

Context Document Burkina Faso



INITIATIVE ON
Agroecology

Agriculture and agroecology in the Hauts-Bassins region,
an ALL intervention area in Burkina Faso

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The first part of this document presents the main elements forming the physical, administrative, social, economic, and political situation of the Hauts-Bassins region. It then presents the main characteristics of the production systems in the region: (1) the characteristics and changes in the agro-sylvo-pastoral system, the main form of agriculture; (2) the milk production systems that will be the focus of our work under the Initiative on Agroecology; and (3) legume production systems, which, through the production of good-quality fodder biomass, have important potential links to milk production systems. Finally, the document covers the agroecological characteristics of agriculture and food systems.

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I. Description of the Agroecological Living Landscape of Bobo-Dioulasso

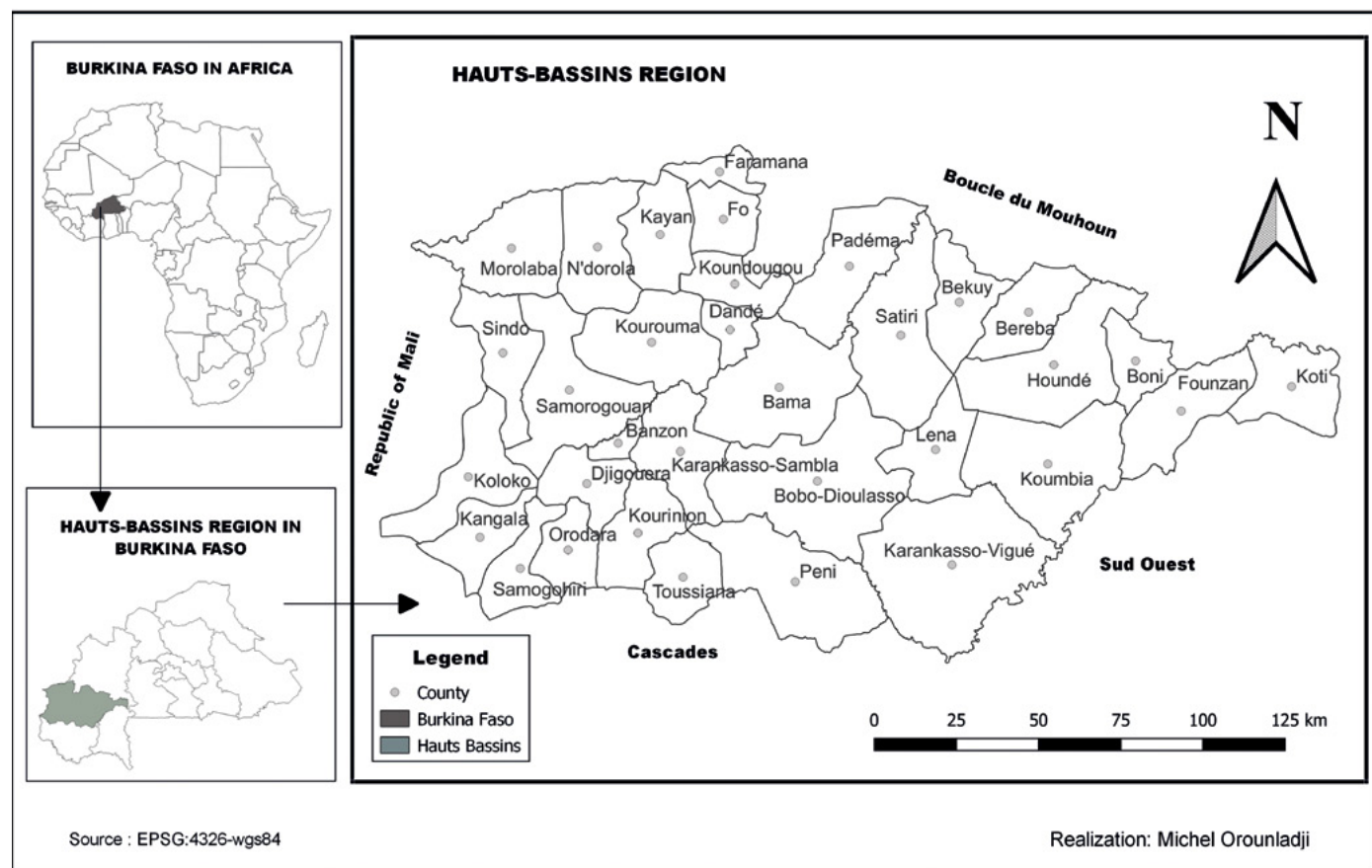
The partnership framework of the ALL is based on the Bobo-Dioulasso Dairy Innovation Platform (DIP), which brings together actors from the local dairy sector and, on the research side, INERA, CIRDES, and CIRAD.

1.1 Location of the Agroecological Living Landscape of Bobo-Dioulasso

The ALL of Bobo-Dioulasso is located in the Hauts-Bassins region, located in western Burkina Faso (**Figure 1**). The region has three administrative provinces: Houet, Kénédougou, and Tuy. These three provinces have a total of 33 municipalities, three of which have the status of urban municipalities

corresponding to the capitals of these regions. These are the communes of Bobo-Dioulasso, Orodara, and Houndé. This region covers a total area of 25,479 km² or 9.4% of the national territory. Because of its geographic position, the Hauts-Bassins region (and in this case Bobo-Dioulasso) has always been a hub in terms of international and national transportation, for both goods and people. It contributes up to 12.7% of the formation of GDP.

Figure 1. Administrative map of the Hauts-Bassins region.



The Hauts-Bassins region has a Sudano-Sahelian climate. Rainfall is characterized by an alternating dry season and rainy season during the same year. At the latitude of the Hauts-Bassins region, the longer dry season lasts about eight months (October to May). The area is then subject to the activity of the Harmattan, a hot and dry wind during the day, cool at night, and blowing in a north-easterly to south-westerly direction from the high-pressure area of the Sahara. The shorter rainy season runs from June to September, with

maximum rainfall in August. The average annual rainfall for the past 25 years has not exceeded 800 mm for the Central zone, and 1,200 mm for the Hauts-Bassins region. Average daily temperatures also experience seasonal variation. In the middle of the rainy season, they are low, with an average of 26 °C. In the dry season, they are high and the maximum is on average 32 to 33 °C. Evapotranspiration (ET) is generally very high. It is higher than rainfall during the period from October to June (i.e., more than nine months), which leads to a



significant decline in water resources, which is detrimental to livestock farming. However, the effects of climate change are a reality in the Hauts-Bassins region.

The population of the Hauts-Bassins region is young. According to the National Institute of Statistics (INSD, 2022), the 5- to 14-year-old group constitutes 27% and that of 15- to 64-year-olds represents 55% of the total population estimated at 2,239,840 inhabitants (of which 1,094,100 are men and 1,145,740 are women). The gender structure of the population of this region is similar to that of Burkina Faso's population as a whole. The population is approximately 49% male and 51% female. The Hauts-Bassins region, with 10.9% of the total population of Burkina Faso, remains one of the most populated regions. Over the period 2006–2019, this region recorded an intercensal population growth rate of 3.3%. The working age population is 54.7% of the total. This constitutes an economic and social challenge for the local authorities in terms of health, education, and employment.

1.2 Environmental context

1.2.1 Land use description

Space occupation in the Hauts-Bassins region is based on activities and available resources. The main land use units, in order of importance, are rainfed fields and agro-forestry areas (44.2%), shrubland and grassland (42.5%), wooded savannah (9.8%), and orchards (1.1%). Other units (buildings, irrigated fields, bare soils, and surface waters) are sparsely represented (less than 1%) (**Figure 2**).

“ The soils of Burkina Faso belong to the large family of tropical ferruginous soils.

1.2.2 State of natural resources

Several types of soil are encountered in the area (**Figure 3**), but the most important are sesquioxide soils and organic matter, which are rich in iron oxide or manganese and come from the decomposition of tropical ferruginous soils. The soils of Burkina Faso belong to the large family of tropical ferruginous soils. They mostly result from in situ alteration of the bedrock. The nature of the substrate, the degree of oxidation, and the depth of the water table determine the nature and richness of the soils. Soil scientists distinguish four main types of soil: leached ferruginous soils, soils with raw minerals, and hydromorphic and solonchic soils. Leached ferruginous soils developed on material rich in kaolin. The high content of oxides and hydroxides of iron and manganese gives them a red or ochre color. On the other hand, their calcium, potash, and phosphorus content are low due to the age of the materials of which they are made. The average thickness of the profile is 2 meters. Water retention capacity is fair to good. These soils are poor in organic and chemical matter. They are the most common in the study area. Raw mineral soils correspond to outcrops of sandstone, ferruginous cuirass, and various elements strongly cemented together.





The surface horizon is barely differentiated. These soils are characterized by a low thickness, or even none. The difficulty of root penetration and the chemical and organic poorness give these soils almost zero agronomic value. Hydromorphic soils are found along drainage axes, at dams, and in backwaters where they are associated with eutrophic brown soils or ferruginous soils. Their swelling capacity is low due to the decrease in montmorillonite. The chemical potential of these soils is low. Their compact and impermeable physical appearance is sometimes unfavorable to the practice of cultivation. The solonetzic soils rest on underlying vertisol clay materials. These are halomorphic soils whose genesis is linked to the presence of potash and geological sodium chloride. The compactness and impermeability of these soils give them extremely limited agronomic value. The soils in this area are usually shallow and low in nutrients. Studies indicate an organic matter content of less than 1% for 55% of the soils. The nitrogen (N) content is also less than 0.06% in 71% of the cases. The phosphate (P) content is less than 30%, and 93% of the soils have a P_2O_5 content of less than 0.06%. Finally, the water infiltration and conservation capacities are low. The horizons are also shallow and rarely exceed 100 cm. These soil conditions are not favorable for the practice of livestock farming because the vegetation that covers the soil is poor in nutrients and the natural water points dry up quickly.

The Hauts-Bassins region is characterized by the density of its natural vegetation, composed mainly of savannah, comprising all subtypes from wooded savannah to grassy savannah. It has

16 classified forests with a fairly rich biodiversity compared with that of the rest of the country. The same species are found there as in the savannah zone but with a higher density. Indeed, this abundant plant cover has favored the concentration of animal resources such as elephants, waterbuck, hippos, crocodiles, monkeys, birds, fish, etc.

The Hauts-Bassins region is one of the most drained in Burkina Faso. Its hydrographic network is made up of the Mouhoun and its tributaries, the main ones being the Dienkoa, the Guenako, the Kou, and the Plandi (**Figure 4**). The particularity of the topography and the climate makes it a real water source. Many of the country's major rivers have their source here: in particular, the Mouhoun, the Bafing, the Tuy (Grand Balé), the Comoé, and the Léraba. Groundwater is relatively abundant and boreholes can give high flow rates of 10 to 100 m³/hour, with peaks recorded by the Office National de l'Eau et de l'Assainissement (ONEA) that can reach 800 m³/hour.

Geological and mineral resources are present in the Hauts-Bassins region, although in moderate quantities. Among the resources available, gold, dolomites, and granites offer potential for local development. The largest gold production mine in Burkina Faso is established in the region (Houndé Gold Operation).

Fishery resources are not negligible, but fishing is a craft activity, which is well developed in the departments of Banzon, Samorogouan, and Sindo.

Figure 2. Land use map of the Hauts-Bassins region

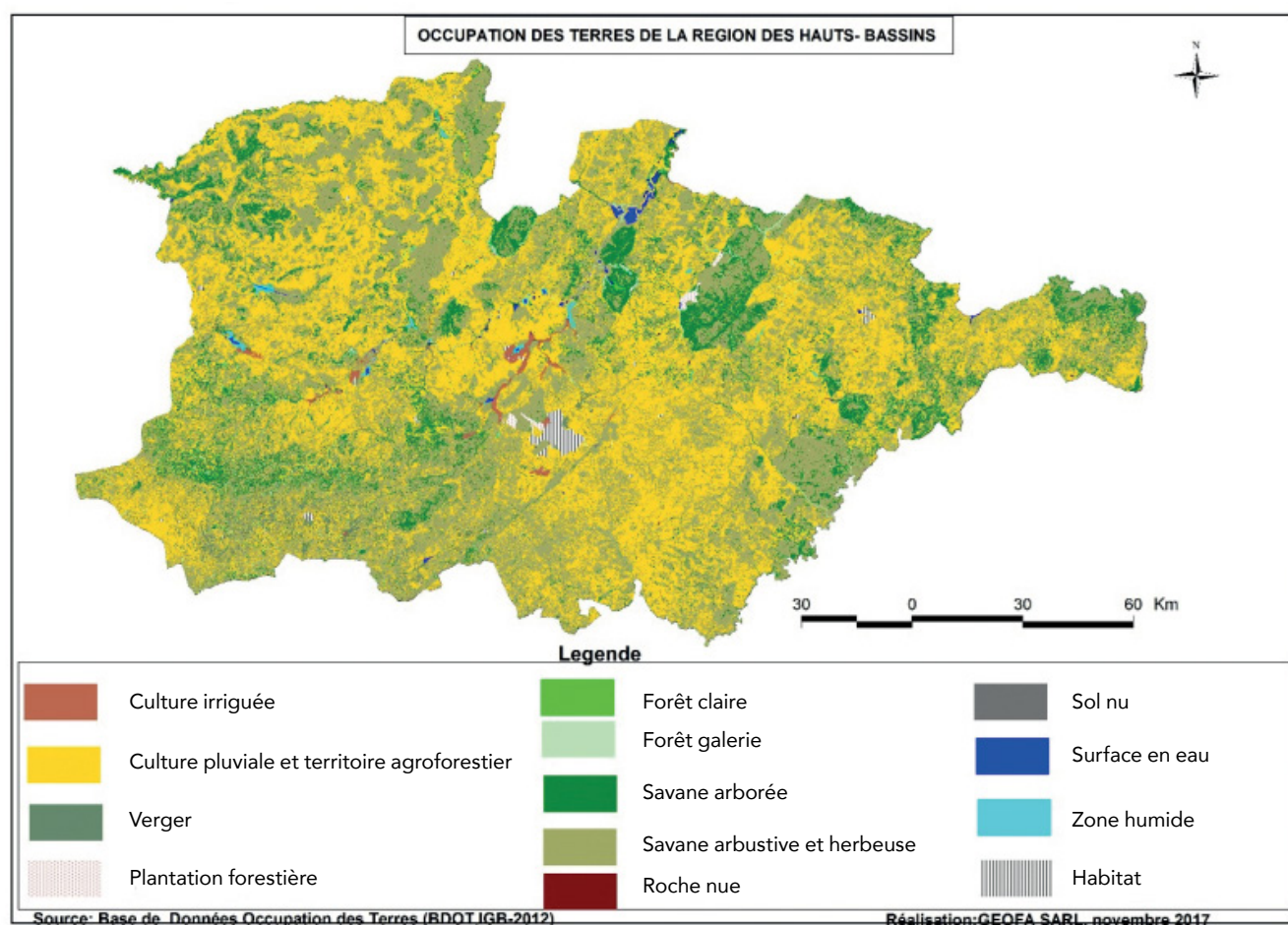


Figure 3. Typology of soils in the Hauts-Bassins region.

