the total area of the province in 2025 (currently 34%) (PPI, 2020).

However, it is challenging for the Lao Government to achieve and implement sustainable agriculture development goals because the collaboration and communication between central and provincial levels and also among provincial to district and to village levels still need to be improved (PAFO, 2020). Furthermore, it is challenging for agriculture development especially in the government sector to establish and implement agricultural activities by themselves – the sector mostly relies on development projects' goals and activities as mentioned above. However, in order to have better collaboration between the central and provincial levels requires clear goals and responsibilities for each team member (Fieldnotes, Dec 2022).

In Salavan Province, 3 agriculture extension centres and 10 stations have been working and supporting farmers under the supervision of PAFO to achieve their agriculture strategy 2025 and vision 2030. The province has implemented the National Agenda by promoting organic agriculture (OA) and GAP, using organic fertilisers and manure. The province aims to set up a household model and expand to wider areas. Also, the Lao government tried to limit the import and use of chemical fertilisers, herbicides and unregistered insecticides. The province has finished the guideline on using compost and finished disseminating the guideline to 75 villages that are in the targeted villages for GAP agriculture productions.

Furthermore, the province has created agriculture groups (68 groups) with areas of 2,800 ha, the province promotes households' income improvement through improving infrastructure and communities' skills with the support from international projects, e.g. KOICA. In addition, the

province has established the integrated rural development committee in 3 Southern Provinces in Laos (Salavan, Champasack and Xekong) based on the Provincial Agreement no. 2741, dated 28/04/2022 and the Village Development Committee in 5 villages (Khauset, Datsiaphonhin, Ownnoy, Dong and NongKae).

An observation from the field visit and from the provincial and district agriculture and forestry reports, Salavan Province has emphasised rice production, aquaculture and orchards but excluded cassava production from their annual report and future development plan. One of the reasons is that the cassava boom led to open more forests and some farmers abandoned their rice production and focused on cassava as described in the study villages (Fieldnote, Dec 2022).

Similar to Salavan Province, agriculture guideline for Xekong Province is mainly focused on complying with the Green Agriculture Practice (GAP) guidelines from the central government (MAF). The agriculture extension centre at Kapue Village has a total area of 3,800 ha, including a forage demonstration site of 150 ha and other trails for other crops e.g. vegetables and orchards. The province emphasised coffee and vegetable production and forage for large livestock. Farmers are motivated to invest in coffee again after many farmers chopped down their coffee to grow cassava (due to the high price of cassava and the low price of coffee). Also, a Vietnamese investor invested in small coffee variety (named *Tomor* in the local name), coffee growers in Thateng District are eager to improve their coffee production and invest their capital and labour in a new coffee production system.

In Salavan, the microfinance in rural areas – Access to Finance for the Poor (AFP) project provided a stable finance institution for local villagers. For example, a field visit at Datsiaphonhin Village and the discussions with the Village Committee have shown how the villagers worked together to access microfinance through the Village Bank supported by the Network Support Organisations (NSOs) (GIZ, 2021) and the Village Bank function effectively (Fieldnotes, Dec 2022).

Opportunities and entry points for co-designing and scaling sustainable intensification

Field visits in December 2022 in Southern Laos (Salavan and Xekong Provinces) and in January 2023 in Northern Laos (Xiengkhouang Province) and desk reviews provided some practical opportunities and entry points for co-designing and scaling sustainable intensification on mixed farming systems in the study areas and possibly across Laos. These are summarised in Table 1.

Table 1: Consolidated recommendations on opportunities and entry points for co-designing and scaling up sustainable intensification of mixed farming systems in Lao PDR

