

# Foresight scenarios of future developments for crop-livestock integration and livestock system in Điện Biên district:

Prospective Workshop, 18-19 October 2022



■ ACTIVITY REPORT

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## Summary

A participatory approach of co-designing prospective scenarios was used to define futures of the crop-livestock integration practices and of livestock systems development at farms and territorial levels in Dien Bien District.

Based on the previous results (landscape characteristics, agrarian diagnosis, farm typology and farm trajectory), a diversity of local stakeholders (farmers, extension agents, local authorities) identify the factors of change in crop-livestock integration practices, and livestock systems development specifying the internal factors (on which they can act) and the external ones (on which they cannot act). The attendees reflect on the range of possible future changes in crop-livestock integration and livestock systems at farm and district levels (current evolutionary trends, possible alternatives).

Finally, they describe the prospective scenarios.

Based on the results of the prospective workshop, 5 scenarios have been designed.

In the first scenario A - The current situation continues. The district still has a mix of farms, specialized livestock farms and crop farms. The number of farms continues to decline in favor of specialized farms. Slope crops are still grown with soil degradation. Fodder has continued to develop on roadsides and in gardens. A few more industrial farms established in the district are dependent on feed processing companies, without links with other farms for animal feed and soil fertility management. Farmers use more chemical inputs and concentrates. Fodder resources are insufficient to support the development of livestock production.

With the scenario B "Feed self-sufficiency", farmers implemented new areas of fodder crops. Slope land crops (maize and cassava) are partially replaced by fodder and forest following reforestation objectives. The farmers and local authorities would be as self-sufficient as possible in animal feeding (on-farm production, applying technical innovations, crop residues treatment, feed formulas). An industrial feed factory is set up in the district. Part of the slope crop plots (maize and cassava) supply the factory. Some farmers process crop and by products through a fodder market. The size of the herds remains modest.

With the scenario C "Environmental Awareness"

To face the environmental impact of agricultural systems, local population and policies support policies of reforestation, decrease in chemical fertilizers and pesticides uses. A manure market is developed to ensure a better distribution of organic matter. The crops on slopes have been stopped and land has been converted to fruit and fodder production. Capacity building and knowledge sharing allow farmers to improve the soil fertility management, inputs saving and apply intercropping, cover crop and agroforestry principles. Livestock systems are adapting to the land use and feed resources.

With the scenario D "Development of intensive livestock farming"

The strong consumer demand pushes the increase of meat production, with an intensification of feeding practices and a specialization of farms. The livestock farms decrease but the herds increase. The animal feeding system is based on fodder and industrial, with a fodder market and feed industrial and private processors. Capacity building and knowledge sharing allow farmers to improve the animal feeding systems, applying precise rationing, limiting feed wastage, promoting weight gain and good animal health. The slope crops supply a feed industrial and private factory.

Finally, in the scenario E "Development of quality livestock and crop products" The farmers engage in niche businesses, using quality signs to develop high added value and quality agricultural products. Policies to protect forests and sloping lands lead to conversion of slope crops to fruit production, forest regeneration or fodder production. Manure and soil fertility management contribute to the recognition of agricultural products quality. Farmers fatten their animals, and maintain moderate herd sizes. Biomass exchanges between farmers are well developed (manure, fodder, processed products).

## **Tóm tắt**

### ***Kịch bản tương lai của mô hình kết hợp trồng trọt - chăn nuôi và hệ thống chăn nuôi ở huyện Điện***

***Biên: Hội thảo Triển vọng, ngày 18-19 tháng 10 năm 2022***

Phương pháp tiếp cận có sự tham gia để cùng phác thảo kịch bản triển vọng được sử dụng để xác định tương lai của các thực hành kết hợp trồng trọt và chăn nuôi và phát triển hệ thống chăn nuôi tại cấp độ nông hộ và cấp độ tiểu vùng ở huyện Điện Biên.

Dựa trên các kết quả trước đó (đặc điểm cảnh quan, chẩn đoán nông nghiệp, phân loại hộ và quá trình sản xuất nông nghiệp của các hộ), các tác nhân địa phương (nông dân, cán bộ khuyến nông, chính quyền địa phương) xác định các yếu tố thay đổi trong thực hành kết hợp cây trồng-vật nuôi và phát triển chăn nuôi, cụ thể là các yếu tố bên trong/chủ quan (mà họ có thể hành động để thay đổi) và các yếu tố bên ngoài/khách quan (mà họ không thể can thiệp). Những người tham dự đề cập các thay đổi có thể xảy ra trong tương lai liên quan đến mô hình kết hợp cây trồng - vật nuôi và các hệ thống chăn nuôi ở cấp nông hộ và cấp huyện (tiếp tục như hiện tại, các giải pháp thay thế khả thi). Cuối cùng, họ mô tả các kịch bản triển vọng.

Dựa trên kết quả của hội thảo triển vọng, 5 kịch bản đã được phác thảo.

***Kịch bản A – Tiếp tục như hiện tại.*** Trên địa bàn huyện vẫn có sự đa dạng các kiểu hộ: chuyên chăn nuôi, chuyên trồng trọt, kết hợp trồng trọt – chăn nuôi. Số lượng nông hộ giảm dần nhường chỗ cho các hộ chuyên canh. Cây trồng trên đất dốc vẫn được duy trì, cho dù đất đai bạc màu. Tận dụng các diện tích lề đường và trong vườn để trồng cỏ. Một số trang trại được thành lập nhưng mua thức ăn chăn nuôi của các công ty chế biến, chứ không có liên kết với các nông hộ khác để quản lý thức ăn và độ phì đất. Nông dân sử dụng nhiều hóa chất nông nghiệp và thức ăn tinh hơn. Nguồn thức ăn thô không đủ để hỗ trợ phát triển chăn nuôi.

***Kịch bản B - Tự cung tự cấp thức ăn chăn nuôi.*** Người dân mở rộng diện tích trồng cỏ. Cây trồng trên đất dốc (ngô và sắn) được thay thế một phần bằng cây thức ăn gia súc và trồng rừng. Nông dân và chính quyền địa phương sẽ cố gắng tối đa để tự cung tự cấp thức ăn chăn nuôi (sản xuất tại hộ, áp dụng cải tiến kỹ thuật, xử lý phụ phẩm cây trồng, chế biến thức ăn). Nhà máy sản xuất thức ăn công nghiệp được thành lập trên địa bàn huyện. Một phần sản lượng cây trồng đất dốc (ngô, sắn) cung cấp cho nhà máy. Thị trường thức ăn thô xanh phát triển, một số hộ chế biến cây trồng và phụ phẩm cây trồng làm thức ăn gia súc. Quy mô đàn còn khiêm tốn.

***Kịch bản C - Nhận thức về môi trường*** Để khắc phục tác động môi trường của các hệ thống nông nghiệp, người dân và chính quyền địa phương triển khai chính sách trồng rừng, giảm sử dụng phân hóa học và thuốc bảo vệ thực vật. Thị trường phân bón hữu cơ được hình thành để đảm bảo phân phối chất hữu cơ tốt hơn. Cây trồng đất dốc bị hạn chế để chuyển sang cây ăn quả và cây thức ăn gia súc. Nâng cao năng lực và chia sẻ kiến thức cho phép nông dân cải thiện việc quản lý độ màu mỡ của đất, tiết kiệm đầu vào và áp dụng các biện pháp xen canh, trồng cây che phủ và nông lâm kết hợp. Hệ thống chăn nuôi thích nghi với mô hình sử dụng đất mới và các nguồn thức ăn sẵn có.

***Kịch bản D - Phát triển chăn nuôi thâm canh.*** Nhu cầu cao của người tiêu dùng thúc đẩy tăng sản lượng thịt, với việc thâm canh thực hành chăn nuôi và chuyên môn hóa. Sở cơ sở chăn nuôi giảm nhưng quy mô đàn của mỗi cơ sở tăng. Hệ thống chăn nuôi dựa trên thức ăn thô và thức ăn công nghiệp, với thị trường thức ăn gia súc và các công ty và cơ sở chế biến tư nhân. Nâng cao năng lực và chia sẻ kiến thức cho phép nông dân cải thiện hệ thống chăn nuôi, áp dụng khẩu phần chính xác, hạn chế lãng phí thức ăn, thúc đẩy tăng trưởng và sức khỏe vật nuôi được đảm bảo. Cây trồng đất dốc cung cấp nguyên liệu cho các nhà máy công nghiệp và cơ sở chế biến tư nhân.