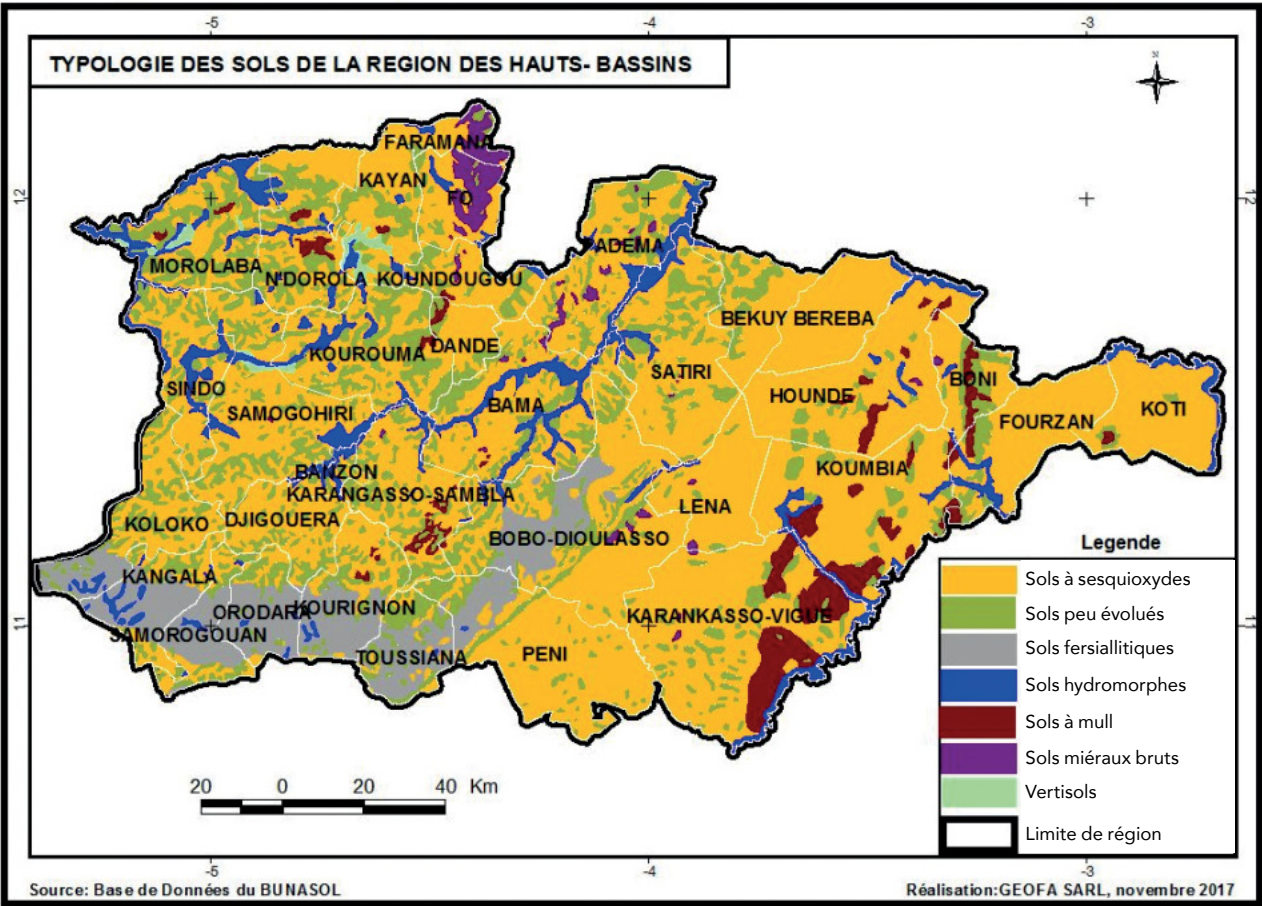
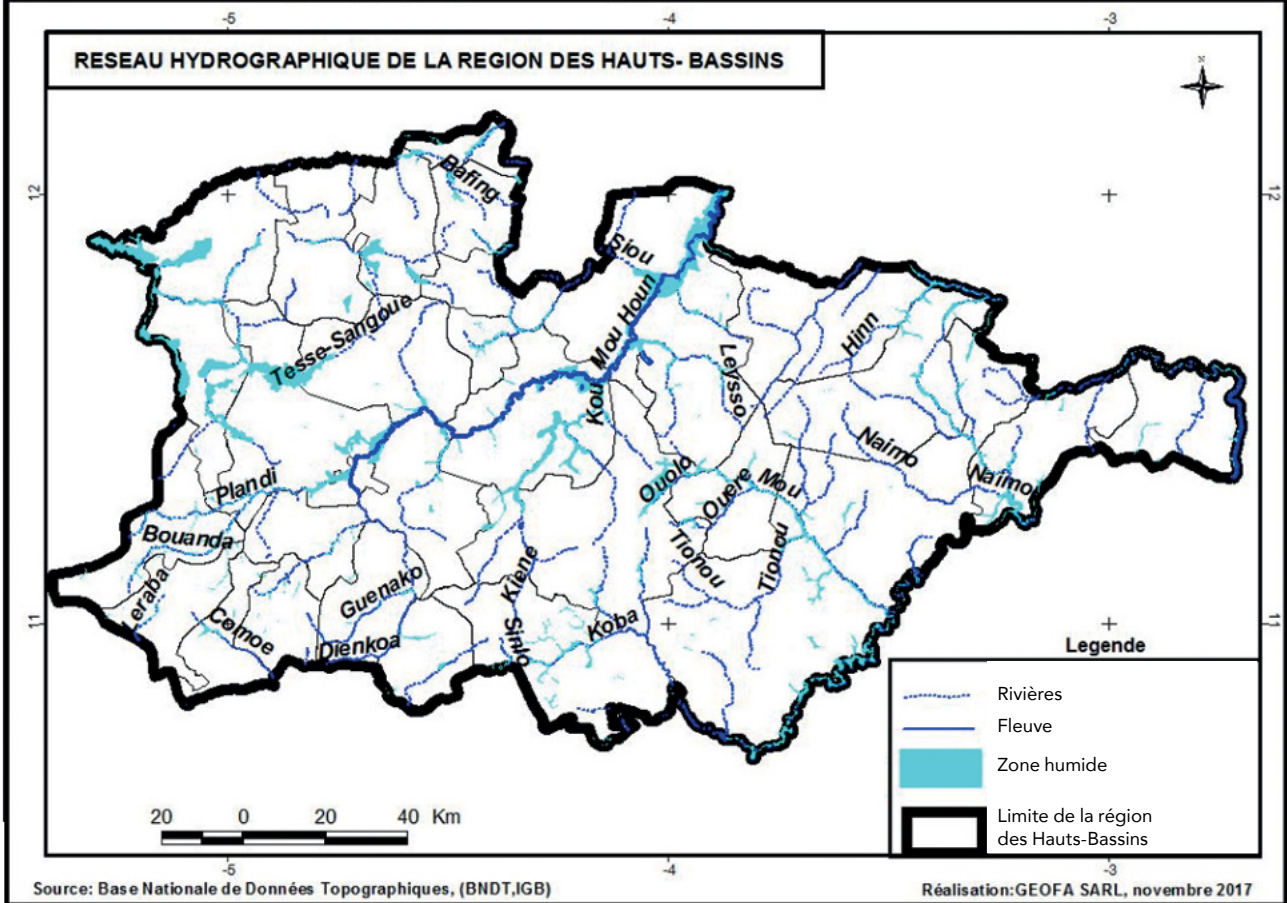


Figure 4. Hydrographic network of the Hauts-Bassins region.





1.2.3 Biodiversity

Floristically, the species encountered in the primary formations are *Vittelaria paradoxa* (shea), *Parkia biglobosa* (nééré), and *Khaya senegalensis* (caïlcédrat). In the savannah, we find *Lannea microcarpa* (African grapes), *Lannea acida*, *Bombax costatum* (red kapok tree), *Prosopis africana*, *Combretaceae* such as *Combretum* spp., *Guiera senegalensis*, and *Caesalpiniaceae*, including *Piliostigma reticulatum* and *P. thonningii*. Grasses are represented by *Andropogon gayanus* and *Cymbopogon* spp. (Atlas Jeune Afrique, 1998). Some non-native species have been introduced by environmental services, such as *Tectona grandis*, *Eucalyptus camaldulensis*, and *Azadirachta indica*. There are also scattered gallery forests in the Nasso-Guinguette area, consisting of more than 250 species. Many of these species have significant importance in local pharmacopeia (*Rauvolfia vomitoria* and *Moghania faginea*). Non-timber forest products consist of shea butter, tamarind, red kapok, baobab leaves, and fruits.

The fauna in the Hauts-Bassins region consists of three major classes of animals: mammals (*Loxodonta africana*, *Syvicapra grimmia*, *Hippotragus equinus*, *Phacochoerus africanus*, etc.), birds (*Francolinus bicalcaratus*, *Numida meleagris*, *Ptilopachus petrosus*, *Bubulcus ibis*, *Actitis hypoleucos*, etc.), and reptiles.

Fishery resources are rare. The main fishery resources consist of catfish, horse mackerel, tilapia, sardines, crocodiles, and Nile monitors.

1.2.4 Water availability for production

The Hauts-Bassins region is part of the Mouhoun watershed and has fairly significant surface-water resources. Surface waters consist of natural rivers, artificial reservoirs, and natural ponds. The main river is the Mouhoun, which is one of the perennial rivers in the country. The Kou, one of its main tributaries, flows downstream from the village of Samandéni at a distance of approximately 13 km and upstream of the stream branch that feeds the hippopotamus pond in Bala.

1.2.5 Water management for production

The region has large developed irrigated perimeters such as Banzon and Samendéni, with significant investments and infrastructure. The most important dam in the region is Samandéni, located in Houet Province (specifically in Bama Municipality), with a capacity of 1,050,000,000 m³, and covering an irrigated perimeter of approximately 200 km². To date, the region has 39 dams and 21 water reservoirs (lakes, ponds, and small dams), with a total developable irrigated perimeter of 739 hectares. This contributes significantly to the development of agro-sylvo-pastoral activities, particularly horticulture.

The intermittent nature of some rivers, coupled with continuous silting, makes it challenging to provide livestock with water and to practice horticulture during the dry season. The density and flow regime depend on rainfall, which is irregularly distributed in both time and space. These rivers represent a valuable potential for the development of agro-sylvo-pastoral, wildlife, and fishery activities in the region.

1.3 Economic context

1.3.1 Key farming systems

This part is taken from Chapter 1 of the book titled *The agroecological transition of agricultural systems in the Global South* (Côte et al., 2019), in which the authors summarize the main characteristics of the agro-sylvo-pastoral systems of western Burkina Faso and their dynamics in relation to agroecology (Vall et al., 2019).

Farmers in western Burkina Faso have to contend with high rainfall variability and extremely volatile agricultural prices. Such uncertainties have led the vast majority of them to diversify their production and practice mixed agro-sylvo-pastoral farming systems using low inputs in order to ensure their food self-sufficiency while containing economic risks. Their agro-sylvo-pastoral farming systems are based on cotton, cereals (maize, sorghum), legumes (groundnuts, cowpeas), and the rearing of cattle and small ruminants (Vall et al., 2006).

1.3.2 Major agricultural commodities and livestock

Farmers have, for a long time, favored a strategy of extending cropping areas and increasing herd size, as long as space is available for them to do so, both for extending cropping areas and for new pastures (Milleville and Serpantié, 1994). However, as population and, consequently, the pressure on the land increased, farmers opted to implement strategies to intensify agricultural production (Ouédraogo et al., 2016; Jahel et al., 2017). This intensification of production was meant to enable them to maintain, or even increase, production to meet the growing local demand for agricultural products (Bricas et al., 2016). Agricultural policies and development entities have thrown their weight behind this intensification to achieve food security and increase exports. This has resulted in a decrease in fallows, a transition to continuous cultivation, overgrazing, and an increased use of synthetic inputs (Vall et al., 2017). Farmers have also intensified production by strengthening the association between agriculture and livestock in order to be more self-sufficient in agricultural energy, fodder, and organic manure. However, the sustained increase in agricultural and pastoral pressure on natural resources has resulted in their degradation and fragilization, leading to a decline in soil

fertility (Bationo et al., 2007), an impoverishment of pastures (Vall and Diallo, 2009), and a critical decline in the potential for production and regeneration of agroecosystems.

In such a context, an agroecological transition must be encouraged to diversify and increase agricultural production in a sustainable manner, while safeguarding agroecosystems. This kind of transition, however, requires profound changes in farming practices (Duru et al., 2014; Titttonell, 2014) and, consequently, calls for efforts to co-design innovative farming systems with the involvement of farmers to try out, assess, and adapt new practices, and to provide support to farmers with these changes (CIRAD, 2016). It is in this perspective that, since 2005, co-designing of innovative agro-sylvo-pastoral farming systems was taken up in western Burkina Faso in order to analyze the interactions among vegetation, livestock herds, and cropping at different scales (farm, territory), and to look for ways to optimize these interactions in order to achieve sustainable intensification (Vall et al., 2016).

Diversity of agro-sylvo-pastoral systems and trajectories of change

On the whole, the agro-sylvo-pastoral farming systems in western Burkina Faso are still at an early stage of the agroecological transition if we base ourselves on Titttonell's (2014) framework for analyzing this transition. They are characterized by the continued use of synthetic inputs at a moderate rate, combined with the introduction of agroecological practices in a rationale of eco-efficiency or of a partial substitution of synthetic inputs by ecological processes.

The first studies showed that agro-sylvo-pastoral farming systems were not homogeneous (Vall et al., 2006). It was therefore clear that any reflection on technical changes in these systems would have to consider this diversity to respond to the constraints of farmers and the opportunities available to them. Three classes of agro-sylvo-pastoral farming systems were identified (**Table 1**): crop-oriented farms with cultivation-dominated systems (cultivators: C), the predominant group (~60%), with variable farm sizes (C1, C2, C3); livestock-oriented farms (breeders: B), a minority (~20%), with a system dominated by cattle husbandry with variable herd sizes (B1, B2) along with cultivation of a food crop; and crop-livestock-oriented farms (agro-pastoralists: AP), also in a minority (~20%), that cultivate large areas and own large herds.

Table 1. Classification of agro-sylvo-pastoral farming systems (based on a sample of 350 farms in western Burkina Faso surveyed in 2008).