Themes of recommendation	Detail	Frequency Recommended
Support for technical guidelines and technology on crops & livestock systems	Provide technical support on improving soil quality and techniques on using fertilisers, herbicides and insecticides.	12
	Assist farmers with techniques and technology for growing small coffee that provide 25-30 tonnes/ha.	7
	Provide technical skills with demonstration plots/trials by taking action and showing farmers tangible evidence.	5
	Assist farmers in accessing forage seeds and growing techniques; and integrate trees in forages. For example, some key informants mentioned that: <i>"We need to look at the water management (water consumption/irrigation) in our cropping systems and know the crop cycles and crop management. So we then know and use our land effectively". (Fieldnote, Dec 2022)</i> <i>"We also see Vietnamese coffee company got 25- 30 tonne/ha, but do not know how to start and what are the details of those techniques. We know only that the system requires fertilisers and water". (Fieldnote, Dec 2022)</i> <i>"Our soil is still fertile; farmers have been cultivating commercial crops for many generations. So, we need techniques that help us get higher production with low cost and labour. However, changing what people have been practicing for generations is challenging". (Fieldnote, Dec 2022)</i>	4
Institutional arrangement/ Engagement	Strengthening agriculture extension engagement with villagers	4
	Opportunity to produce organic fertilisers in local communities and reduce importation (this link to National Agenda)	1
	Better coordination between central and local government (provincial and district) levels and province to province and district to district.	1
Support for farmers' organisations	Support farmers to create effective farmer groups or crop and livestock production cooperatives.	3
	Assist farmers in accessing to microfinance and grants for sustainable agriculture and improve rural households' livelihoods.	3
	Exchange lessons and practices with other farmers in other areas	1
	For example, some key informants mentioned that: <i>"We have been trained about sustainable farming systems for many years, but nothing really happened or changed because we do not have enough capital to take action. We need a project that not only provides training and skills, but we want to a project that assist us to access credit; we don't mean that we want grants, but we want to take loans with a stable finance institutions." (Fieldnote, Dec 2022)</i> <i>"We still have natural resources-biodiversity that we need to preserve/protect. So we want to create tourism that links to sustainable agriculture – Agrotourism. Furthermore, we need to consider food safety and nutrition while increasing household income". (Fieldnote, Dec 2022)</i> <i>"We want to have farmer cooperation which will be easy for investors and also projects to work with farmers. Currently, we do not have cooperation. So, in the future, we want to have production cooperation, engage with companies and work with government and villagers". (Fieldnote, Dec 2022)</i>	

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Appendices

Appendix 1: Scoping study villages

No.	Location	#Households population (ppl)	Total Land area (ha)	Agriculture land (ha)	Coffee/ Cassava/ maize/vegetables & others (ha)	Plasture Forages (ha)	Livestock (heads) cattle water buffalo
1	XiengKhouang Province	47,161 264,000	15,99200	610,000	60,000	550,000 22,000	160,000 62,000
1.1	Phoukoud District	5,000 27,000	309,600		Maize – 5,900; Rice – 2,900		29,000 7,500
1.1.1	Lungjong	147	10,154	3,700		110 56	860 90
1.1.2	Longhang	105	7,800	4,800		90 74	448 70
1.1.3	Longkhan	131	11,500	2,600		60 55	2,800 40
1.2	Kham District	- 51,800	209,000	26,000	Rice – 6,400, maize – 12,300; Job's Tears – 1,200; tuber- <i>mansakou</i> – 550; garlic – 320		28,000 3,200
1.2.1	Somphanxay	198	2,000				1,200 100
1.2.2	Num Hom	118	-		Maize – 327; rice – 327	200	1,000 50
2	Salavan Province	442,000	1,069,100	298,000			
2.1	LaoNgarm District	NA	92,000	43,000	Coffee – 16,500; cassava – 15,000; rice – 3,200		38,000 3,300
2.1.1	Phonnouane	182	500	470	Cssava – 460; rice – 10	0	30 0
2.1.1	Datsiaphonhin	383	6,800	1,700	Cassava – 580 Coffee – 300 Cardamom – 50 Peanuts – 100 Bananas – 50	5	Cattle: Buffaloes:150 0
3	Xekong Province	130,000	766,500	-			
3.1	Thateng District	44,000	70,490	24,000	Coffee – 6,000; cassava – 8,500; Paddy rice – 4,000, upland rice – 98; vegetables – 640		17,300 2,700
3.1.1	Huasé	493 2,600	2,160	1,500	Coffee – 569, cassava – 333; paddy rice – 395	0 4	270 59
3.1.2	Lakkhao	169	1,656		coffee – 348; vegetables – 105;	0 2	350

Appendix 2: Village name that involved in the Strategic Support for Food Security and Nutrition Project (SSFSNP) in Kham District

2017	2018	2019	2020
Ban Nameang	Ban Longpiew	Ban Naloaung	Ban Hin
Ban Naphanh	Ban San	Ban Namouan	Ban Nahphieng
Ban Yodpian	Ban Houayphat	Ban Phouhin	Ban Leanahdor
Ban Bouamphieng	Ban Phonxay	Ban Tha	Ban Xaydou
Ban Namchark	Ban Naxay	Ban Houayhorm	Ban Sanfane
	Ban SobOr	Ban Sankham	
	Ban Soum mam	Ban Sanphoh	
	Ban Vieng	Ban Hatkham	
	Ban Sobnah	Ban Vansong	
	Ban Sobpern		
	Ban PhienPhang		
	Ban Sankeo		

The CGIAR Research Initiative on Mixed Farming Systems aims to provide equitable, transformative pathways for improved livelihoods of actors in mixed farming systems through sustainable intensification within target agroecologies and socioeconomic settings.

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