***Kịch bản E - Phát triển các sản phẩm trồng trọt và chăn nuôi chất lượng.*** Người nông dân tham gia vào các thị trường ngách, sử dụng các dấu hiệu chất lượng để phát triển nông sản có chất lượng và giá trị gia tăng cao. Chính sách bảo vệ rừng và đất dốc dẫn đến việc chuyển đổi cây trồng trên đất dốc sang cây ăn quả, tái sinh rừng hoặc sản xuất thức ăn gia súc. Quản lý phân bón và độ phì đất góp phần nâng cao chất lượng nông sản. Nông dân vỗ béo vật nuôi và duy trì quy mô đàn vừa phải. Trao đổi sinh khối giữa các hộ được duy trì tốt (phân bón, thức ăn gia súc, sản phẩm chế biến).

## Objectives

The objective of the workshop was to specify prospective scenarios for agricultural systems in Dien Bien district, at the farm and district level over the next 20 years (horizon 2040). Some scenarios had been developed within the framework of the Beef Cattle project in 2019, concerning the beef cattle production in Dien Bien Province (Duteurtre, 2019).

Within the framework of the ASSET project and the GASL AN2 network, NIAS, CIRAD and DARD are interested in the evolution of crop-livestock integration practices on farms and at territorial levels in Dien Bien District, as well as in the development of livestock systems in relation to the development of other activities (conservation agriculture, agroforestry, afforestation).

The main questions are:

- What are the changes in practices to come in the diversity of the farm and in the territory, in terms of crop-livestock integration practices, in terms of livestock systems?
- What will be the drivers of these changes?
- Who are the actors involved and what are their means of action?
- What will be the impacts of these changes on sustainability?

## I. Methodology

### A participatory approach

CIRAD, NIAS, and DARD teams have mobilised a participatory approach of co-construction of prospective scenarios used in exercises to define futures of the livestock and/or crop sector in Vietnam, Senegal, Indonesia etc (Bourgeois et al., 2018; Duteurtre, 2019; Nguyen, 2017).

A participatory approach involving local authorities, extension services from DARD and People Committee allows to involve the stakeholders in the design of the scenarios, relying on their knowledge and experience to define potential evolutionary patterns of livestock systems and crop-livestock integration practices.

The team build on the results of various works carried out previously: the **agrarian diagnosis** of the Dien Bien district (analysis of the landscape and history), the **typology of crop livestock farms** (focusing on specialisation and on crop-livestock integration practices), and the **trajectories of mixed farm** in the district.

These results made it possible to define the study system (diversity of farm and the Dien Bien district, 2 levels), to describe the landscape elements and farming systems that make it up, and to trace the past changes that have taken place there and the factors behind these changes, with particular emphasis on crop-livestock integration practices and farm specialisation versus diversification processes.

The historical interviews conducted with experts and those conducted with farmers to study the evolutionary trajectories of the farms suggest several possible futures for the farms and the Dien Bien district. These possible futures can be discussed with the participants at the end of the workshop and compared with the scenarios identified by the participants. Some of the scenarios identified during the workshop will be selected, based on their interest in the PhD work, and their interest for the local partners.

Using at least one locally adapted modelling tool representing the farms and the territory, we will simulate the selected scenarios to analyze their effects on the performance of the farms and the territory. The results of these simulations will be presented to the partners and possible recommendations may be derived from this work. At least, the results should feed some of the current and future reflections on the future of livestock system in the district.

The method used for this workshop consists of the following 5 steps.

- 1- Presentation of the objectives of the workshop

- 2- Presentation of the previous results: studied system, landscape characteristics, history, past evolution dynamics (typology, frieze, trajectory), Beef Cattle scenarios, and discussion with the participants to verify the first results, delimit the studied system and its main characteristics and agree on the theoretical framework of the prospective scenarios.
- 3- Identify the factors of change in crop-livestock integration practices, and livestock systems development on the farms and in the Dien Bien district. These factors of change are both "*internal*" (on which we can act) and "*external*" (on which we cannot act). From these factors, the "*driving variables*" are then selected (internal forces that have a strong influence on other internal forces).
- 4- Reflect together on the range of possible future changes in crop-livestock integration and livestock systems at farm and district levels. Start from the current evolutionary trends, and the possible alternatives and move towards a reflection on potential breakthrough changes. Select the hypotheses to be retained according to their relevance, their interest for the participants, and their plausibility.
- 5- Describe the prospective scenarios in detail, focusing on each component of the crop-livestock integration and livestock systems development. What improvements in performance are expected? What are the expected negative effects?

### **Participants involved**

The workshop was jointly organised and facilitated by NIAS, CIRAD and DARD.

The workshop is part of the ASSET project (*Agroecology and Safe Food System Transition in Southeast Asia* found by AFD and UE) and will contribute to the activities of Alice Le Trouher PhD (*Trajectories of crop-livestock integration in the context of specialisation in Northwest Vietnam*) and to the definition of the strategy for the development of the forage production value chain and the livestock value chain development.

The workshop will contribute to the activities of the GASL AN2 Network (*Global Agenda for Sustainable Livestock, Restoring value to Grasslands*) by preparing the ground for initiating dialogues between stakeholders on the multi-functionality of livestock systems and considering the future of Livestock Grazing Systems.

Bourgeois *et al.*, (2018) invite the organizers to carry out a "*mapping of necessary knowledge*" to select participants. The foresight focuses in particular on the evolutions of crop-livestock integration practices and livestock systems development, at the farm and the Dien Bien district levels. To ensure that the points of view expressed (Nguyen Mai Huong, 2017) and the areas represented are complementary, we invited actors with technical knowledge of local agricultural systems (crop, livestock, and forest management practices), knowledge of regulatory aspects (agricultural policies, land policies, etc.), and knowledge of the role of the local authorities in the development of the project.

To give each participant the space to express themselves and take part in the discussions, we favoured group sessions with a maximum of 7 to 8 people per group. Among the participants, in addition to their knowledge, we tried to ensure that they are representative of gender, age, ethnic groups and socio-economic diversity. We hoped that people from each of the five communes where we worked for the previous work will participate in the workshop. Those invited should be open to discussion and willing to exchange ideas and listen to those of others.

The participants were:

- Farmer: technical agricultural knowledge, reality, farm scale
- Village chief/farmer: agricultural knowledge, local administration, link with authorities, reality, farm, and village/commune scale
- Farmers belonging to a cooperative, farmers involved in groups (Mr "goat", Mr "clean vegetables"): broader agricultural knowledge, agricultural market. Farm and district level.

- Agronomist and/or veterinarian, People's Committee extension worker: knowledge of legislation and field reality. Commune and district level.
- DARD officer: knowledge of agricultural and land legislation. District, province, national level.

A participants list is in Annex 2.

The results of the workshop were presented to some of the experts involved in the first stages of the study to obtain an external critical opinion.

## II. Steps and first results

### **Stage 1: Presentation of the objectives of the workshop and round table presentation**

**Ms Xuan, vice president of DARD Province**, introduced the topic and the duration of the workshop, emphasizing the importance of livestock production in Dien Bien province, with the future trend towards ecological and agriculture, and safe industry in order to create "clean-safe" products, thereby creating the highest value for agricultural products. She wants the parties to exchange ideas together to create new changes in Dien Bien province agriculture. She emphasised the new market needs, the technicality and the change in practices needed to meet the requirements of the project. Agricultural products serve livestock and livestock products serve agriculture.

She recalled that possible recommendations could be proposed by the experts at the end of the workshop. These results could be used by the provincial DARD to start thinking about the direction of production in the future.