Groups	Classes	Livestock (heads of cattle)	Cultivated area (ha)	Percentage (%)
Crop-oriented (cultivators)	C1	<10	<5	18
	C2		5.1–10	26
	C3		>10.1	16
Crop-livestock-oriented (agro-pastoralist farmers)	AP	>10	>7.5	20
Livestock-oriented (breeders)	B1	10–29	<7.5	5
	B2	>30		15

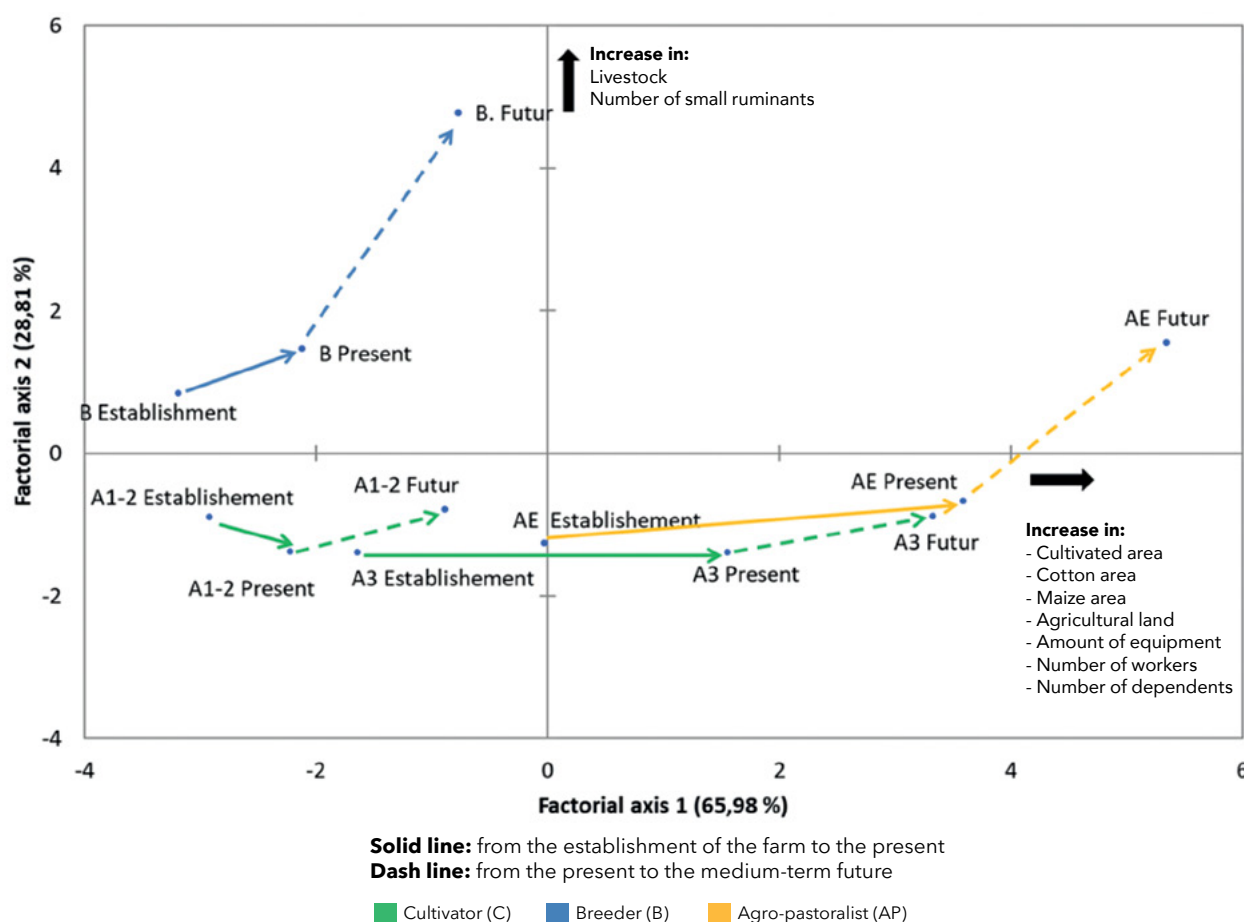
We then characterized the trajectories of these different classes of agro-sylvo-pastoral farming systems to better understand the changes taking place, and thus determine whether they exhibited any aspect of an agroecological transition. This work was carried out with a sample of about 40 farms belonging to these three classes. Data were collected by retrospective surveys for three periods: the establishment of the farm, the current state of the farm, and the medium-term future envisaged by the head of the farm. The analysis was based on structural variables and relied on multivariate analysis (see Vall et al., 2017, for details of the method).

Figure 5 shows the simplified evolutionary trajectories of the different categories of agro-sylvo-pastoral farming systems.

Figure 5 shows that, since the establishment of their farms, all farmers have sought to increase their cultivation area, herd size, and the amount of equipment they own. It also

shows that the farmers intend to pursue these objectives in the future, in spite of an ever-constraining land context. For cultivators, it is mainly the extension of cropping area that dominates. In the case of C1 and C2 farmers, the change is modest, even problematic in some cases, with a reduction in the meager livestock herd. C3 farmers seem to be aiming for the current situation of agro-pastoralists. In the case of livestock breeders, the increase in livestock clearly dominates the trajectory of evolution. As for agro-pastoralists, it is clearly the extension of cropping area that has been the dominant driver from the time of establishment of their farms to the present, followed by the desire to increase their herd size in the future thanks to the capitalization of agricultural surpluses into cattle. The sub-classes of C1 and C2 farmers have been merged, as have been those of B1 and B2 livestock breeders.

Figure 5. Simplified trajectories of evolution of agro-sylvo-pastoral farming systems.



Evolution of agricultural practices

Regarding agricultural practices, our work has shown the following developments: a trend toward crop diversification, an increased use of synthetic inputs (fertilizer, pesticide), and, at the same time, a strengthening of the association of cultivation and livestock breeding (**Figures 6 and 7**) to widen their sources of income and to respond to the emergence of new markets (rice, sesame, soya, sunflower, etc.). The observed diversification does not yet reflect any agroecological practice, especially since this diversification involves pure crops and on very small crop rotation plots amid areas still largely dominated by cotton and maize.

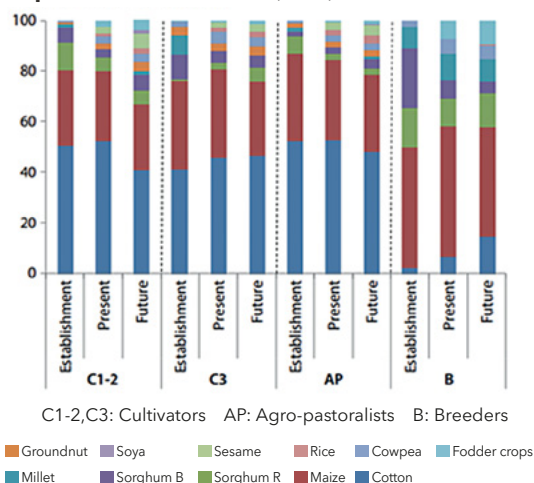
Figure 6. Changes in the number of crops according to the classes of agro-sylvo-pastoral farming systems.

a. Number of crops in the rotation



Figure 7. Changes in crop rotations according to the classes of agro-sylvo-pastoral farming systems.

b. Proportion of surface area (in %)



Farmers rely more heavily on synthetic inputs such as mineral fertilizer (NPK and urea), herbicide, and insecticide. For mineral fertilizer, this change was observed for all categories of farms. Farmers who used mineral fertilizer only marginally until the 1990s increased their use substantially, initially for

cotton and then for maize. They have also increased the rates, although they remain moderate compared with those in very intensive agricultural systems in developed countries. This trend toward increased rates is clear for maize (**Figure 8**) but has, on the other hand, decreased for cotton (**Figure 9**). Since intensive cotton has been cultivated widely for a longer period than maize, the rates were increased a long time ago. It was also observed that farmers divided all fertilizer inputs, something that did not occur previously. Farmers started to use herbicides in the 2000s, which now represents a widespread practice.

Figure 8. Changes in mineral fertilizer rates in maize, between the time the crop was first grown and the present, and comparison made/desired for the current practice, according to the classes of agro-sylvo-pastoral farming systems.

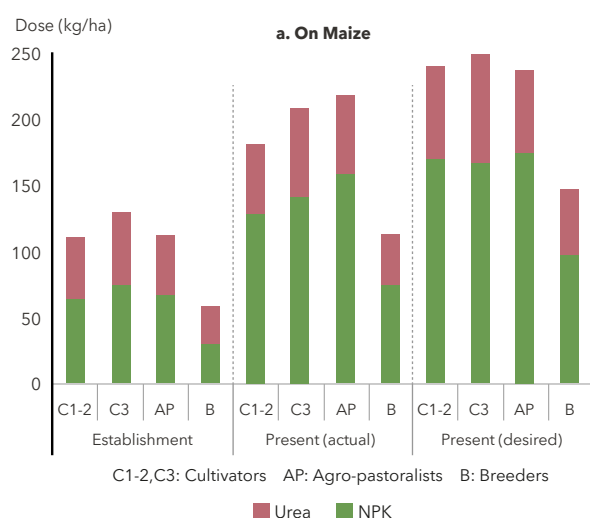
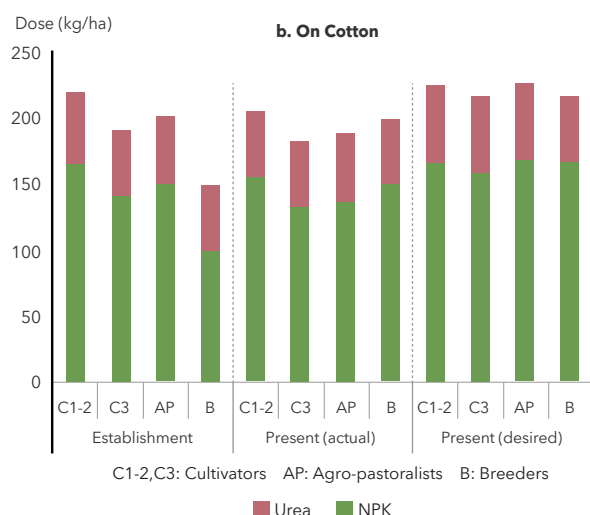


Figure 9. Changes in mineral fertilizer rates in cotton, between the time the crop was first grown and the present, and comparison made/desired for the current practice, according to the classes of agro-sylvo-pastoral farming systems.



Farmers have increased the interaction between agriculture and livestock, and this trend is seen in all farm categories. They began adopting animal traction to extend cultivated area, especially since the mid-1980s for most of them. Some well-to-do farmers, especially agro-pastoralists, have now even adopted tractors. Farmers have also significantly increased their production of organic manure and they use it extensively on maize and cotton (Figures 10 and 11), a practice they justify by the decline in soil fertility and the increase in the price of fertilizer.

Figure 10. Changes in the application of organic manure to maize, according to the classes of agro-sylvo-pastoral farming systems.

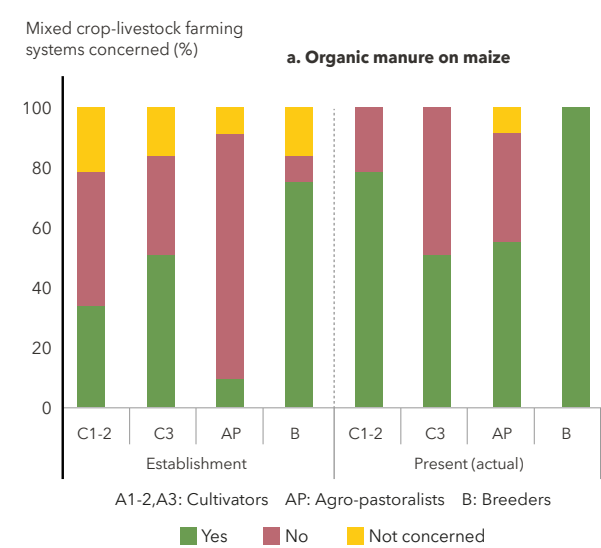
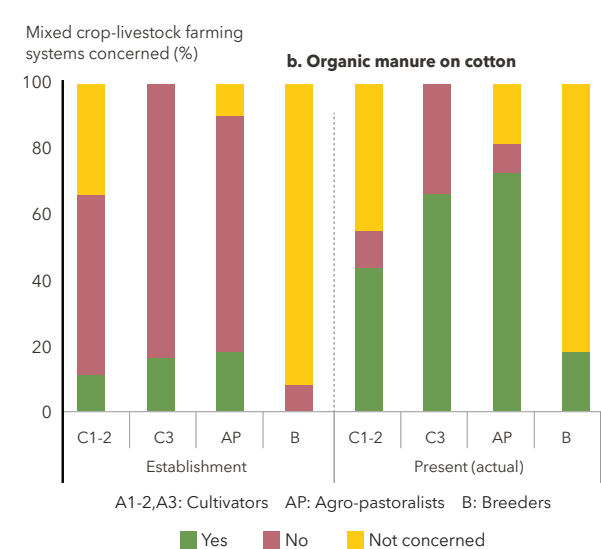


Figure 11. Changes in the application of organic manure to cotton, according to the classes of agro-sylvo-pastoral farming systems.



Farmers have also begun increasingly to store crop residues systematically for fodder purposes (Figure 12). We have also observed the beginning of the development of fodder crops by a small number of livestock breeders and agro-pastoralists, who intend to increase the area for these crops in the future (Figure 13).

Figure 12. Changes in the practice of storing crop residues to feed livestock according to the classes of agro-sylvo-pastoral farming systems.

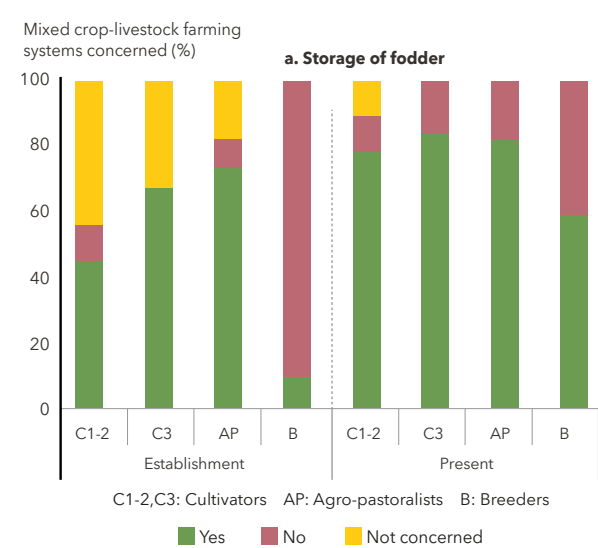
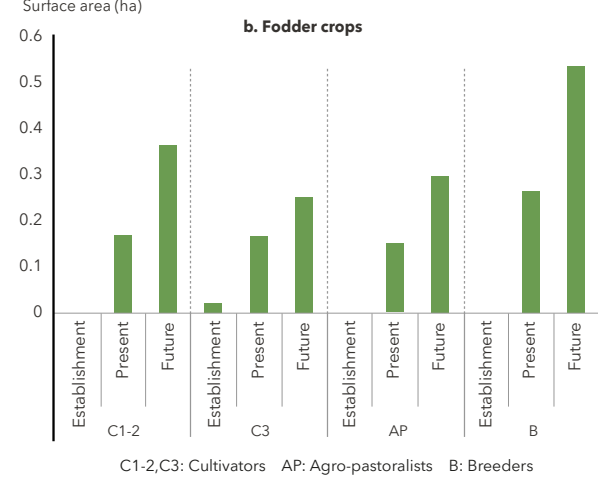


Figure 13. Changes in the practice of fodder production according to the classes of agro-sylvo-pastoral farming systems.



Regarding trees present in cultivated plots (Table 2), we did not find any obvious relationship between the classes of agro-sylvo-pastoralagro-sylvo-pastoral farming systems and the types and density of trees. We did observe, however, that breeders tend to maintain a greater diversity of species.

Table 2: Density and types of trees in cultivated plots as measured by number of trees per hectare, according to the classes of agro-sylvo-pastoral farming systems. Sources: personal data, observations made on 40 farms.

Classes	All species	Shea (<i>Vitellaria paradoxa</i>)	Nere (<i>Parkia biglobosa</i>)	Balazan (<i>Faidherbia albida</i>)	Other species
C1-2	14 ± 5	9 ± 3	1 ± 2	1 ± 1	2 ± 2
C3	13 ± 5	8 ± 5	1 ± 1	2 ± 3	1 ± 0
AP	11 ± 4	8 ± 3	1 ± 1	1 ± 2	1 ± 1
B	14 ± 8	7 ± 9	1 ± 1	0 ± 1	6 ± 4
Avg.	13 ± 5	8 ± 6	1 ± 1	1 ± 2	3 ± 3



Focus on dairy farming systems

In 2003, the study of milk production systems on the outskirts of Bobo-Dioulasso carried out by Hamadou et al. (2003) showed a strong predominance of pastoral-type production systems (98%), the remaining part being occupied by production systems in the process of intensification. About 15 years later, the studies by Sib et al. (2017) and Vall et al. (2021), carried out in the same area, but also in the Ouagadougou dairy basin, showed a tendency toward the emergence of more intensive systems driven by market demand and by the search for intensification methods at lower financial costs (mainly in Ouagadougou). However, these studies concluded that agro-pastoral milk production systems with grazing animals remain largely predominant. More recently, Sodré et al. (2022) showed the emergence of dairy cow feeding methods based on the use of quality fodder in western Burkina Faso, in line with local market demand. These feeding systems, which are quite promising from a technical and financial point of view, are nevertheless still little adopted. In summary, over the past 20 years, the milk production situation

in the Bobo-Dioulasso region has changed little, even if for about 5 years we have seen a more marked development and a tendency to intensify production, linked to the emergence of a market driven by the proliferation of mini-dairies and milk collection centers.

In 2020, the Africa-Milk project studied the milk production system of about 140 milk farmers of western Burkina Faso with a focus on the dairy units, characteristics of dairy cows, the feeding system, the marketing of milk, and the recycling system of co-products (crops: straw, tops) and animals (feces). A brief summary of the analysis of these data is presented below.

There are two main families of dairy farm production systems in western Burkina Faso:

- The agro-pastoral dairy farming system (**Figure 14**).
- Small “intensive” agroecological dairy farming systems with cows in zero grazing (**Figure 15**).

Figure 14. The agro-pastoral dairy farming system in western Burkina Faso.

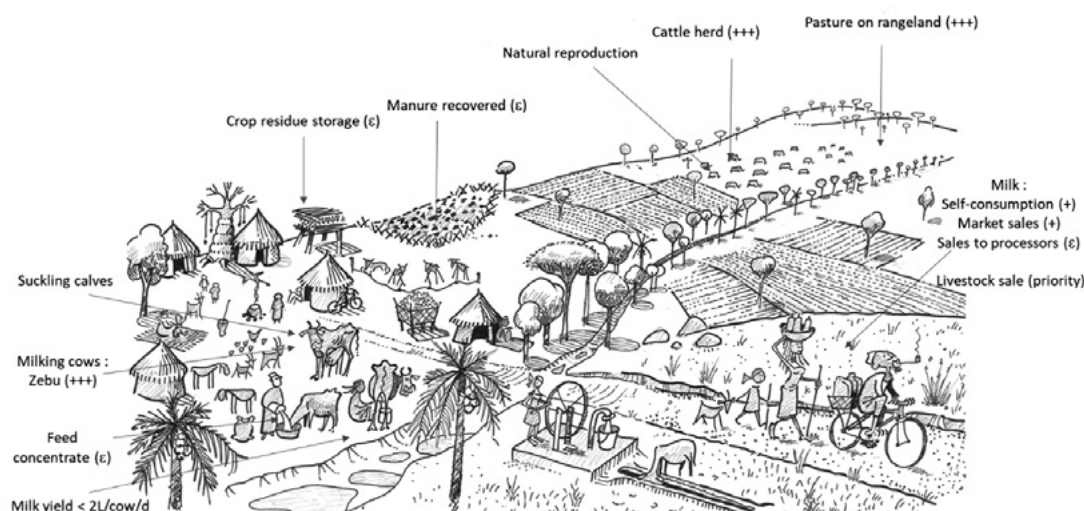
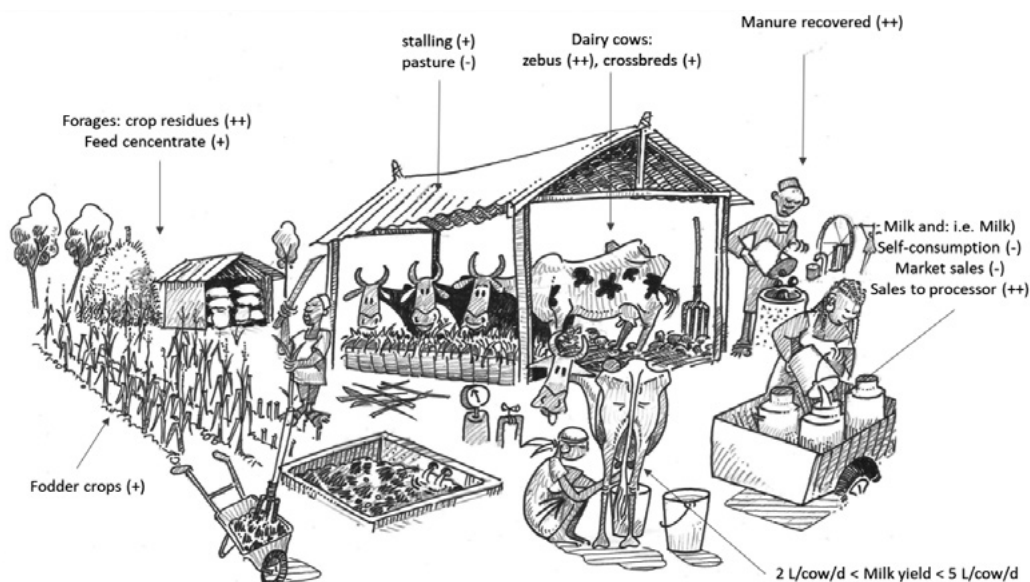


Figure 15. Small “intensive” agroecological dairy farming systems with cows in zero grazing.

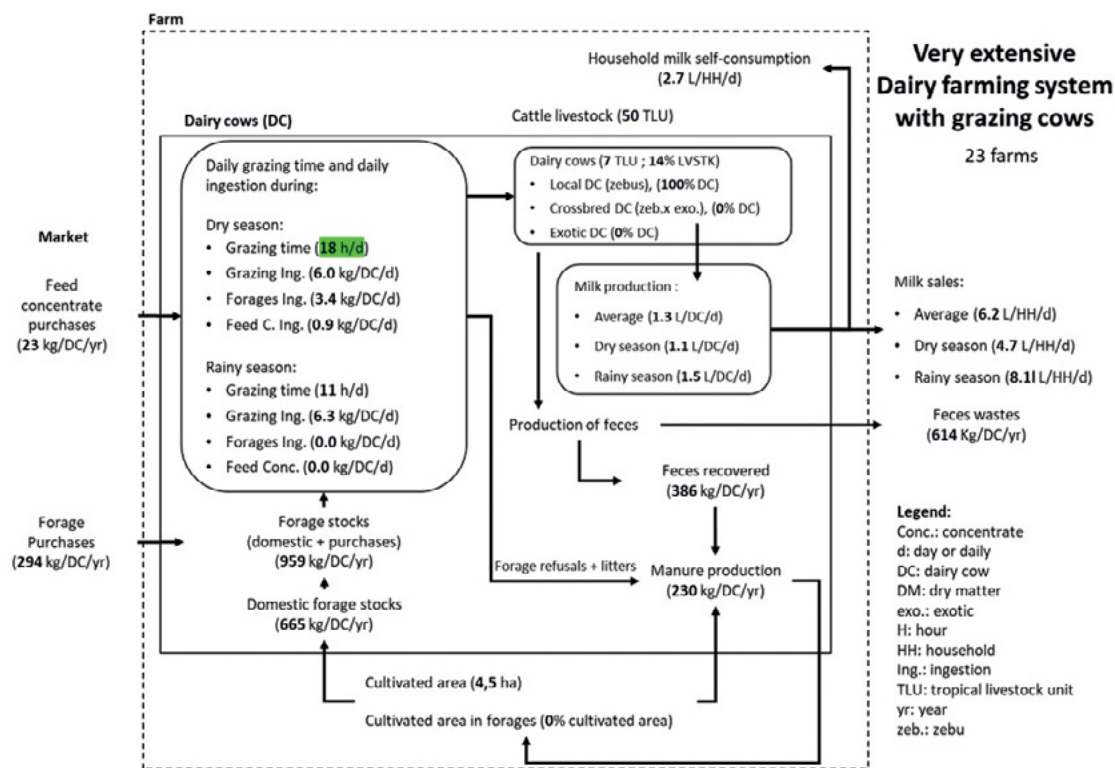




The agro-pastoral system (see **Figure 16**) is by far the most represented (99% of cases), with three variants (**Figures 16, 17, and 18**).

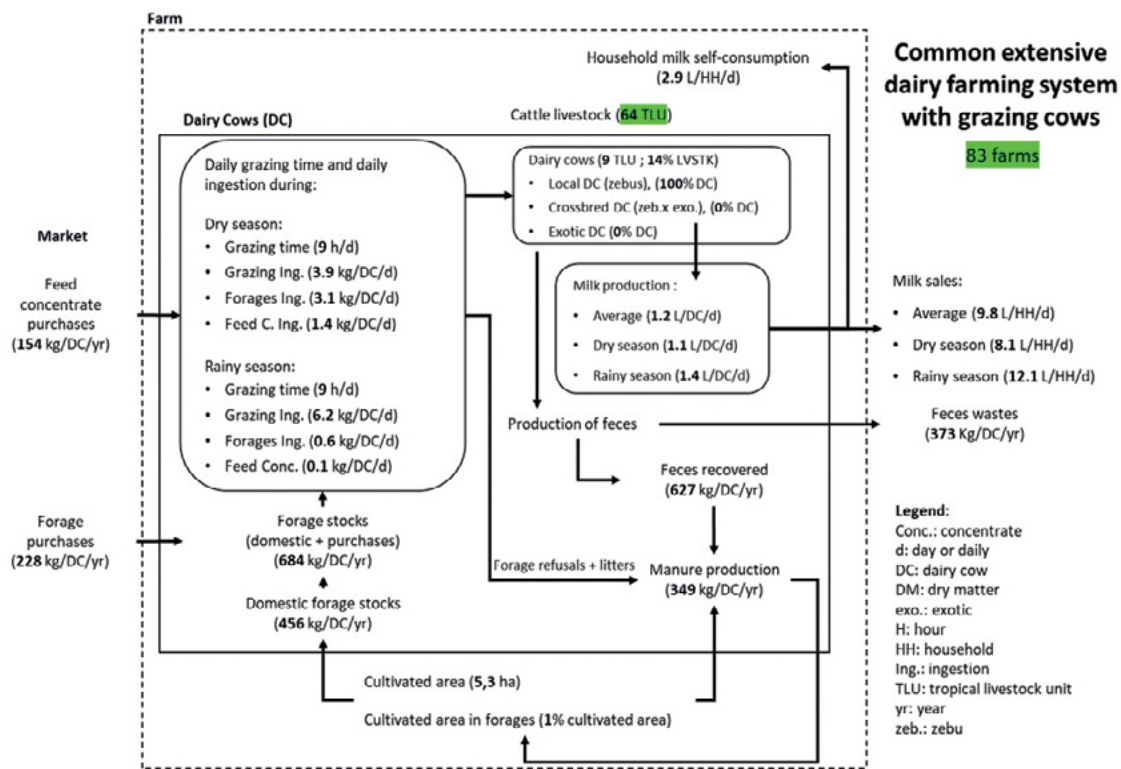
The very extensive dairy farming system with grazing cows (23 farms, **Figure 16**) is characterized by very long daily grazing times. Dairy cows are local (zebu) with suckling calves. The feeding system is based on rangeland grazing. Mobility is extremely important and that is why few crop and animal co-products are recycled. In this system, farmers collect small quantities of milk from their dairy cows. A low amount of milk is delivered to processors.

Figure 16. The very extensive dairy farming system with grazing cows.



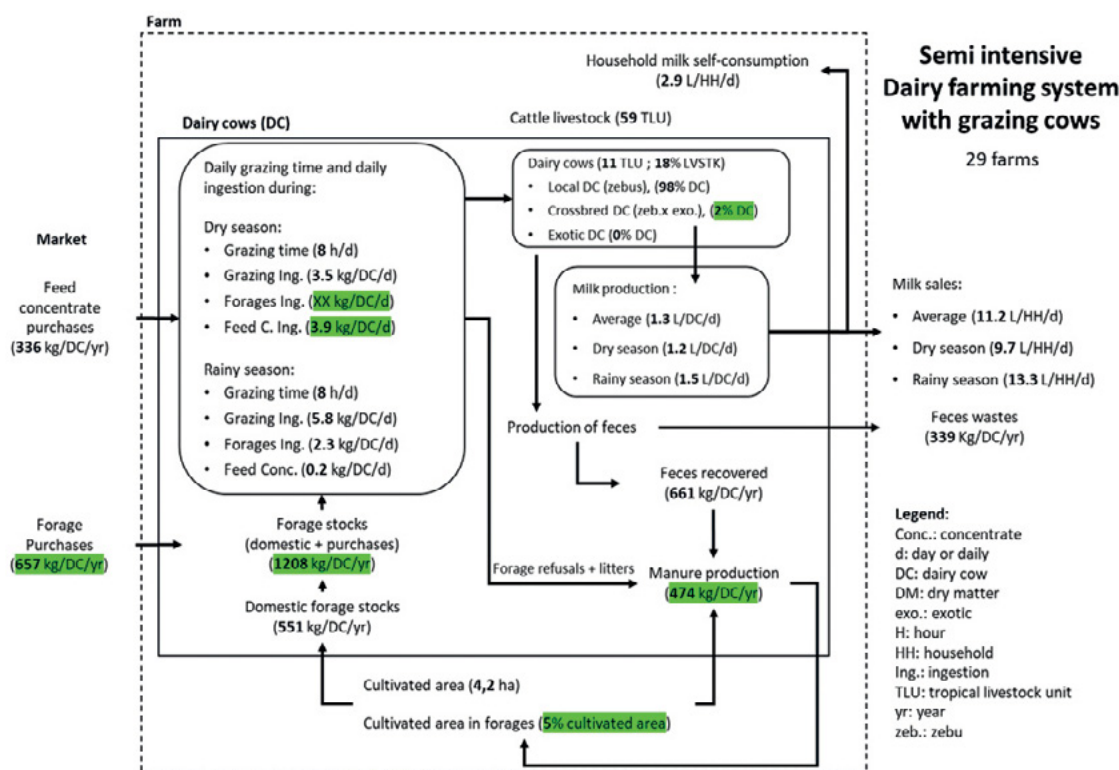
The common extensive dairy farming system with grazing cows (83 farms, **Figure 17**) is the most represented. Dairy cows are local (zebu) with suckling calves. The feeding system is still based on rangeland grazing; however, the use of fodder and feed concentrate is higher than with the preceding type. The mobility of dairy cows is lower and that is why the rates of recycling of animal and crop co-products are higher. In this system, milk yields are higher and a greater amount of milk is delivered to processors. However, the seasonality of milk production is still important and that is a not good thing for dairy processors who rely mainly on this dairy farming system.