### **Stage 2: Presentation of the studied system, its landscape characteristics, its history, its past evolution dynamics, and the initial livestock development scenarios**

#### ***Give the definition of combining plants and animals (crop livestock integration)***

According to Uncle Hoa: is to take agricultural by-products for livestock and vice versa

Ms. Thuy: is to take agricultural by-products to make biogas to compost for fields, cultivate pastures for cattle, stino grass for chickens, ducks, fish...

A start: take people as the center of agricultural products to serve people in the future to create crop prices, reinvest in future farming and livestock, and take advantage of the power to pull cattle.

Mr Hoa gave the example of fertilising rice fields with cattle dung and feeding cattle with rice straw.

Ms Thuy's example: use of crops, rice bran, pdr for livestock as feed and manure for crop fertilisation.

Mr X (belongs to the interest group in the village of Na sang 1). In his village, following technical advice, composting basins were built with the aim of reducing the purchase of expensive chemical fertiliser. EG cuttings were given. Zuzi" is produced for C&C and pen is grown for poultry and fish.

Another potential benefit of AEI is to make money, for example by selling manure or livestock by-products.

***What about animal traction?*** Farmers are benefiting less and less. Buffalo are raised more for meat, but this depends on the area and is not yet a general rule. In the most remote areas in particular, the transport of products by buffalo (or cattle) is still practiced (impassable roads, lack of infrastructure).

#### ***Historical milestones of Dien Bien: 1950-2022***

Some details on the timeline

1975 and 2008: cold waves

1996: floods affected the agricultural sector with the destruction of crops, landslides that blocked rice fields and swept away animals. The army was sent to help the affected populations.

2012: 'blue ear' epidemic in pigs throughout the province with almost 100% mortality. As a result, only 2 years later some farmers dared to start pig farming again

2013: foot mouth disease in cattle

Despite the epidemics in pig farming, the total pig population in the district continues to increase due to the development of factory farms.



2015: veterinary law on livestock  
 2018: Production Act

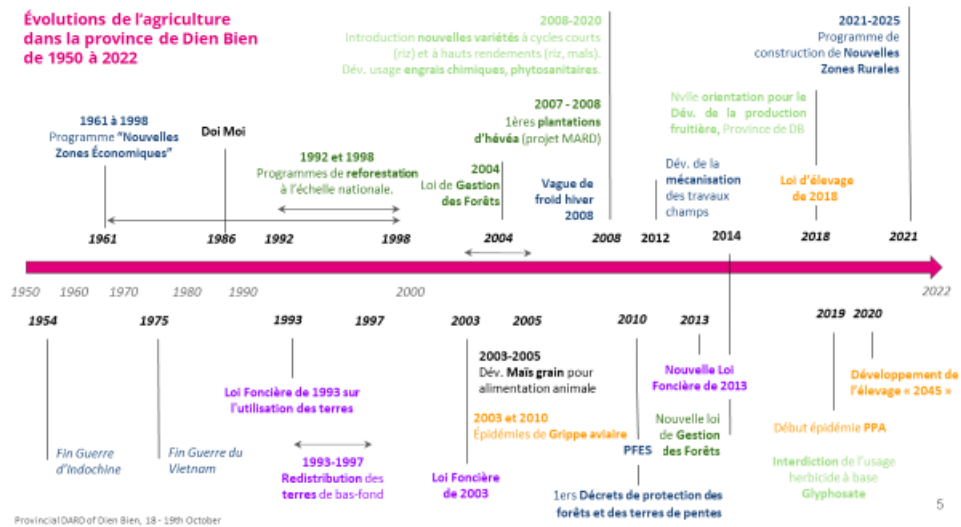


Figure 1. Historical milestones of Dien Bien from 1950 (Le Trouher, 2022)

**In terms of geographical location:**

To the west: many forests, sloping land, low cultivation efficiency, future economic development will be more developed such as Thanh Hung, Thanh blanket, and furrow communes.... colored flowers. Livestock can still graze because there is still hilly land

To the east: the land is fertile for more efficient crops such as maize and cassava.... livestock is raised in captivity

To the south: as in Nua Ngam communes, animal husbandry is grazing because of hilly land, grazing, and poor fertility of buffaloes and cows. Growing cassava all year round, there is no water source in the drainage ditch, not active water in agriculture, only relying on rain water, so farming that crop is shared by Uncle Tham, Ms. Chinh in Nua Ngam.

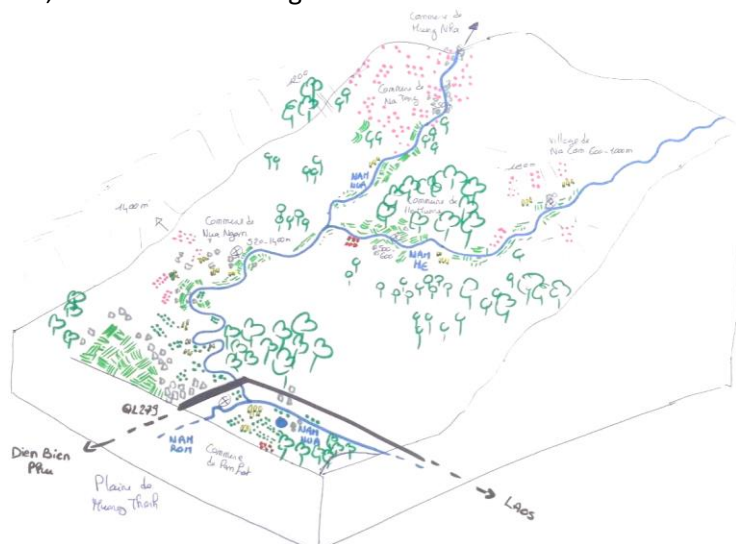


Figure 2. Dien Bien District geographical organisation (Le Trouher 2022)

Different land uses were observed, especially between the east and west of the lowland rice-growing area. This was confirmed by the participants, in the east (Thanh An), there are more crops on the slopes because the soils are more fertile, in the west there are more forests, there are no more crops on the

slopes or less because the soils are degraded. These differences in use are linked to a difference in soil quality.

The development of market gardening is more noticeable in the west than in the east. Despite the unfavourable conditions of the sloping soils, the economy develops better on this side of the plain thanks to fruit trees and market gardening.

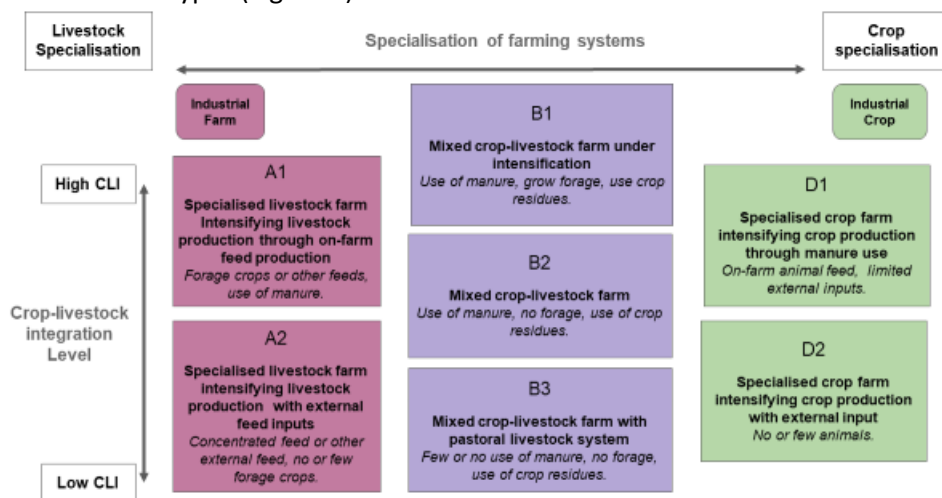
### What are the impacts on livestock farming?

Different impacts in the east and west, with more animals in stalls in the east (Thanh An hill) and animals still roaming around in the west (Noong Luong hill) (mostly under supervision). In the more mountainous parts, grazing is practiced in the southern part of the district and even roaming all or part of the year. There are [some] plans to grow fodder.

Mrs. Chinh from Noong Luong: 6-7 years ago we used to grow 1 cycle of maize or 1 cycle of rainfed rice on a slope but now (we don't use it anymore)... We used to be able to practice raiding but not anymore because it leads to conflicts with crops destroyed by animals. The small livestock farmers have sold their animals. Only the biggest breeders with 10-30 animals in stalls continue to breed and grow fodder. In his village there is no irrigation, water depends on the rains, hence only 1 cycle of summer rice.

### Farm classification

Last February-March, 111 households were surveyed in 5 communes: Nong Luong, Thanh An, Pom Lot, Nua Ngam, and He Muong. Based on the combined density of livestock production, households are divided into 7 types (Figure 3).



Provincial DARD of Dien Bien, 18 - 19th October

Figure 3. Farm typology

- B1: intensive farming of crops and livestock, with grass growing using agricultural by-products
- B2: Households combine crops and livestock using manure, not grass, using agricultural by-products
- B3: combine crops and practice livestock with little or no use of manure, do not make use of agricultural by-products, do not plant grass
- D1: households specialize in intensive farming, use manure, are self-sufficient in animal feed, and limit the use of external inputs.
- D2: households specialize in cultivating crops, remember to invest in the outside, have no or few livestock
- A1: Future livestock-specializing household is the owner of a feed source and grows grass using agricultural by-products
- A2: The household specializes in intensive livestock production with external feed sources and refined feed

Presentation of the typology and request to the farmers to situate themselves if possible.

Mrs Chinh is in category D1 (crops, pigs, little purchase of concentrates)

Reaction of DARD members: this typology corresponds to a certain reality but there are rather D1s and no D2s today. The "Bs" are in fact small farmers.

### **Farm trajectories**

There are 3 development trajectories

#### **Trajectory 1: "Stop grazing and grow grass"**

Increase the area of crops on sloping land and increase the area of forest protection

Future demand for feed owners is higher, reducing herd size and developing straw grass

Benefits of raising buffaloes and cows in captivity...: demonstrating herd health, easy protection, and disease prevention.

Reduce the number of herds due to no one to cut the grass and no forage

***How important are these changes?*** According to the participants, there are now 60-70% fewer farms practicing free roaming than before (10-15 years?).

Other reasons for stopping free roaming are changes in farmers' perceptions and in particular the realisation that it is easier to control epidemics if the animals are close to the farm, or in stalls. And do not mix with other farmers' animals.

With stalling, it is also possible to feed the animals better for better health and greater mass gain.

In Mrs. Chinh's village of Tan Ngam, there were 40/50 households with livestock compared to 10/50 today. According to Mr K, this decrease in the number of smallholders can also be explained by the lack of land for fodder production (following the end of grazing).

Fodder has become necessary for breeding.

#### **Trajectory 2: "households move from a combination of crops and farming to specialization and intensification of livestock"**

Because there is no grazing fund, no people to take care of cattle, market potential for development, self-sufficiency in feed sources when there are not many crops left.

Future husbandry is concentrated with a large amount of manure

Ms. Soi shared: she specializes in fattening cattle, has 3 gardens to grow grass to buy straw, add bran to increase transparency, fatten and sell meat.

Mrs Diu: In the past there were rather small breeders. If they want to specialise in breeding, why not increase the herd to 20-30 animals maximum. The purchase of inputs is necessary for better economic efficiency, feed autonomy is difficult to achieve.

Mrs Soi: In the past, she used to raise pigs, but with the successive epidemics, she sold them and bought cattle. Today she fattens 10-12 young cattle. She feeds them with fodder that she grows herself and buys rice straw (from > 1ha of rice field). She takes advantage of the rice bran and adds a little concentrate.

#### **Trajectory 3: households switch from growing to specializing in crops**

Availability of favorable land and water resources, developed output market

External private fertilizer source with manure maintenance, high organic fertilizer demand

The "D1" group is the most present in the "Ds", it concerns almost all farms (excluding industrial farms).

Concerning **other potential trajectories**, there have been cases of development of niche farming (deer, >10 farmers in the district, porcupines), depending on the modes and failures.

**-Farms that have disappeared?** Some practices are disappearing: such as cooking rice bran, vegetables, banana trees for pigs. Others are appearing, such as growing fodder, to the detriment of C&C.

- Some rice farmers have stopped farming to convert to processing agricultural products
- Breeders have stopped breeding to convert to animal slaughtering activities.

Concerning the potential for development of dairy farming, this is impossible because the processing plants are too far away.

### **Stage 3: Identifying the actual internal and external "drivers of change" of crop-livestock integration practices on farms and in the Dien Bien district**

#### **Policy for sustainable development of grazing and land cover systems**

##### 1: livestock development

Loans with low interest rates, support technical expansion, feed production, Support future farmer organizations such as cooperatives, Open vaccination sessions for pets

##### 2: fruit trees and industrial plants

Through the agro-forestry system, planting trees with noses such as mango, avocado, orange ; Fertilizer support; Combine product consumption

##### 3: forest management and protection

Payment for Environmental Services to protect the land in watersheds ; Have a plan on the use of forest land, protection forests and production forests ; Development vision of beef cattle market in our province ; Future cow breeding will focus on enterprise-scale intensive farming, market-oriented semi-intensive farming in the future. won't change significantly from today

#### **Current factors**

##### **a) soil fertility management**

Uncle X; discolored land

Ms. Hop: the land cannot be ploughed

Ashan: fertilizer prices increase

Uncle Hoai, Miss Chinh: abuse of pesticides

- Currently fertilisers are used in an unbalanced way (too much Urea, not enough P, K for example). This influences productivity and leads to the degradation of certain areas.
- Lots of rain this year

##### **b) forage: / Animal feed**

Small land fund, no place to graze

K has a water source for plants

K enough straw

No land available, water quality issues, high price of concentrates

But also:

- Unfavourable climate and no irrigation source for fodder
- No grazing area
- No land for fodder
- Few personal rice fields so little rice straw
- Compulsory monitoring of livestock

##### **c) Pulling power/Traction**

- Agricultural mechanization

#### **d) Trade forage forage and agricultural by-products**

Raw feed prices are still high

Exchange goods with each other such as a house for straw, a farmer for survivorship, wages for transportation

High demand for livestock

#### **e) Use of land for different activities farming, animal husbandry, afforestation**

Planning of different types of land

Soil fertility

Guaranteed water source

Always keep an eye on the variety of plants

Regulations on forest protection

The climate changes erratically

#### **f) development of livestock production system**

- Output value for agricultural products, output is not stable
- Increasing the area for planting grass lacks technical knowledge
- Thin Veterinary Network
- Buy expensive seeds

#### **New possible factors**

##### a) soil fertility management

Use manure

Organic fertilizer

Intensification of many crops, infertile soil

Bio-fertilizers

Increase salary

In the future, soils will be even more degraded and there will be more diseases, impacting on fertility.

There will be an intensification of production by producers motivated by limited land resources

Polluted water

Pesticide abuse

Limited land resources

Desire to see production income increase

If obligation to stop using pesticides: monitoring of the VietGap technical itinerary

##### b) forage:

Industrial feed is more and more popular

Cattle raised in captivity

Industrial park expansion

Limite en resource foncières : limite production de fourrage

Thinking about disruptive factors, one can imagine the development of industrial areas like in the Delta which will create additional pressure on arable land.

Development of animal housing

##### c) Pulling power

Do not use force to pull pets

There is no way back for animal traction, the future will see even less.

##### d) Trade forage forage and agricultural by-products

The needs of livestock farming and the evolution of the price of chemical fertilisers are factors that could motivate the development of the exchange of fodder and manure.

The problem is that the quality of the by-products is not assured

At the current price of manure or fodder, it is not interesting to sell/purchase these by-products.

High fertiliser/fodder prices in the future would limit the purchase/sale because of the high price of rice husk

By-products and even fodder from others are not necessarily interesting because the quality is not assured.