Figure 17. The common extensive dairy farming system with grazing cows.



The semi-intensive dairy farming system with grazing cows (29 farms, **Figure 18**) has more agroecological practices linked to the principle of recycling (storing crop residues to feed cows and turn more dung into manure) and the beginning of crop forage production on-farm. Dairy cows are still mainly local (zebu) with suckling calves; however, some of these farms include crossbred dairy cows in the dairy production unit. The feeding system is still based on rangeland grazing; however, the use of fodder and feed concentrate is significantly higher than in the two preceding types. The mobility of dairy cows is lower and that is why the rates of recycling of animal and crop co-products are higher. In this system, milk yields are higher and a greater amount of milk is delivered to processors. However, the seasonality of milk production is still important. It seems that these systems are on a path of agroecological intensification “made in Burkina Faso” for dairy production in agro-pastoral systems.

Figure 18. The semi-intensive dairy farming system with grazing cows.

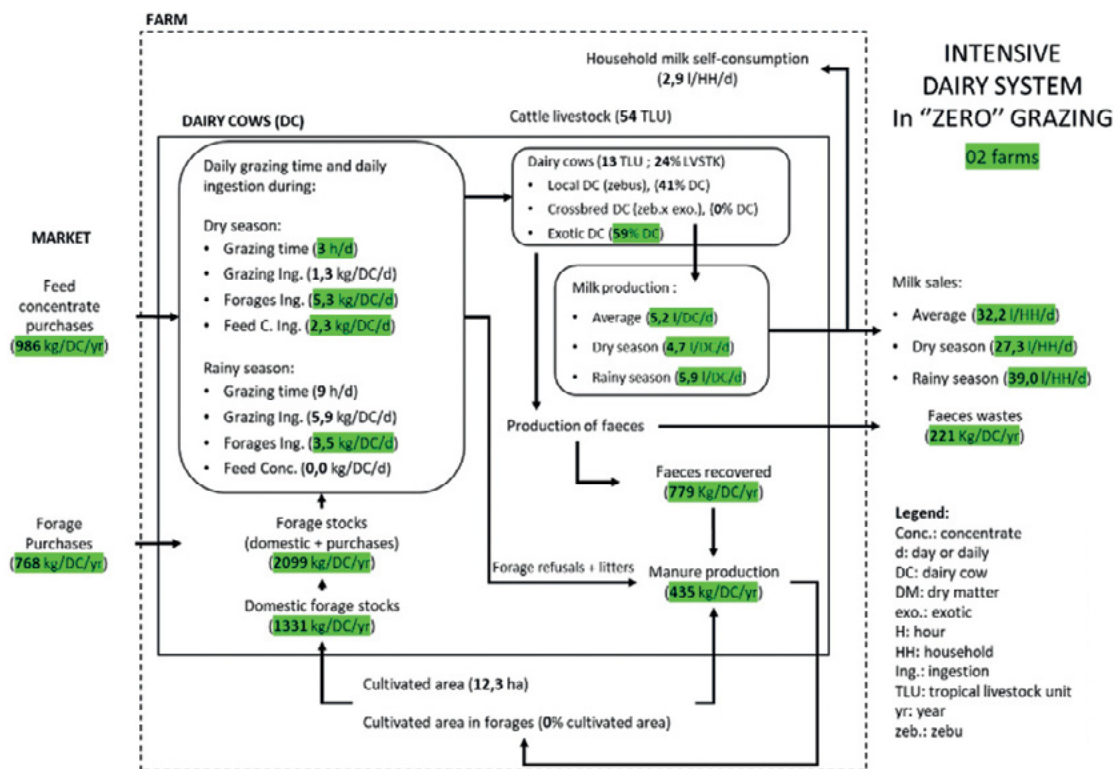


The second large family of milk production systems is shown in **Figure 19**. This system is still only slightly represented (1% of cases). Many countries in sub-Saharan Africa rely on this type of milk production system to supply their milk value chain. And, in many countries, it has worked very well (Kenya, Ethiopia, Uganda, Tanzania, Madagascar, etc.). However, this system must be adapted to the environmental, social, and economic conditions of each country. The small intensive agroecological dairy farming systems with cows in zero grazing counted only two farms in the sample from the Africa-Milk study (**Figure 19**). This system presents a combination of advanced agroecological practices (recycling of plant and animal co-products, maintenance of grazing) and conventional intensification (use of feed concentrates, crossbred and pure exotic dairy cows, artificial insemination). Dairy cows are mainly crossbred and exotic. The feeding system is based on fodder and feed concentrate; however, the daily times for grazing are maintained, which is good for the cows' welfare. The mobility of dairy cows is lower and that is why the rates of recycling of animal and crop co-products are higher in this system. Milk yields are significantly higher and the amount of milk delivered to processors is also significantly higher. This farming system

represents a kind of quite interesting intensive agroecological dairy farming system “made in Burkina Faso” that delivers important quantities of milk to dairy processors.

“ The mobility of dairy cows is lower and that is why the rates of recycling of animal and crop co-products are higher in this system.

Figure 19. Small intensive agroecological dairy farming systems with cows in zero grazing.



Focus on legume production systems (seeds and forage)

Fodder production systems

The Initiative on Good Agricultural Practices (GAP) advocated by FAO also promotes fodder plants with a view to diversifying and intensifying agricultural production. In relatively intensive production systems where natural pastures have become rare, the development of the production of fodder plants not only compensates for the scarcity of this resource, especially in the dry season, but also provides additional income for small cotton producers. In addition, the production of fodder legumes can contribute to maintaining or restoring soil fertility. However, the development of fodder production depends on the existence of safe and sustainable outlets.

In the city of Bobo-Dioulasso, more than 26 permanent fodder sale sites can be found. According to the results of surveys (Sanou et al., 2016), the fodder comes from several sampling (natural fodder) and production (crop residue) sites. The fodder taken from these various sites enters the city by six road axes. The most important (in terms of affluence and use) are those of Bobo-Dioulasso-Bama and Bobo-Dioulasso-Dinderesso. The minimum distance between the sites and the nearest fodder markets is 5 km. One can travel up to 40 km in the dry season. Classified forests, lowlands, the edges of watercourses, alluvial plains, and fallow land are the main sampling sites. Production sites include fields of cereals, pulses, and dry-season irrigated crops.

In order to bring about innovation in agricultural methods, farmers in the Hauts-Bassins region use mainly composting, improved seeds, stone bunds, chemical fertilizers, and

Production sites include fields of cereals, pulses, and dry-season irrigated crops.

herbicides (Dayamba et al., 2019). Increasingly, farmers practice cultivation techniques such as early sowing and crop rotation. In Houet as in Tuy, both men and women are using the major options mentioned for improvements, and this could indicate that the dynamics of improvement/adaptation are seen as being the responsibility of the entire household and not specified by gender.

The practice of animal husbandry is becoming more and more intensive. The problems of finding suitable grazing oblige owners not to let their livestock stray. Thus, more and more, breeding is practiced on-site with a selected diet and health monitoring. To alleviate the feeding problem, crop residues, vitamin supplements, and wilted grasses are used. Some herders, however, practice transhumance toward the southwest and the coastal areas. Except for transhumance and the cutting and conservation of hay (in Tuy), which are reserved for men, the other innovative options mentioned are practiced by both men and women. It should be noted that, in addition to the options mentioned in these localities, the Ministry of Animal and Fishery Resources is promoting fodder crops even if, in some areas, this idea is slow to get started.

When livestock farming (especially cattle) increases in size, it quickly has a strong ecological footprint on the landscape because it occupies a greater area, knowing that in theory it takes about 2 ha/year per head of livestock. This means that, on most farms, the majority of fodder resources are harvested off the farm. The ratio "theoretical area necessary for the farm's livestock"/"cultivated area of the farm" is from 0.8 to 1.5 for farmers, about 4 for agro-pastoralists, and greater than 30 for livestock. The intensification of fodder production will become a necessity to develop local livestock farming.

Grain legume production systems

The most widely grown legumes in Burkina Faso are peanuts, soybeans, and cowpeas. They are appreciated not only for their seeds but also for the quality of the fodder they provide for livestock, which has good nutritional quality. Coulibaly (2012) stated that the average protein rate is 36% for soybeans, groundnuts, and cowpeas. With grain legumes, we can also mention mucuna (velvet bean), cowpea, and cajanus (pigeonpea). Although others may not be cultivated, they can be mentioned as plants providing supplements to the diet of suckler cows in rural areas: *Acacia albida*, *A. africana*, and *Piliostigma reticulatum*.

In a study, Hama-Ba et al. (2017) noted that 98% of the households in Burkina Faso are familiar with the first three legumes mentioned above and 70% consume at least one. Legumes are well known and consumed in all localities. However, many households consume cowpeas as their main dish. They are also cooked in sauce to accompany other dishes.

In cereal-based infant porridges, the addition of legumes improved the protein content two to three times compared to certain imported porridges.

Peanuts and soybeans are mainly consumed as snacks. Cakes, peanut paste, soybean skewers, and soubala are the main forms of consumption.

Widely used as a supplement in livestock feed rations, legumes are a source of good-quality fodder. Crop residues (haulms) constitute quality feed supplements for livestock in Burkina Faso, but are still little used (Sodré et al., 2022). Legumes produce good-quality fodder (Coulibaly, 2012). The content of digestible nitrogenous matter is greater than 200 g/kg of dry matter. Legumes also help increase gross farm income.

As an indication, **Table 3** referenced by Savadogo (2000) gives some elements of comparison confirming the importance of legumes as good-quality fodder

Table 3: Elements of appreciation of some crop residues

Crop residues	OM (% DM)	CP (% OM)	ME (MJ/kg OM)	DOM
Legume haulm				
Cowpea	88- 92	13.9- 21.7	9.2- 11.7	58- 74
Peanut	85- 90	8.5- 25.3	8.7- 10.8	55- 68
Voandzou	84- 92	5.5- 10.1	7.9- 9.5	50- 60
Cereal straw				
Maize	87- 95	4.6- 6.5	6.3- 8.7	40- 55
Millet	89- 93	4.8- 9.3	4.6- 10.0	29- 63
Rice	77- 86	2.3- 8.6	6.7- 9.0	42- 57
Sorghum	90- 94	2.8- 7.0	6.8- 10.3	43- 65

Keys: OM = organic matter; DM = dry matter; CP = crude protein; ME = estimated metabolizable energy from digestible organic matter (1 g of DOM equivalent to 15.8 kJ of ME).

Source: : Savadogo (2000).

Legume cultivation helps to improve the soil and therefore agricultural production in general. Legumes offer, through the mechanisms of biological nitrogen fixation, an important source of fertilizer.

The constraints to a greater use of legumes in production systems are often of a socio-cultural nature or ignorance of their production. Technically, legumes are demanding in phosphorus.

Despite the implementation of conclusive experiments and specific extension programs, fodder crops in the strict sense have been very little adopted by producers for the reasons mentioned above. To bypass land and labor allocation

problems, trials that combine cereal crops with fodder crops are underway at the research level in partnership with regional agricultural development organizations.

Thanks to the support of certain projects in the livestock sector, legume production is experiencing a growth in yield. Coulibaly (2012) demonstrated that the maize-cowpea association allows a 30% area saving (land equivalent ratio) vis-à-vis pure crops, therefore providing a reason to motivate farmers. The maize-mucuna association allowed a saving of 35% in area compared with pure culture of maize and mucuna in terms of fodder production, and 26% in area in terms of overall production (forage + grain) of the system.



1.3.3 Market information for both inputs and outputs

The commercial sector is extremely important for the Hauts-Bassins region, where many national and foreign enterprises are represented. The region is linked to the others parts of the country by national roads that permit the development of commercial flows, largely based on domestic products.

Commercial activities in the region take place in the markets in the three provincial capitals. General commerce is distinguished by the import and export of various goods (oil, canned tomatoes, rice, office supplies, spare parts, construction materials, etc.), real estate deals, goods transportation, itinerant merchants, livestock markets, art galleries, bars, pawn shops, flea markets, press distributors, security services (surveillance, guarding, cash transportation), shows, insurance brokers, cota/games, travel agencies, public transportation, mobile phone agencies, financial institutions and microcredit, and petroleum products (gasoline, diesel, and lubricants).

The region exports agricultural and horticultural products (maize, sorghum, sesame, onion, tomato, cabbage, etc.) to other regions of Burkina Faso and to neighboring countries such as Côte d'Ivoire, Ghana, Togo, and Mali. The trade in handicrafts takes place in local markets or the handicrafts are exported to markets in other regions.

Microfinance institutions exist in the region that support women and youth, as well as producer organizations and traders, through microcredit.

1.3.4 Key factors affecting agricultural productivity

It appears that the Hauts-Bassins region enjoys a thriving agricultural economy, owing to a relatively favorable climate compared to other parts of the country. This region is able to meet its own cereal needs and even sell a portion of its production beyond its borders. However, it is important to note that several factors threaten this agricultural prosperity.

First, the current climate variability has a significant effect on agricultural activities, making planning and production more uncertain. Additionally, the excessive use of chemicals contributes to the loss of biodiversity and soil degradation, which can lead to long-term adverse consequences for the sustainability of agriculture in the region.

Another major challenge is the increasing demographic pressure, which results in a decrease in available agricultural land and heightened competition for living spaces. This situation has a negative impact on natural grazing areas, further complicating livestock feeding.

In the face of these challenges, it would be prudent for local stakeholders to implement environmental preservation and agricultural sustainability measures, such as promoting sustainable farming techniques, diminishing the use of chemicals, preserving farmlands and natural grazing areas, and implementing climate change adaptation practices. Furthermore, awareness and education programs for farmers on sustainable methods and biodiversity conservation could also help mitigate the negative effects of these challenges on agriculture in the Hauts-Bassins region.