Motivation for the choice of buyers/sellers: very often they sell to collectors who offer the best prices.

Motivation for choice of supplier: price (1) and quality (2), acceptance of purchase on credit (3)

Donations to neighbours, family:

If rice straw is donated, the threshing service is paid in return by the recipient (example of practice).

Some give manure for free and there are a few cases where manure is sold.

There is no really developed market for pdr manure or fodder

If in the future there are buyers, then there will be producers

If prices are attractive then there will be more trade.

#### e) Use of land for different activities farming, animal husbandry, afforestation

The soil is discolored

The climate is not suitable for farming

- Soil fertility affects land use

- Water resources are also important for the development of irrigated terraces, for example.

More crop rotation could be practiced to maintain soil fertility

- Protection of forests by law

In the future it is mainly the fertility of the soil that will influence its use.

- The increasingly uncertain climate will also play a role

#### f) development of livestock production system

Intensive livestock farming

Farming system in

High market price

#### **Now**

- Market opportunities

- Development of forage areas

- Technical difficulties: Artificial insemination, accurate health diagnosis

- Mastery of techniques

#### **Future**

- The price of concentrated feed

- The price of pigs for sale, if the price of pigs increases then...

#### **Factors identified as most important in the future for the different groups are :**

- The level of soil degradation and the abuse of pesticides (fertility)

- The generalisation of the use of concentrates (feed)

- Continued mechanisation (traction)

- Market development/existence (trade)

- Climate (land use)

- The sale prices of animals, the outlets (livestock dev)

#### **Stage 4: Consider the range of possible future changes for crop-livestock integration in terms of farm and district level practice and select assumptions to be retained**

##### About animal feed

-In the future, the demand for meat is increasing

Farmers have a change in animal feeding system, making use of by-products, not depending 100% on refined feed.

Ms. Hop shared: there is a mixer, pressing bran for livestock, but these are small and future activities, there is not a recipe for mixing seeds for farmers.

Ms. Chinh shared: The inadequacy in transporting animal feed is that Dien Bien does not have a processing plant, we sell raw materials to the factory, then the factory transfers bran bags to Dien Bien, which increases the cost of production. enter, product price team

Price policy is supported by the state

The main lady shared that if only supporting farming to support the price of animal feed but no output value for agricultural products, people will not be excited and interested in livestock.

Ms. Soi shared that if bran was cheap, she would feed the buffaloes with bran directly

A Son also said that the price of input products is still high, for example, to grind bran we have to buy 1 bag of rice husk 20,000 VND mixed with corn, rice ...

Planting grass to sell to livestock farmers

People are willing to grow grass to sell if the market is stable and the price is good

The market for buying and selling straw is more developed

Farmers will collect straw after the harvest, compost it with salt, build a straw house to keep it all year round

Assuming 10-20 years there is a collective grazing area

This idea is not practical because the land fund is small, it will only be suitable for captive breeding, grass cultivation ....

Assume to raise clean cattle and feed 100% clean grass.

Farmers are willing to change the clean livestock model, but they must ensure the output of their products

Farmers are also willing to apply scientific and technical advances in animal husbandry, and will invest in technology after a reasonable balance between costs and profits.

#### About animal traction

Agricultural mechanization uses less force to pull cattle, using force to pull cattle, not in time to harvest and sow according to the season...

**Farmers are not afraid of difficulties, willing to apply and invest in scientific and technical progress, but must ensure output for agricultural products.**

#### **The difficulties encountered in livestock production in the future**

The difficulty of the output value for unstable agricultural products made people worry the most, when the real problem was that the seed was expensive but the commercial price was too cheap. farmers lose money. The covid epidemic still has a surplus in the future, the epidemic on livestock and poultry is also complicated

The input factor is still high, the output value for agricultural products is not stable, directly affecting the future farming of the household.

Industrial feed also has to be imported from abroad or from other provinces, traffic is difficult, transportation costs are high.

There are no grazing grounds

The climate changes erratically

Border gate is banned, domestic goods are stagnant

Reduce farm size, increase farm size

The tendency of enterprises to invest less in agriculture because of low profits and high costs

There is no redundant labor, young people go to work in big cities or factories

They agreed with the following comments:

- Desire to reduce labor force, i.e. agricultural mechanization
- Prices of input products decrease, stabilizing output values for agricultural products
- Hope more and more machines support farming to replace human labor
- Wish there was a factory to process animal feed

Table 1. Most important factors and Effects of the most important factors.

Content		Factor	Effects on practices
Soil fertility management practices	1	The soil is more degraded	<ul style="list-style-type: none"> <li>- Increase the use of organic fertilizers and green manures</li> <li>- Replace with perennial crops or legumes that guarantee yield and income.</li> <li>- Intercropping legumes with fruit trees</li> </ul> (Consequences of this factor on production: low crop yield, reduced income, lower product quality)
	2	Rise and abuse of drugs due to a increase in pest	<ul style="list-style-type: none"> <li>- Using biologic drugs</li> <li>- Intercropping crops with plants that repel insects.</li> </ul> (In animal husbandry, there is a method of planting lemongrass trees around the barn) (Consequences of this factor on production: Affect product quality, Drug-resistant pests)
	3	Better knowledge about technical innovation	The application of new techniques depends on the suitability of each crop <ul style="list-style-type: none"> <li>- Can increase intercropping,</li> <li>- Can increase land cover crops</li> </ul> The number of households applying technical equipment increases, but it takes a long time for people to see the benefits
	4	Rise in chemical fertilisers prices	Trend towards higher fertiliser prices, <ul style="list-style-type: none"> <li>- Producers continue to use fertilisers but in smaller doses.</li> <li>- Increase in the use of organic fertilisers for 1/3 chemical 2/3 organic.</li> <li>- Ash can be used to replace K.</li> </ul>
Animal feeding practices	5	Development of the meat market with a rise of meat demand	<ul style="list-style-type: none"> <li>- more and more concentrated/industrial feeds used</li> <li>- No more simple agricultural by-products are given, they are transformed once transformation techniques are mastered. For example rice bran and ground corn but still buy concentrates, if transfo formula then self production and no need to buy so many concentrates. It seems that this kind of formula already exists (rice flour, ground fish). No such official recommendation yet but some cases that would have learned these techniques elsewhere.</li> <li>- It is always necessary to have some concentrated feed, even if it is self-produced, because the quality may not be guaranteed. A reality: they sell the raw materials to the feed mills and then buy back the feed.</li> </ul>
	6	Public policy (helping on feed prices)	It would be good but it depends, the (market) prices of their products have to be stable; if there is a subsidy but their meat prices go down then it's no use. Less painful for them, because currently for pigs, cooking of ground cassava, but ground, vegetables, <b>- for example with subsidy more concentrates, less cooked feed.</b> More economical because gas or wood needed for cooking. It is good for the farmers (pigs), they have to buy rice bran and manioc but it is expensive (20,000 VND/bag of 20kg), if the prices are subsidised it is good for them. For fodder, in the case of subsidised prices she would not produce more fodder herself but <b>- buy fodder from others with subsidies.</b> If there are orders for fodder, one could think of going into production. But he doesn't see the difference between that and the current production of maize for sale. <b>- He is thinking of growing fodder on maize and cassava plots today</b> (he has a hulling machine so it is convenient to have rice and banana bran for pigs now).



Content		Factor	Effects on practices
			<p>He is thinking of increasing pigs today to 30 but if prices are subsidised could be up to 60.</p> <p>Increase buffaloes and cattle? → <b>even with subsidised feed prices, if meat needs do not increase then: high production but low prices.</b> There is no point in increasing the herd.</p> <p>Maybe a scenario imagined: subsidized feed prices by the state is not feasible for her. <b>If one day there is a feed factory in the district, the prices might go down, but if not, not.</b></p>
	7	Increase the production of forage.	<p>- <b>Buying fodder from producers,</b> (currently she buys banana trunks for her cows, if fodder available why not).</p> <p>No increase in the herd but will feed them better</p> <p>- <b>development of a fattening system.</b></p> <p>The fattening system is more interesting than farmer/fattener because it takes a lot of time to have a calf and to grow it up.</p> <p>In NL commune, more than 10 cases are fattening buffaloes with fodder, concentrates, and brewery dregs bought from Hanoi (but it depends on the market price for the dregs). At the moment the price of cattle is falling, so fodder only.</p>
	8	Law prohibiting the burning of rice straw	<p>- <b>would store more rice straw.</b></p> <p>Some already store rice straw in a covered hut (salt, pdr, salt etc.).</p> <p>Pdr market? The price of rice straw would decrease. The development of the market will depend on the needs.</p>
	9	Creation of new communal grazing area	<p>This is not at all feasible with the increasing population.</p> <p><b>Another feasible scenario is the conversion of maize or cassava plots to fodder.</b></p> <p>Even with grazing again, <b>she would continue to graze because of better disease control.</b></p> <p>If such a development was made on the land, <b>she could return to grazing if there were benefits.</b></p> <p>Mrs X has seen TV reports of farms like this, but not possible here as everyone would put the animals on it and no more grass in a few days.</p> <p>Not a realistic scenario, some cases with huts on high ground but for the herd of 1-2 families only. Some have fenced off areas for their animals or family animals.</p> <p>Rotation of grazing on fallow land, if 5-6 plots rotation possible but land is no longer available so not really feasible.</p> <p>Land resources are no longer available for this because if fallow areas are used, they will be occupied by maca, rubber trees etc. + price of land on slopes.</p> <p>Grass-fed farming valued with label in some countries, maybe in DB in the future?--&gt; M X gives an example for his fish: herbs only and market price 100k/kg while other fish 60k/kg, but others react and say that it is because he thinks directly to consumers. If selling to collectors, same price for all.</p> <p>Advertising of Vinamilk (3.0), without concentrates etc.</p> <p><b>There should be a brand for these products and with specialised shops that sell these products and value them.</b></p>
	10	Better knowledge about technical innovation (silage, other transformation practices)	<p>If the new techniques are more effective, why not?</p> <p>Some people are already storing elephant grass in small pieces.</p> <p>If the techniques and processed feeds are efficient, they would be willing to implement them. The investment needed VS income will have to be calculated.</p>
	11	Agricultural mechanization	<p>If there are roads or paths to the rice fields, then no more animal traction. This will depend on the infrastructure.</p>

Content		Factor	Effects on practices
Animal traction practices			<p><b>- Stop animal traction if necessary infrastructure is present (roads)</b></p> <p>No resumption of animal traction because less painful with machines, work is faster.</p>
	12	Development of agricultural tourism	To meet the needs of tourism, <b>traction could be resumed a little in some villages</b> . If it is profitable for them.
Exchanges of crops residues, manure, forage, other biomass	13	Intensive husbandry (specialisation of farms)	<p>Intensified livestock farming, probably the trend in the future as small-scale production has higher production costs, <b>buffaloes/cattle will be more stabled</b>.</p> <p>The number of smallholders is decreasing, at the moment land consolidation is taking place, so that crop production is feasible. But small scale as S average 0.3 ha per household but in 20 years if industrial areas, these areas can attract young labour force, and land consolidation would be feasible in this case for people really wanting to work in agriculture.</p> <p>The trend is towards specialisation of livestock and agriculture.</p>
	14	Development of a specialised market for trading manure and animal feed	<p>Currently agricultural products are not able to meet the needs of producers, e.g. manure for maca has to be bought from Ha Dinh province in the centre and by-products ... rice straw market (1.5M/truck of 2 tons).</p> <p>Maize and peanut stalks are sold to deer farmers, a spontaneous transaction, there is currently no market.</p> <p>There are concentrated dry crop production areas such as the communes of ..... Winter areas up to 70-90 Ha. For more remote areas already purchase/sale of PDR.</p> <p>In 20 years, it will not be possible to burn rice straw because it influences the airport, so there will be collectors of fodder and manure and there will be professional processors to produce compost or transform agricultural by-products such as silage to sell to breeders.</p> <p>In this case there will be state aid because it also concerns the environment. (burning).</p> <p>LACK OF EFFECTS ON PRACTICES</p>
	15	Development of industrial farms (need of feeds, manure available)	<p>There are already some farms like Huy Toan (3000-4000 pigs)</p> <p>There are companies like Mavin who are applying for permission to build pig farms in DB province.</p> <p>This trend exists but the number of farms may not increase very fast because of the distance between DB province and big markets.</p> <p>LACK OF EFFECT ON PRACTICES</p>
Land use	16	Implementation of a Policy on forest protection (increasing planting perennial trees, reducing annual trees, ditching grazing)	<p>If there are policies to support perennial plantations such as maca or fruit trees and forest protection</p> <p><b>- people will reduce the area under slope crops (cassava, maize, rainfed rice) and convert them to fruit trees.</b></p> <p>With a regulation of the prohibition of rambling</p> <p>- <b>people will increase the area of fodder on plots currently cultivated with maize, cassava and rainfed rice,</b></p>
	17	Climate Change? (rise of T°C, lack of water ?)	<p>- trials of perennial crops such as maca or fruit trees, in experimentation to see how effective they are and whether they are suitable for climate change conditions</p> <p>LACK OF EFFECTS ON PRACTICES</p>
	18	Market price fluctuations	<p>Buffalo and cattle prices are very volatile, <b>producers tend to diversify production activities</b> to get secure and stable income.</p> <p>LACK OF EFFECTS ON PRACTICES</p>
	19	Market demand	<p>Market needs as people tend to produce more fodder or decrease the number of heads for goats etc., niche market for better profitability</p>

Content		Factor	Effects on practices
			LACK OF EFFECT ON PRACTICES
Livestock production development	20	Strategies for local livestock development (ex 2045 etc.)	There are orientations for 2045 In general, there is support for buffalo herds, cattle and pigs, and for the link with the market and artificial insemination. There is support for farmers' organisation and cooperatives. There is support for the creation of production groups in the same village. Effects: more cooperatives and groups present. LACK OF EFFECTS ON PRACTICES
	21	Market price? augmentation diminution?	Market prices are not stable because retail prices are always high but sales at the producers' are always low because of the need to go through several intermediaries. Difficult to predict. Market stability plays a very important role. Once prices are stable, people can make production decisions. For example, profitability to invest in livestock. LACK OF EFFECT ON PRACTICES
	22	Meat quality development (niche market, labels..)	Livestock products depend on the export market, for example China (cows, buffaloes). In recent times, exports are facing difficulties (China, covid?) In 15-20 years agricultural products should meet quality criteria. Thanks to the development of concentrated production areas and producers will be more qualified. LACK OF EFFECTS ON PRACTICES

**In the future**, one of the challenges for local livestock farming is the **presence of outlets**. Farmers can accept hardships but the important thing is price and market opportunities.

Form Ms Hang, there are factors that lead to **higher prices for concentrates** (war, covid) and **unstable or lower prices for products**, influencing the profitability of livestock farming.

**In Dien Bien people want to have a feed factory in the province, but not all raw materials are available in the province**. In addition, Dien Bien has difficulties with infrastructure (road, distance).

Less and less pasture with the development of plantations (maca) influences the livestock systems.

New epidemics (recently new diseases like avian flu, blue ear disease in pigs, FPA) affect the export (ex. few exportations to China because of Covid).

In Dien Bien, climate change plays a role in the development of livestock farming (WHICH one?).

According to the law of animal husbandry, animals should not be raised in residential areas, that's why the trend is to **decrease the number of farmers** and increase the number of animals per farm to solve the problems such pollution.

Most of the farmers are old, but the **young people** are all currently working in the industrial areas. In the future they are thinking of mechanisation and equipment to replace manual labour (ex. machines already in place: fodder cutting machine, automatic feeders for pigs).

There is a labour challenge for livestock development in the district, but mechanisation of farming activities may help in this respect (Mrs. Hang).

No plans from the province or the district for the **development or maintenance of grazing area** because land resources do not allow it (exchange with Mrs Hang at the end of the workshop).