1.3.5 Agricultural financing

Agricultural financing is mainly structured around the cotton sector. Farmers are organized in cooperatives for economic purposes. Cooperative principles may seem attractive, as is apparent from Art. 8 of the law: *"A cooperative society is any autonomous association of persons who have voluntarily come together with a view to satisfying their common economic, social and cultural needs and aspirations by means of an economic enterprise, democratically managed, by providing an equitable share of the necessary social capital and by accepting a fair participation in the risks and the benefits of this enterprise, in the operation of which the members participate actively and of which they are the sole owners and the sole users"* (definition inspired by recommendation 127 of the International Labour Organization, ILO), adopted in 1966. The National Union of Cotton Producers of Burkina (UNPCB) is the apex of the Cotton Producers Groups (GPCs) created in 1996 with the aim of facilitating the supply of agricultural inputs and equipment, the proper management of credit, and increasing production.

Access to credit for equipment (carts, ploughs, wheelbarrows, seed drills, etc.) is on the basis of the collaboration agreement between the UNPCB and the RCPB (Network of Credit Unions) that the organic GPCs have concluded partnership protocols with allowing their members to access equipment credit without calling on a guarantee fund, with an interest rate of 10% for a period of 3 years.

1.3.6 Financial education of farmers

Development and education initiatives have been implemented in the country to improve access to financial education for farmers. Awareness and training programs are often organized to enhance technical skills and promote

sustainable farming practices, aiming to enhance agricultural productivity and foster the socioeconomic development of rural communities in Burkina Faso.

1.3.7 Land tenure situation

The main factors exerting pressure on land include, among others, the following:


- Natural population growth: The natural increase in population contributes to increased demand for land as more people require places to live and for diet crops.
- Internal migration: Populations from overcrowded areas in the North and Plateau-Central regions, where arable land availability has declined significantly, migrate to other regions, placing additional pressure on available land resources.
- Extensification of agro-pastoral activities: The expansion of agro-pastoral activities, particularly for the cultivation of cotton, leads to the need for more land for agriculture and livestock.
- Poverty and precarious living conditions: Poverty and challenging living conditions among the population can drive the development and expansion of mining practices that exploit natural resources.
- Return of migrants: Returning migrants, as well as land sales and the establishment of large projects such as Samandéni, can further strain land resources, sometimes leading to land-related conflicts.
- These factors collectively contribute to the increased demand and competition for available land, leading to land use and ownership problems and conflicts in the region.

1.3.8 Farm assets and income

Farm assets and income for farmers in Burkina Faso can vary depending on several factors such as the scale of farming operations, access to resources, and the specific region in which they operate. Land is a crucial asset for farmers in Burkina Faso, and its availability and quality significantly affect the productivity and profitability of their agricultural activities. Many farmers in Burkina Faso own livestock, including cattle, sheep, and goats, which serve as a source of income and can be used for agricultural purposes such as ploughing and transportation. Farming tools and equipment, including ploughs, irrigation systems, and harvesting tools, are essential assets that contribute to the efficiency and effectiveness of farming operations.

The primary source of income for many farmers in Burkina Faso comes from the sale of crops such as cotton, millet, sorghum, maize, and peanuts, among others. Income is also generated through the sale of livestock and related products, such as milk, meat, and leather. Some farmers might receive income from government support programs, subsidies, or agricultural development initiatives aimed at promoting sustainable farming practices and improving rural livelihoods.

However, it is important to note that many farmers in Burkina Faso face various challenges, including limited access to financial resources, fluctuating market prices, and vulnerability to climatic changes, which can affect their overall farm assets and income. Efforts to improve agricultural infrastructure, access to markets, and the adoption of sustainable farming techniques are crucial for enhancing farm assets and income for the country's farmers.

 The primary source of income for many farmers in Burkina Faso comes from the sale of crops such as cotton, millet, sorghum, maize, and peanuts, among others.

1.3.9 Supportive infrastructure (roads, electricity, storage, agro-industry, etc.)

The road network is relatively dense, but mostly difficult to navigate, especially during the winter season, particularly concerning rural tracks. The Hauts-Bassins region is the crossroads of several international routes linking Côte

d'Ivoire, Mali, and Ghana (Ouagadougou-Bobo-Abidjan by road and rail, Ouagadougou-Bobo-Sikasso-Bamako, Ouagadougou-Bobo-Ségou-Bamako, Bobo-San-Mopti, Bobo-Diéboukou-Léo-Wa Tamalé) and national routes (Bobo-Dédougou, Bobo-Ouagadougou, Bobo-Banfora, Bobo-Gaoua, Bobo-Diéboukou) in this part of West Africa and western Burkina Faso. According to statistical data, the region had a road network of 1,470,887 km in 2016, including 651,271 km of paved roads and 819,616 km of unpaved roads. Means of transportation for inter-urban and intra-urban travel are buses from various transportation companies, personal vehicles, tricycles, motorcycles, mopeds, bicycles, carts, and occasionally animals (mainly donkeys and horses). The region is also served by the Abidjan-Ouagadougou railway operated by SITARAIL, with passenger and freight trains as well as modern container platforms. SITARAIL manages 1,260 km of railway lines connecting Côte d'Ivoire and Burkina Faso. The region has three specifically developed airfields for takeoff and landing, equipped with the necessary infrastructure for mission preparations: the airfields of Bobo-Dioulasso, Houndé, and Orodara. The regional capital's airport is Bobo-Dioulasso.

The Hauts-Bassins region has the second-largest city in Burkina Faso and it is an important economical and industrial site. Primary industries are the agri-food industry (BRAKINA, DAFANI, CITEC Oil Mill, etc.), agro-industry (SOFITEX, SOFIB, MABUCIG, etc.), light industry (SONACEB carton, FILSAH cotton products, etc.), mechanics and metallurgy (SOAF, CBTM, PROFEL, EERIBF, etc.), chemicals, and their derivatives (SAPHYTO, NOVATEX, etc.). The region's industry primarily focuses on the domestic market, but, with the development of the cotton sector, it is increasingly oriented toward export. Since 2005, the export industry for fruits, particularly fresh and dried mangoes, has been in operation, including a public packaging station and a fruit terminal.

Communication includes postal services, telecommunications, and information and communication technologies. The country has numerous communication channels, including public, private, and traditional media, advertising, cinema, and the internet.

1.3.10 Drinking-water sources

The supply of drinking water is obtained through boreholes with pumps, modern wells, functional fountain posts, etc. The supply of drinking water to the city of Bobo-Dioulasso comes through the capture of the ONEA sources in Nasso (15 km from Bobo-Dioulasso). Secondary water supply lines are installed in localities with more than 2,000 inhabitants (Karangasso Vigué, Poya, Soumouso, Darsalamy, Léna, etc.). Based on data from the general census of the population and habitat in 1996, the main water supply method in the province remains wells, while in the city of Bobo-Dioulasso it remains fountain posts and autonomous water pumps. In rural areas, water point management committees have been set up to manage water points. Houet Province, for example, has 244 water point management committees.



1.3.11 Migration situation

The area received a large proportion of migrants from other locations in the country, particularly the Central Plateau, the North, and Central West, following the periods of severe drought experienced from 1974 to 1984. Foreign populations from neighboring countries, such as Mali, have settled in the region since the time of French West Africa. Since 2022, strong internal migration has been observed toward urban centers following terrorist threats.

1.3.12 Employment opportunities (on- and off-farm)

The Hauts-Bassins region is characterized by a young population (35.6% of the population was from 15 to 35 years old in 2016), and many are without permanent employment. After agricultural work, craftsmanship, small-scale trade, and many other informal activities engage many young people in search of better-paying jobs. The employment promotion policies implemented have indeed facilitated job creation, but the results remain below expectations.

Since the tertiary sector is not very developed in the region to provide enough jobs, the only avenues that seem to be appealing to many young people are migration and work in artisanal gold-mining sites.

1.3.13 Sources of energy

Energy sources are diverse and varied, used by households according to their place of residence (urban or rural), their status, or their financial capabilities. The main energy sources are firewood, charcoal, petroleum products, electric energy, and solar energy. However, there has been a recent promotion by the Burkinabe government of the use of biodigesters through the National Biodigester Program of Burkina Faso (PNB-BF).

Firewood and charcoal are the primary locally used energy sources for cooking and in preparing *dolo* (a traditional Burkinabe drink). Gasoline, petroleum, diesel, and butane gas are the petroleum products used in the region. There is an increasing use of butane gas for cooking, especially in households in which the head of the household is engaged in tertiary sector occupations. The distribution of hydrocarbons in the region is ensured by retailers and small-scale resellers.

Several operators supply the region with petroleum products, mainly TOTAL BURKINA, OTAM, SODIGAZ, SHELL BURKINA, EXEL, and PETROFA. Electric energy is provided by the National Electricity Company of Burkina Faso (SONABEL). The level of production remains insufficient. In certain localities (rural areas), this energy is substituted by solar energy for lighting administrative facilities, public places, and households.

The biodigester improves access to energy, especially clean energy, for lighting and cooking. This energy is accessible to all and contributes to improving the living conditions of rural and peri-urban households outside the coverage of electricity. It helps to enhance the energy supply in the Hauts-Bassins region.

The strengths of the energy sector are evident in the existence of energy sources, alternative energy (solar), and suppliers of petroleum products in the region. Constraints are the low coverage of the territory in the electricity grid, the weakness of SONABEL's resources, accessibility problems in certain areas, and the high consumption of wood as the main energy source for households.

1.4 Social context

1.4.1 Household structure and size

In the Hauts-Bassins region, 448,275 households were counted during the 5th General Population and Housing Census. Half (50.0%) of these households reside in urban areas. The average household size in the region is lower than the national average. On average, 5.0 people live in each household in the region, whereas the national average is 5.2 people (synthesis of the final results, 5th RGPH). Urban households have fewer people on average (4.5) than those in rural areas (5.4).

The distribution of households by province shows that more than half of the region's households fall under Houet Province. The proportion of households residing in urban areas is higher in Houet (64.2%). The opposite phenomenon is observed in Kénédougou Province (89.4% in rural areas) and Tuy Province (73.2% in rural areas). Overall, the average number of people living in a household is higher in Kénédougou (5.4) and lower in Houet (4.8). In rural areas, the average number of people living in a household does not vary much from one province to another (5.6 in Kénédougou, 5.1 in Tuy, and 5.4 in Houet).

1.4.2 Gender relations

The life of women in the Hauts-Bassins region is still marked by the predominance of customary and religious rules, whose application or interpretations are often unfavorable to them. Although their role is important, the contribution of women to major family decisions is often of an advisory nature.

Women have an outsider position within the lineage and are therefore excluded from any land ownership, except in urban areas (plotted areas) where land is acquired under modern or written law. Nevertheless, a woman can obtain an individual plot on her husband's or any other operator's land through him. Generally, she has only a right of usufruct.


Women are present in all sectors of economic and social life. In terms of production, women are significant economic agents. During the rainy season, they work in the family fields and also maintain their individual plots. In the dry season, they are very active in income-generating activities, mainly in small-scale trade, dyeing, soap making, brewing of *dolo* (a traditional Burkinabe drink), poultry farming, rearing small ruminants, and collecting and selling local or semi-processed products to meet their own needs and those of their households.

Despite their crucial role in promoting the socioeconomic development of the region, this segment of the population faces numerous constraints: illiteracy, monetary poverty, low levels of education and information, difficulties in obtaining credits and subsidies, insecure access to land, socio-cultural burdens, etc.

The Hauts-Bassins region has a predominantly young population (those under 20 years old represented 56.6% of the total population in 2016). These youth constitute a significant asset for the development of the region, but they face the

thorny issue of unemployment. Indeed, after agricultural work, many of them (rural youth) find themselves without activities. They attribute this situation to the insufficiency of water reserves for off-season farming, their low level of qualification and training, as well as the difficulties in obtaining credits and other subsidies, which do not allow them to undertake their own activities. Urban youth also face unemployment and a lack of funding for self-employment, etc.

Elderly people play a very important social role and are true storehouses of knowledge. They intervene in customary and religious matters and in the management of property, conflicts, and the preservation of peace. They also provide advice, transmit scientific knowledge (traditional medicine), and educate younger generations through their life experiences. The situation of the elderly is marked by cardiovascular diseases and those related to old age. Furthermore, there is a lack of geriatricians to specifically provide for them, as well as a lack of suitable recreational facilities.



The life of women in the Hauts-Bassins region is still marked by the predominance of customary and religious rules, whose application or interpretations are often unfavorable to them

1.4.3 Ethnicity (when there are no barriers to refer to it)

The main languages spoken are Dyula (or Bambara), Senufo, Mossi, Bobo, Fulfulde (or Peulh), Bwamu (or Bwamou), and Toussian. The Mooré and Dioula languages are the most spoken in the region, with 29.5% and 27.1% of speakers, respectively. The Bobo linguistic group ranks third, far behind the top two, with 16.2% of speakers in Houet Province. The Senufo linguistic group is primarily concentrated in Kénédougou Province, with 38.9% of speakers. The Muslim religion is dominant, practiced by 72.3% of the regional population. Islam is more prevalent in Kénédougou Province (78.2%), where the proportion is above the regional average. On the other hand, Tuy Province stands out for the highest proportion of animists, at 29.2%, compared with the regional average of 10.9%. The results of the assessment show that the various religious groups live in perfect harmony. Actions should therefore continue to strengthen inter-religious dialogue.

1.4.4 Literacy of farmers and other food system actors in the ALL

Limited access to formal education, particularly in rural areas, affects the literacy levels of farmers and other food system actors. However, efforts have been made to improve access to education and promote adult literacy programs in some regions. Vocational and technical training programs have been introduced to provide farmers, including dairy farmers, with practical knowledge and skills related to agricultural practices, livestock management, and dairy production. Extension services and agricultural programs often play a crucial role in disseminating information and best practices to farmers, thus helping to improve their understanding of modern farming techniques, market dynamics, and sustainable dairy production methods.

“ Limited access to formal education, particularly in rural areas, affects the literacy levels of farmers and other food system actors.

1.4.5 General health conditions of the ALL population

In terms of health, the different sectors of the cities of Ouagadougou and Bobo-Dioulasso have primary health centers. Hospitals, insufficient in number, are supported by medical centers with some surgical support. Many private clinics support the state with offers of care for the middle classes. In rural areas, the state policy is to cover a radius of 15 km around each health center so as to reach the entire population.

1.4.6 Knowledge sharing

Knowledge sharing takes place in various fields with the support of regional authorities. Various government services facilitate the implementation of activities in the region. This often occurs within the framework of NGO activities or research and development projects in specific localized areas.

1.4.7 Community leadership (in the ALL context)

Sedentary breeders, whose exact number does not seem to be known, are organized into groups and benefit from the supervision of state technical services and development projects (PNGT, PDRI, CIRDES). The region's potential for livestock hides certain constraints to the development of the activity.