On behalf of the farmers, the information shared by the farmers, DARD would like the results to become a basis for the project to partially solve the difficulties that people are facing now.

## **Association of factors of changes and effects**

Working session in NIAs office in Hanoi involving Alice Le Trouher, Thuy Dinh Khanh, Tuan Han Anh and Mélanie Blanchard (Nov 9<sup>th</sup>, 2022)

### **" 1 + 4 + (2) "**

1 Severe soil degradation encourages farmers to use more organic fertilisers, to replace their annual crops with perennial crops or market gardening to secure yields and income, and to intercrop fruit with market gardening.

4 Rising prices of chemical fertilisers encourage farmers to reduce their use, increase the use of organic fertilisers and find non-chemical substitutes.

2 Overuse of pesticides for pest control is becoming less effective, environmentally damaging, and burdensome for farmers. They decide to use more organic plant protection products and to intercrop with naturally repellent plants (+biological control? this idea was not given but...). Factor 2 does not necessarily occur at the same time as the other 2 (ferti vs pesti) but it is possible.

### **" 3 + 1 + 2 + 4 "**

3 With a better knowledge of innovative techniques for maintaining soil fertility, farmers can develop or start intercropping, increase or implement plant cover.

### **"5a + 6a" and " 5b + 3 "**

5 Factor 5 impacts on animal feeding practices. An increase in demand for meat is expected as a result of the development of the meat market. (a) Farmers use more or start using industrial and concentrated feeds for better productivity. (b) Farmers produce their own processed feeds (on-farm feeds) from their by-products through the appropriation of technical skills (training, sharing...). They follow formulas recommended by DARD and ensure quality and autonomous feeding of their animals.

### **"6a + 5a", " 6b + 7 " and " 6c + 16 "**

6 Public policies in favour of farmers to support feed prices would have 3 effects. (a) Increase in the purchase and use of concentrates; decrease in cooked feed in rations. (b) The purchase of fodder grown by other producers for farmers who do not wish to develop their fodder production or who do not have the land resources to do so. (c) The development of fodder crops, by converting maize and manioc areas.

The development of a feed mill would be welcome in the district.

### **"7a + 6b" and "7b + 5a + 5b" (e.g. silage)**

7 The increase in fodder production (motivated by...?) leads to (a) the development of fodder purchase for some farmers, (b) the development of fattening systems.

"8 + 5b + 7b (silage production, fattening systems) + 14" (airport pdr)

8 Law prohibiting the burning of rice straw resulting in the storage of larger quantities of rice straw (or grazing).

(9) not at all realistic, so limited interest in scenario modelling

"10 + (3) + 5b + 7b" (3 as innovation scheme)

10 Better knowledge of technical innovations for animal feed.

"11 + all other factors except 12 (and 1, 2, 3, 4 maybe?)

For the evolution of animal traction, it is assumed that the use of draught animals will continue to decrease and stop completely if the infrastructure (roads, organisation of rice fields) allows it.

### **" 12 "**

12 Development of agricultural tourism, some draught animals are kept for tourists, to show the old practices.

Agricultural tourism in Vietnam on the products, on the landscape, homestay, reception on the farm. Could be linked with the development of more ecological practices...income from agrotourism, with development. Demand for quality products (niche markets etc.).

### **"13 + 7b + 5a + (5b) + 6a + 10 + (8)**

13 The specialisation of farms influences the exchange of biomass from the farms (crop residues, manure, fodder, other). Animals are more likely to be kept in cowsheds, the number of smallholders has decreased, land consolidation is taking place. The development of industrial areas may attract

younger workers who may wish to work in agriculture. This specialisation leads to the development of (7b) fattening practices, (13) complete stalling, (5a, 6a) the use of concentrates, (10) silage and also sometimes (5b) feed autonomy.

**" 14a + 1 + 4 ", "14b + 6c + 7 and "14c + 5b + 7b**

14 The development of specialised markets for manure, fodder and other feeds is accompanied ('in 20 years' time') by the presence of collectors of (a) manure and (b) fodder, but also by professional processors for the production of (a) compost and the (c) processing of agricultural by-products (e.g. for the production of improved feeds (rice straw + urea, maize silage etc.). These processed products will be sold to farmers.

**"15 + 13 + 14abc + (7b + 5a + 5b)**

15 The development and establishment of industrial (livestock) farms is accompanied by significant feed requirements and manure availability. Although these large farms usually contract feed with other large companies, it is possible to imagine local purchases/sales (more if local feed companies). These (13) specialised farms can encourage the development of (14abc) biomass markets. Some of them aim at (7b) fattening animals, use (5a) industrial feeds ((5b) but could develop on-farm feeds?).

**"16a + (6c) + 1 + 2 + 3 and "16b + 6b + 6c + 7a**

16 The implementation of public policies for the protection of forests and the development of perennial tree crops (16a) encourages farmers to reduce the area of slope crops (cassava, maize, rainfed rice) in favour of fruit trees. Public policies prohibiting animal roaming(16b) encourage farmers to increase the area under fodder crops by converting maize, cassava and rainfed rice plots. This is because they need more grass for animal feed. These fodder crops need to be maintained according to 'good' practices to ensure the protection of slope soils and forests.

**" 17 + 16a + 1 + 3 + 2 "**

17 Climate change and its many effects are prompting farmers and local authorities to develop large-scale trials of trees such as macadamias and other fruit trees to see how they respond to climate change. Linked to (16a, 1, 3, 2) decrease in annual slope crops and intercropping practices.

**" 18 + 21 "**

18 Fluctuating market prices encourage producers to diversify their activities in order to ensure a constant income.

**"19 + 5a + 6a + 22**

19 The increase in demand on the meat market leads to the development of a richer diet (e.g. use of cultivated fodder or concentrates) but also to the development of (22) niche markets.

**" 20 + 6a + 18 + 19 + 22 "**

20 For livestock development, the strategies for local livestock development in vision 2045 are implemented. These guidelines support the grouping of livestock farmers into cooperatives, the practice of artificial insemination, the development of (19) niche markets, in conjunction with (18) price stability and the (22) development of quality chains.

**" 21 + 18 "**

21 Fluctuating market prices (redundant with 18)

**" 22 + 19 "**

22 The development of a quality meat market with the establishment of labels. For example.

## **Stage 5: Description and discussion of the prospective scenarios**

It is assumed that rice-growing areas will change little in the coming years because they are important for the economy and local food sovereignty (no decrease in land or if urban inhabited areas or industrial production develop) and they are limited by limited land resources (no strong increase because land is on slopes, mountainous, not irrigated, difficult to access). On the other hand, cultivation practices are bound to evolve: mechanisation, new varieties, phytosanitary, fertilisation management, management of crop residues.

### **Scenario A "The current situation continues**

The district still has a mix of family farms, specialized livestock farms and crop farms. The number of family farms continues to decline in favour of specialised farms. Slope crops are still grown to the detriment of the soil, fodder has continued to develop on roadsides, in gardens. A few more industrial farms have been established in the district. They are dependent on feed processing companies and have no link with the rest of the territory for feed and fertilisation. Farmers are using more and more chemical inputs for fertilisation and concentrates when possible for feeding. Fodder resources are insufficient to support the development of livestock production.

### **Scenario B "Feed self-sufficiency**

Farmers have expanded and implemented new areas of fodder crops, encouraged by local agricultural development policies. Plots of annual crops such as maize and cassava on valley bottoms and slopes have been partially replaced by fodder and forest following reforestation objectives. The objective of the farmers is to be as self-sufficient as possible in feed by producing feed on the farm. In general, the district wanted to become more feed self-sufficient throughout the territory in order to be more resilient. The technical innovations were transmitted by the agricultural supervisors and through discussions between farmers who have appropriated them. They transform crop residues to benefit from additional and better quality feed: rice straw treated with urea, maize silage, others (nutritional quality increases). Concentrated feed formulas have been shared by the agricultural management and farmers can produce their own feed (maize meal, cassava meal, etc.) for pigs, poultry and as a supplement to livestock. An industrial feed factory was set up in the district (LIEU) 10 years ago and farmers have retained some of the slope crop plots (mainly maize and cassava) to supply the factory with raw products. Some farmers have started to produce processed agricultural products which they then sell locally, and the fodder market has also developed. The size of the herds remains modest although the number of animals is higher than in the 2020s due to the limiting condition: the availability of feed (because of the lack of availability of agricultural land).