1.4.8 Power relations in the ALL

The ALL includes research teams, state technical services, NGOs, the private sector (finance, industries), milk processors, and producers, including agro-pastoralists and livestock breeders. The increase in rural population leads to an expansion of cultivated areas and thus increased spatial competition, potentially leading to conflicts with the livestock sector, which is also growing. Analysis of local power

dynamics and national rural development policies shows that land pressure is accompanied by a territorialization of bushlands at the expense of pastoral routes. This process fuels socioeconomic inequalities between livestock breeders and farmers. The position of livestock breeders in power dynamics is complex. Those who implement rural space planning policies and production development (the state and its administrations, international donors, NGOs, and development projects) have, either directly or indirectly, contributed to the decline in pastures. They have prioritized agricultural development through the expansion of cultivated areas and have not invested in protecting grazing spaces. To address this, a policy of consultation on shared resource use and territorial integration of activities is needed (Gonin, 2014).

1.5 Political context

1.5.1 Community representation in politics

Community representation in politics in the Hauts-Bassin region of Burkina Faso has been shaped by the following. Local governance structures, such as municipal councils and village committees, often provide avenues for community representation in decision-making processes at the local level. Traditional and cultural practices play a significant role in the political representation of communities, with local chiefs and traditional leaders often serving as important figures in representing community interests and concerns. Political parties and social movements have also played a role in advocating for community representation, often by promoting the inclusion of community leaders and members in political decision-making processes and governance structures. Civil society organizations, including advocacy groups, NGOs, and community-based organizations, often work to promote community representation and participation in the political sphere, advocating for the rights and interests of local communities.

1.5.2 Local participation in policy-making decisions

The social organization is of both traditional and modern types. Modern power is embodied at the village level by the Village Administrative Officer, who acts as an intermediary between the departmental prefect and the village. Regarding traditional power, its organization is almost the same in all the villages of the Bobo ethnic group. The following distinctions can be made:

- The village chief, generally from the founding family of the village, intervenes in the resolution of conflicts on the land.
- The land chief, from the lineage of the founding family, allocates land for cultivation and ensures adherence to customs related to it.
- The youth leader, also known as *ye/evoe*, is responsible for organizing and educating the youth. This person also oversees the initiation ceremony. As for the Dô chief, this is the religious leader responsible for the well-being of the village and the entire society.

In some villages, the roles of the village chief and land chief are combined under the same person (Bossora, Sokourani, and Tiarako), and the village chief can also combine the roles of the Village Administrative Officer.



1.5.3 Women's participation in local leadership

Women participate in the animation of political life through their representatives in decision-making bodies of local authorities, although their number remains very low. In fact, the current Regional Council has 78 councillors, with only 6 women, representing 7.7%.

1.5.4 Inclusion of all social groups in political decisions

Many efforts were being made to promote the inclusion of all social groups in political decisions in the Hauts-Bassin region of Burkina Faso, as well as in other parts of the country. Local governance structures, such as municipal councils and community-based organizations, have played a crucial role in providing platforms for the representation and participation of various social groups in political decision-making locally. For example, the youth participate in the associative and political life of the region. They are organized into several associative movements operating in various fields ranging from health (HIV/AIDS/STIs) to education, culture, social work, agriculture, environmental protection, and the fight against the effects of climate change.

“ The youth participate in the associative and political life of the region.

1.5.5 Policies in favor of agroecological transition

Among the public actors involved in agroecology support policies, for example, the General Directorate of Plant Production (DGPV) of the Ministry of Agriculture and Hydraulic Development (MARAH) occupies an important place, as it piloted the development of the National Strategy for Agroecology (SNAE). Two positions have been created to strengthen the support of this strategy by the state services: that of the ECOWAS National Agroecology Focal Point created in 2017 to manage and implement the Programme d'Appui à la Transition Agroécologique (PATAE), a position endorsed by the director of the Department of Agricultural Production Development (DDPA), and that of Focal Point Agroecology and Organic Agriculture created in January 2018 following a plea from the CNABio to facilitate communication with agroecology actors by offering them an entry point to the Ministry; this position is held by the director of the market gardening service at the DDPA, who is now the director of the DDPA. Other government departments play an important role in promoting agroecology. Agents from the MARAH's Department of Processing, Food, Promotion of Standards and Nutritional Quality of Agricultural Products (DTAN) and agents from the Ministry of the Environment train producers to diminish the use of synthetic pesticides and raise awareness of their danger to the soil. In addition, the DTAN implements training on nutrition-sensitive agriculture and encourages crop diversification and crop-livestock association. Other structures such as the Permanent Secretariat of the National Council for the Environment and Sustainable Development (SP-CNDD), which is part of the Ministry of the Environment, subsidize the purchase of equipment to support the development of agroecological practices.







Whether public or private, the actors involved in promoting agroecology belong to different types of stakeholder networks. The networking of these actors is organized, for example, through umbrella organizations. Nationally, agroecology actors are grouped around organizations such as the National Council of Organic Agriculture (CNABio), the Confederation of Peasants of Faso (CPF), the Cooperative Society of Distributors of Organic, Ecological Inputs and Adapted Agricultural Materials (SCO/DIBEMAA), the National Federation of Peasant Organisations (FENOP), the Citizen's Collective for Agroecology (CCAIE), the Burkinabe Council of Community Development Organisations (BURCASO), the Network of Burkinabe Civil Society Organisations for Sustainable Food and Nutritional Security in Burkina Faso (ROSSAND), and the Collective of Organisations and Associations for Farmers' Seeds (COASP-Burkina). Internationally, agroecological actors can be found in networks such as the Network of Burkinabe Agroecological Initiatives (RBIA), the Alliance for Agroecology in West Africa (3AO), the Network of Farmers' and Producers' Organisations of West Africa (ROPFA), the West African Organic Network (WAfrONet), and the International Federation of Organic Agriculture Movements (IFOAM).

Agroecological stakeholders are also put into networks through research and development projects involving different partners. Increasingly, development programs and research projects aim to network different actors to promote the sharing of experiences and the dissemination of agroecological good practices. This is the case of the PRIVA/BF project launched in February 2022, which aims to bring together different agricultural actors to disseminate agroecological practices used and tested effectively by small-scale farmers at the municipal, regional, and national levels. Before it, the Programme for Assistance to Economic Initiatives (PAIES), the project Transition towards a peasant agroecology for food sovereignty (TAPSA Sahel), and the Support Project for the Innovative Dissemination of Agroecological Techniques (PADITA) also aimed to create networks.

1.5.6 Policies hindering agroecological transition

Although Burkina Faso has been making efforts to promote sustainable agriculture and agroecology, certain challenges and policies might still hinder the full transition to agroecological practices. The following are some potential factors that might hinder the agroecological transition in Burkina Faso:

- Subsidies for chemical inputs: Government subsidies on chemical fertilizers and pesticides might encourage the continued use of conventional agricultural practices, thus discouraging farmers from transitioning to agroecological methods that rely on natural and organic inputs.
- Limited access to finance and credit: Farmers might face difficulties accessing financial resources and credit facilities to invest in the necessary equipment and infrastructure for the adoption of agroecological practices.
- Inadequate institutional support: Limited institutional support and extension services focusing on agroecological practices might pose a challenge for farmers looking to transition to sustainable farming techniques.
- Land tenure issues: Land tenure insecurity and disputes could hinder long-term planning and investment in agroecological practices, as farmers might be reluctant to implement practices that require significant long-term investments in land.
- Market and trade barriers: Inconsistent market demand and trade barriers for organic and agroecological products might discourage farmers from transitioning, as they might perceive a lack of profitability in the organic market.
- Policy implementation challenges: Challenges in implementing and enforcing existing policies related to sustainable agriculture and agroecology might limit the effectiveness of supportive measures.

II. Current state of agroecological principles in the ALL

An exhaustive census of all agroecological actors in Burkina Faso seems unrealistic, especially in a difficult and evolving security context. However, the synthesis written by Dedieu (2023) based on the following three maps of agroecological actors in Burkina Faso identified the main actors involved in agroecology:

- PIVA report (2022): Directory of agroecological actors at the national level. A study carried out by the Laboratory for Rural Studies on the Environment and Economic and Social Development with the participation of the Peasant Confederation of Burkina Faso as part of the Project Intensification and Popularization of Agroecological Practices in the Regions of Plateau-Central and Centre-West in Burkina Faso (PIVA/BF).
- Biovision report (2022): Mapping of initiatives and strategies of agroecology actors in Burkina Faso, a study carried out by N. Zankone for the Biovision Foundation (Foundation for Ecological Development) and the Albert Schweitzer Ecological Centre (CEAS).
- FAIR & TAFS report (2022): Analysis of the institutional dynamics around agroecology in Burkina Faso. The state of play of public policies, actors, and discourse. Report produced by C. Midena as part of the projects Fostering an Agroecological Intensification to improve farmers' Resilience in Sahel (FAIR Sahel) and Agroecological Transitions for Sustainable Food Systems: arguments for public policies (TAFS).

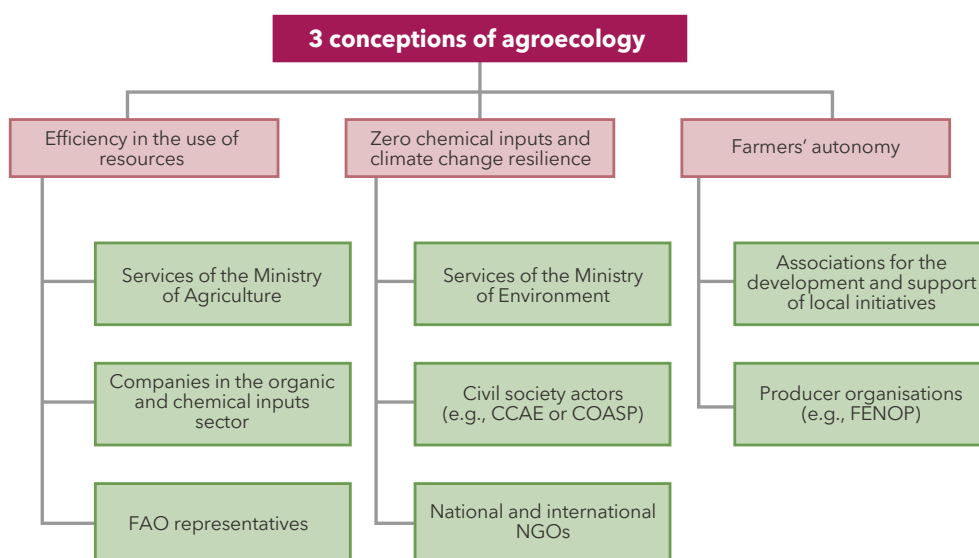
The PIVA report lists 325 actors promoting agroecology in Burkina Faso. It distinguishes between individual and collective actors, those belonging to the public sector, and those belonging to the private sector (associations and

NGOs, companies, cooperatives). The Biovision report, which lists 227 agroecology actors, lists the following categories of actors: cross-sectoral service and support providers (organic input manufacturers, agricultural extension, certification, research, promotion, and marketing actors), producers (individuals and groups of producers), actors from civil society and international NGOs (e.g., advocacy), funders (who support the maintenance of public action through projects), and political, administrative, national, and local authorities. The FAIR & TAFS report goes into more detail about the dynamics of the actors around agroecology to propose a diachronic and synchronic analysis of their relationships to agroecology.

“ The FAIR & TAFS report goes into more detail about the dynamics of the actors around agroecology to propose a diachronic and synchronic analysis of their relationships to agroecology.

This plurality of actors corresponds to a plurality of conceptions of agroecology. According to the FAIR & TAFS report, three main conceptions of agroecology are unequally defended (**Figure 20**).

Figure 20. Three conceptions of agroecology according to the actors.



Agroecology as a vector for efficiency in the use of resources: Agroecology is seen above all as a means of making the use of resources more efficient with the aim of sustainably intensifying agricultural production in order to combat poverty and consolidate or even increase producers' income. Policies supporting agroecology focus on the rational use of chemical inputs and their complementarity with organic inputs. This concept is supported in particular by public authorities in the agricultural sector, companies in the organic and chemical input sector, and FAO representatives.

Agroecology as a vector of resilience to climate shocks: The potential contribution of agroecology to adaptation to and mitigation of climate change, particularly through the recovery and preservation of degraded land, is emphasized without strictly proscribing the use of chemical inputs. This concept is supported by the Ministry of the Environment, some civil society organizations, and NGOs.

Policies supporting agroecology focus on the rational use of chemical inputs and their complementarity with organic inputs.

Agroecology as a means of farmers' autonomy: Agroecology should enable farmers and the country to become more independent of chemical inputs, improved seeds, and imported agricultural products. Some associations for the development and support of local initiatives and farmers' organizations wish to rehabilitate local seeds and varieties that are better adapted to the climate of Burkina Faso, to promote a cultural identity and a local diet, to enhance the value of farmers' knowledge and know-how, and to demonstrate the advantages of agroecology by example and by peers to public authorities and producers, with particular emphasis on the involvement of young people and women in its development.

These three conceptions of agroecology sometimes overlap. The third, for example, appeals to institutional actors in a context of worsening food insecurity following the war in Ukraine. A relocation of the agricultural system would make it possible to respond to economic, environmental, and food and nutritional security concerns. Furthermore, a consensus is emerging on the interest of agroecology in preserving the health of consumers and, more marginally, of producers, by decreasing the risks of consuming products contaminated

by pesticides or the risks of contaminating groundwater and therefore water intended for household consumption or for agriculture.

2.1 Recycling

Principle: Preferentially use local renewable resources and close as far as possible resource cycles of nutrients and biomass.