### **Scenario C "Environmental Awareness**

Strongly impacted by soil degradation leading to a decrease in yields, the collapse of local biodiversity, redundant water pollution problems, significant risks to human health and the climatic context, the local population and policies have supported a policy of reforestation and a decrease in the use of chemical fertilisers and synthetic plant protection products. The management of fertilisation of cultivated soils is a central issue in the development of agriculture in the district. A manure market has developed to ensure a better distribution of organic matter. The majority of annual crops on slopes (maize and cassava) have been stopped and land has been converted to agroforestry (fruit trees + fodder) for reforestation. Better knowledge of soil needs and functioning, and training provided by local agricultural supervisors, have enabled farmers to improve their fertilisation management and save on inputs. Intercropping, plant cover and agroforestry have been developed in a way that is adapted to each agroecological context. (The question of the use of regenerated soil biomass by livestock is now being asked. Where is it available and accessible? How can it be used?) Livestock farming has continued to develop in the district by adapting to these constraints of land use and soil protection.

### **Scenario D "Development of intensive livestock farming**

The development of livestock farming and the increase in the production of meat products as a result of strong consumer demand was made possible by the intensification of feeding practices and by the specialisation of farms. The herds of farms with livestock production, which are fewer in number, have increased in size. The animals are mostly kept in stalls. Livestock feeding is based on fodder production, which has developed in recent years. A fodder market has emerged and farmers can produce their own fodder if they have the financial, land and human resources, or buy it on the market from accredited collectors. The livestock sector has become more structured and farmers buy their feed (concentrates, flour, silage, processed rice straw, etc.) from specialised shops or companies. In order to meet standardisation, provide consistent quality and comply with health safety regulations, farmers no longer buy feed directly from other farmers apart from fodder. The management of livestock residues varies from farm to farm. The manure produced can be used by farmers with crops, and the surplus, if any, will be sold. Manure can also be sold directly if farmers do not have crops, either locally or outside the district. Farmers' knowledge of their animals' dietary needs has been enhanced through training and communication with and between farmers. They practice more precise rationing, which limits feed wastage and promotes weight gain and good animal health. The opening of an industrial feed factory in the district 10 years ago has encouraged this development of livestock farming. Farmers have retained some of the slope crops (mainly maize and cassava) to supply the factory with raw materials. Part of the slope crops were converted to forest according to the reforestation objectives.

#### **Scenario E "Development of quality livestock and crop products"**

The development of quality livestock and fruit/tree products with high added value has enabled farms in the district to break away from the mainstream of production and consumption in order to engage in niche businesses, using quality signs (labels etc.). Production quantities and herd sizes are limited by feed and land resources, but the benefits are visible. Policies to protect forests and sloping lands have been followed by the conversion of part of the annual crops into perennial crops (macadamia, value-added fruit trees etc.). The remaining plots were left for forest regeneration or converted to fodder. The quality and locality of the feed is paramount in this scenario. Good environmental practices for manure management and soil fertility benefit product recognition. Farmers fatten their animals, requiring large quantities of feed and moderate herd sizes. Exchanges, sales, purchases of feed, rice straw, fodder, processed products and manure between farmers have developed well.

#### **References**

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Annex 1. Agenda

Schedule	Description of activities
	<b>DAY 1</b>
7.30 - 8.00	Preparation of the meeting room
8.00 – 8.30	Welcome participants <b>Presentation of the objectives of the workshop (Stage 1) (All together)</b> Round table discussion (30min)
8.30 -10.00	<b>Presentation of previous work required (Stage 2) (All together)</b> Time for exchange, answering questions, and validation of a common vision (1h30) - Agricultural history and the frieze (5 min + 10 min) - Typology of agricultural farms (10 min + 10 min) - Evolution trajectories over the last 20-30 years (10 min +15 min) - Previous livestock development studies (15 min + 15 min)
10-10.30	Coffee break (20 min) Group constitution (10min)
10.30-11.50	<b>Factors for change (Stage 3)</b> - Explanation of working instructions and answers to questions (10min) (All together) - <i>Current factors</i> (20 min) (Group) 1 post-it each (10 min) Group exchange and new post-it notes (10 min) - Expected & unexpected <i>new factors</i> (30 min) (Group) 1 post-it each (15 min) Group exchange and new post-it notes (15 min) - <i>Classification of factors</i> into categories (20 min) (Group)
11.50-1.20	Lunch break (1h30)
1.20 – 2.25	<b>Factors for change (part 2) (Stage 3)</b> Debriefing of the group session, resume of the results of each group by 1 reporter (45min, 15 min per group) (All together) Discussion to decide the <b>most important factors</b> (20 min) (All together)
2.25-3.25	<b>Possible future changes (part 1) (Stage 4)</b> - Explanation of working instructions and answers to questions (10 min) ) (All together) - <b>Expected changes</b> for new expected and unexpected factors (50 min) (Group) 1 post-it each (20 min) Group exchange and new post-it notes (30 min)
3.25-3.50	Coffee break (20 min) Group photo (5 min)
3.50-4.50	<b>Possible future changes (part 2) (Stage 4)</b> Debriefing of the group session, resume of the results of each group by 1 reporter (30 min, 10 min per group) (All together) - <b>Grouping factors/impacts into compatible developments scenarios</b> (30 min) (Group)
4.50-5.00	Attendance sheet Day Closure (10min)



Schedule	Description of activities
	<b>DAY 2</b>
8.00 – 8.15	Welcome participants, Attendance sheet Remind the objectives of the workshop and the ongoing step (15min)
8.15 – 8.45	<b>Finishing possible future changes (part 2) (Stage 4) (Group)</b> - Grouping factors/impacts into compatible developments scenarios (30min)
8.45 – 9.50	Debriefing of the group session, resume of the results of each group by 1 reporter (45 min, 15 min per group) (All together) Discussion (20 min)
9.50 – 10.10	Coffee break (20 min)
10.10 – 11.40	<b>Description of the selected scenarios (Stage 5) (All together) (1h30)</b> Summary of the history of the scenarios (45 min) Identification of the impacts of these scenarios (25 min) General discussion: challenges and desirable scenarios (10 min)
11.40 –	Workshop wrap-up and closure remarks (10 min) Allowance for the 1,5 days Information and authorization forms for the use of information and images (photo,video) (10 min)

Annex 2. Participants list

	<b>Name – Position if known</b>
1	Trần Thị Dịu- Núa Ngam- CN trâu, bò , lợn, Trồng ngô, khoai, sắn
2	Vì Văn Thoong- Núa Ngam- CN bò, cá, gà
3	Nguyễn Mạnh Cường- Noong Luống- CN cá, Trồng cây có múi (bưởi)
4	Ngô Tiến Bình- Chị Muôn- Noong Luống- Chăn nuôi bò, lợn
5	Bác Hoa- Pom Lót- Chăn nuôi bò, trồng rau, cá
6	Bác Hoà- Pom Lót- Chăn nuôi bò
7	Bác Kim- Sam Mứn- cn Bò
8	Chị Muôn- Noong Luống- Chăn nuôi bò, lợn
9	Nguyễn Hồng Thắng
10	Nguyễn Thị Hương Thảo
11	Tòng Văn Khởi
12	Lưu Thị Hoài Thu
13	Nguyễn Thị Hằng
14	Trịnh Thị Hồng
15	Nguyễn Ngọc Hưng
16	Lò Văn Sơn
17	Nguyễn Xuân Hoài
18	Vì Văn Thắm
19	Đỗ Thị Sỏi
20	Bùi Thị Hợp
21	Trần Thị Chính
22	Tòng Văn Dương
23	X (name on the signature list)