In agro-sylvo-pastoral systems in general: In the Hauts-Bassins region, producers have developed an original peasant crop-livestock association model, implemented on most agro-sylvo-pastoral farms, including dairy production units. It is based on (i) significant use of bovine and donkey animal energy for animal traction and transportation; (ii) a diversified production of organic manure (domestic waste, manure and compost from pits, farmyard manure); (iii) fodder valorization of agricultural residues standing in the field or stored at home during the dry season; and (iv) the capitalization of agricultural surpluses in livestock farming. Today, in a continuous cropping system, all agricultural land is ploughed, weeded, and sometimes mounded using animal traction. In the 1990s, 30% to 40% of farms had a hitch, 0.2-0.5% of farms owned a tractor, and 60-70% were farmed manually (Tersiguel, 1995). Our results indicate that, now, 84% of farms have a hitch, 2% a tractor, and only 14% still cultivate manually. Exclusively manual cultivation has strongly declined. Very large farms are replacing cattle with motorized ploughing. Regarding organic manure, the situation has changed a lot. The production methods, which were traditionally limited to production from farmyard manure, have greatly diversified because, according to data from the 2008 Fertipartenaires farm census (unpublished), 65% of farms produce farmyard manure, 47% of farms produce manure and compost in pits, and 29% of farms recycle household waste into organic manure. Such diversification and generalization of organic manure production practices has been observed elsewhere in West Africa (Blanchard et al., 2013) and to a lesser extent in Central Africa. Some techniques promoted by research and development are progressing rapidly, such as the production of manure in pits (33% of farms have at least one yard pit and 7% a pit in the field; unpublished Fertipartners Project); others, on the other hand, such as an improved yard (cattle enclosure, with litter made up of crop residues for manure production), were not adopted (Berger et al., 1987). Organic manures are used to improve the parts of fields deemed the least fertile with localized and massive inputs (>10 t/ha or even more) and mainly on maize crops (data from Fertipartenaires). However, the fodder crop proposed in the classic agronomic models of crop-livestock association remains to this day little adopted by producers. Many breeders believe that the costs of abandoning grazing herd practices are too high to justify the establishment of forage crops, despite the decrease in natural grazing areas. To increase the production of organic manure, and thus contribute to raising soil fertility through significant manure inputs and consequently reflect on the productivity and income of farms, it is necessary to decrease

the loss of crop residues and animal manure throughout the process of collecting, producing, and applying organic manure. During the collection stage, the main losses for the farm are caused by bush fires and common grazing in the case of agricultural residues, and by the diurnal wandering off the farm and subsequent loss of animal excrement (40% to 50% of droppings are thus dispersed in nature) (Zoungrana: personal communication on a thesis in progress). The control of fires requires the establishment of rules recognized by the community (prohibition of late fires, village surveillance committees, etc.). Decreasing scavenging involves intensifying fodder production on farms. However, the findings are that, at present, land pressure is not yet sufficient for farmers to give up this practice. The setting up of pits on farms and in fields and developing transportation equipment by reducing work constraints and increasing the number of collection points help to decrease losses. Moreover, according to Compaoré and Nanéma (2010), galloping urbanization generates waste in the big cities of Burkina Faso. This waste is piling up in unacceptable landfills despite the efforts of municipalities to decrease it because the traditional methods of incineration and burial are no longer able to curb the waste produced. Waste has high concentrations of nutrients and heavy metals in a wide variety of forms and availability. Thus, the nutrients contained in this waste are increasingly recycled as fertilizer in urban and peri-urban agriculture by producers, most often in direct application because the composted proportion remains low. Risks of soil and groundwater pollution and also contamination of the food chain in the long term exist. But composting municipal waste before it is used can significantly diminish pollution problems. This allows the sorting of certain undesirable elements and the hygienization of the compost produced, which will limit contamination of the environment. Municipal waste composting is increasingly recognized as a viable management method for solid organic debris. The composts produced have high contents of organic matter and nutrients (N, P, and K), which contribute to plant nutrition and allow a significant increase in crop yield. Composting is currently seen as an environmentally sustainable component in an integrated waste management system and would have a triple benefit in this regard: sanitation of the urban environment, a decrease in health risks, and increased agricultural productivity through the renewal of soil nutrients. Finally, there are also many interesting initiatives such as the promotion of biodigesters, the popularization of ecological toilets by the French association KOASSANGA, the manufacture of charcoal from agricultural waste by a medical student, and the reuse of industrial drink bottles by juice producers.

In milk production systems in particular, we see that improving the recycling of crop residues into fodder and animal waste into organic manure goes hand in hand with the passage of very extensive agro-pastoral systems with little specialization in milk (**Figures 13 and 16**) toward more intensive systems that retain important agro-pastoral characteristics (**Figure 16**) or evolve toward a model of mini-dairy farms (**Figure 17**).

“ The setting up of pits on farms and in fields and developing transportation equipment by reducing work constraints and increasing the number of collection points help to decrease losses.

2.2 Input reduction

Principle: Reduce or eliminate dependency on purchased inputs and increase self-sufficiency.

In agro-sylvo-pastoral systems in general, the use of synthetic inputs is relatively limited: we speak of a low-level input system. However, crops such as cotton and maize, which in these systems occupy more than half of the rotations, are quite heavy consumers of mineral fertilizers, herbicides, and, for cotton, insecticides. Overall, as the summary below indicates, the trend is upward in the consumption of this type of product. The use of herbicides is now widespread. The Ministry of Agriculture indicated in 2017 that the proportion of agricultural areas benefiting from NPK and urea increased over the period 2010–2017. NPK remains the most used input (from 27% to 41% of areas), followed by improved seeds (from 13% to 23%) and organic manure (from 12% to 23%). The proportion dropped drastically in 2018 for all inputs except organic manure and a return to normal was observed in 2019. In 2022, 210,000 tons of NPK and 80,000 tons of urea were made available to producers by the Ministry of Agriculture. The price increase of chemical fertilizers in 2022 following the crisis in Ukraine has significantly decreased their use. The contribution of livestock to the supply of decomposed organic matter is very much in demand for plant production. The use of pesticides has long been considered as one of the key elements of agricultural development by improving the yield and quality of agricultural products and this by decreasing losses caused by pests. In Burkina Faso, the use of pesticides was estimated at 2,533 tons of formulated products with a market value of FCFA 12.7 billion (in 1997), and this only on cotton and sugarcane crops and by plant protection services. About 185 commercial specialties (about 100 active ingredients) are currently in circulation in Burkina Faso, 75% of which are active ingredients with insecticidal, acaricidal, or nematocidal activity. Organophosphates



and synthetic pyrethroids constitute approximately 65% of the different specialties in circulation. The amount of active ingredient used as insecticides reaches 495 tons, consisting mainly of the chemical family of organophosphates (91.7%), while active ingredients with herbicidal activity, including triazine, amount to 165.3 tons (22.5%). Pesticides could certainly constitute one of the factors of agricultural development in a context of agricultural intensification dictated by both demographic pressure and economic needs. However, pesticides represent real dangers at three levels: (1) their toxicity for users in the agricultural environment and professionals in the phytosanitary industry (Toé et al., quoted in the FAO 2008 report); (2) toxicity for consumers due to the presence of toxic residues; and (3) environmental pollution and toxicology. Village markets are flooded with phytosanitary products made available to producers. However, according to Compaoré and Nanéma (2010), it appears that 78% of the distributors of phytosanitary products have not received training on the safe management of pesticides. Nonetheless, 83.6% of the pesticide distributors provide information to users on the choice of products to use, 4.0% on the risks associated with pesticide use, and 5.4% on pesticide use techniques. As part of the Human Health Initiatives, the preservation of consumer health involves controlling the amount of pesticide residues in agricultural products so that they are below the maximum residue level (MRL). Aware of the importance of the issue of pesticide residues and to ensure proper management of pesticides in CILSS countries, the Project (FAO/CILSS) Pesticide Management in the Sahel (GCP/RAF/335/NET) to achieve a sustainable systemic control of pesticides and residues undertook a pilot study on the maximum limits of pesticide residues admissible in agricultural products in three selected CILSS countries (Burkina Faso, Mali, and Senegal) in July-August 2002. This study was followed by a roundtable with laboratories on formulation quality control and residue analysis. Another initiative of the Pesticide Initiative Programme (PIP) of the Liaison Committee Europe-Africa-Caribbean-Pacific (COLEACP), for the promotion of horticultural crops, concerns only fruits and vegetables intended for export to European Union countries. Efforts to develop biopesticides based on extracts of natural substances are being carried out by NGOs and research.

In milk production systems in particular, the trend is also toward a reasoned increase in the use of inputs such as animal feed. In a recently published article, Vall et al. (2021) presented the situation and evolution of milk production systems in Burkina Faso, both market-driven and in search of intensification strategies at lower financial costs. Sodr   et al. (2022) showed that, for dairy cow feeding, a very promising feeding strategy, from a technical and economic point of view, but still very little widespread in Burkina Faso, was based on the intensive use of quality fodder (i.e., rich in protein) as a supplement or replacement for industrial feed (increasingly expensive).

2.3 Soil health

Principle: Secure and enhance soil health and functioning for improved plant growth, particularly by managing organic matter and enhancing soil biological activity.

In agro-sylvo-pastoral systems in general: In Burkina Faso, a decline in soil fertility is the major constraint to the development of agro-sylvo-pastoral production systems. Indeed, there is an overall decrease in the yields of the various crops and acceleration in the degradation of agricultural land. Degradation now affects more than 24% of the arable land, which is detrimental to the national economy in general and to the existence of many rural populations in particular. Tropical ferruginous soils (the most common in Burkina Faso) are characterized by poor structural stability of the surface horizons linked to their richness in silt and fine sand and their low organic matter content. The drop in the rate of organic matter leads, under the influence of the strong kinetic energy of the rain and the decreased development of the vegetation, to the formation of crusts, which limits permeability. The physical degradation of soils includes three phenomena: crusting, structural dislocation, and compaction. This situation has the immediate consequence of exposing the soil to erosion by water and wind. The chemical degradation of the soil is the result of the depletion of nutrient elements in the soil, following exploitation without the addition of fertilizers or organic inputs, the source of the mineral elements. The chemical depletion of soils in the Sudano-Sahelian zone is usually faster for the major elements because of the extensive nature of the production systems themselves, which explains the drop in production after a few years of exploitation. The lack of nitrogen and phosphorus

represents the two main limiting factors in production, while the low rate of organic matter is the cause of the poor structure and the low rate of water retention. However, the massive use of mineral fertilizers in their current formulas can also lead to depletion of soils in bases (acidification) and organic matter, which is particularly reflected in potassium deficiency and aluminum toxicity. Soil management (erosion control and runoff conservation) will maintain and improve soil fertility by decreasing the loss of soil, nutrients, and agrochemicals due to erosion, runoff, and leaching in surface water or groundwater. These losses represent an inefficient and unsustainable management of these resources, in addition to their possible deleterious effects at a distance. Soil management will also seek to promote biological activity in the soil and protect the natural vegetation and wildlife of the environment. Soil recovery techniques (Zai, Half-moon, Sahelian bocage, stone bunds, natural regeneration) and organic fertilization (composting) contribute to the preservation of soil quality.

In milk production systems in particular: Soil fertility is also an important issue because these systems are based on the fodder biomass produced on farms, which is dependent on the agricultural soils, along with the spontaneous biomass produced on the rangelands, which is dependent on the soils of the rangelands. In systems that tend to specialize in milk production, the decrease in livestock mobility increases the proportion of dairy animal waste recycled into organic manure (**Figures 16 and 17**). However, this decrease in the mobility of dairy cows has a slightly negative impact on the organic fertilization of the rangeland soils, which are less frequented and therefore receive less manure.



Eric Vall / CIRAD

2.4 Animal health

Principle: Ensure animal health and welfare.

In agro-sylvo-pastoral systems in general: Animal health monitoring in Burkina Faso, entrusted to private veterinarians, is a determining factor for good meat and milk production. In peri-urban areas, it consists of chemo-preventive treatment, external and internal deworming, as well as specific interventions related to clinical cases. The absence of a vaccination protocol, apart from vaccines against rinderpest and contagious bovine pleuropneumonia (CBPP), which remain mandatory, gives producers free rein to manage the health of their herd. Depending on the systems, the importance given to this parameter is different. Livestock production is therefore strongly influenced by the breed of animals. In peri-urban areas, the genotypic composition of the herd is quite varied. The presence or absence of cross-breeding makes it possible to distinguish farms. The mobility that characterizes pastoral and agro-pastoral livestock systems keeps herds away from care structures for a large part of the year. In addition, livestock health supervision structures are insufficient, particularly following the withdrawal of the state from the provision of health services (care, drugs, and production). The mobility and grouping of animals promote the spread of diseases and outbreaks of infection.

In milk production systems in particular: What characterizes these production systems is the decreased mobility of dairy animals due to the morning and evening milking times and their proximity to the collection center or dairy where their milk is sold. Therefore, an important issue of animal welfare is linked to the decrease in mobility and the frequentation of pastures. We see that now, even in the most intensive local production systems, the hours that animals go out to pasture are maintained in all seasons (**Figure 17**), which seems very important for a balanced diet but also for their general well-being.

“ The mobility that characterizes pastoral and agro-pastoral livestock systems keeps herds away from care structures for a large part of the year.

2.5 Biodiversity

Principle: Maintain and enhance diversity of species, functional diversity, and genetic resources and thereby maintain overall agroecosystem biodiversity in time and space at field, farm, and landscape scales.

In agro-sylvo-pastoral systems in general: The Hauts-Bassins region is extremely rich in plant resources. It has 16 classified forests distributed between the provinces of Houet (9) and Tuy (7) offering opportunities for the exploitation of timber and services. We should mention the communal and village forests as well as school groves. The Hauts-Bassins region has a large fauna made up of three main classes of animals: mammals, birds, and reptiles. This wildlife potential is the basis for the development of hunting and tourism, which is booming in the region. Agro-sylvo-pastoral farms are characterized by the presence of a diversity of trees in crop plots (about 10 trees/ha). The transition to animal-drawn mechanization has led to the density of this planting being thinned out to facilitate the passage of equipment. With the transition to mechanization, which is currently underway, this trend toward deforestation could be accentuated if provisions are not made to review the spatial organization of this wooded plantation. It provides many environmental services (soil fertility, refuges for many animals, etc.), economic services (timber and non-timber forest products), and social services (for the celebration of local rites, etc.).

In milk production systems in particular: Biodiversity issues mainly concern the composition of the dairy herd. To date, it has been composed of local animals of the zebu breed (very well adapted to the local habitat, but having low milk production). In systems undergoing intensification and specialization, we see more and more local animals crossed with exotic dairy breeds (Montbeliarde, Holstein, Alpine brunette, etc.). The evolution toward crossbred animals retaining the hardiness of local breeds with dairy traits to increase milk yield seems to be a promising avenue. This is a path that has also been taken by many East African countries that have now become self-sufficient in milk.

2.6 Synergies

Principle: Enhance positive ecological interaction, synergy, integration, and complementarity among the elements of agroecosystems (animals, crops, trees, soil, and water).

In agro-sylvo-pastoral systems in general: This principle has already been largely presented in previously regarding the recycling of animal and plant co-products. Traditionally, the interactions among crops, animals, and trees are numerous and relatively intense in agro-sylvo-pastoral systems, even if they can still be improved. This is mainly about interactions located inside the farms among the livestock workshops, the plots, and the trees of woodlands. Now, given the quite significant increase in population, extension of cultivated land, and livestock, interactions among farms relating to access to certain resources, such as crop residues, are increasingly important and more and more conflicting. In particular, common grazing rights,

which formerly did not pose a problem, generate more and more conflicting situations between herdsman and farmers who also rely on these residues to feed their animals in the dry season. We noted, however, the existence of positive synergies among farms through the establishment of livestock penning contracts, the acquisition of crop residues, and the acquisition of organic manure.

In milk production systems in particular: The synergies are the same as those presented above in the more general context of agro-sylvo-pastoral systems (positive or negative).

“ Traditionally, the interactions among crops, animals, and trees are numerous and relatively intense in agro-sylvo-pastoral systems, even if they can still be improved.

2.7 Economic diversification

Principle: Diversify on-farm income by ensuring that small-scale farmers have greater financial independence and value addition opportunities while enabling them to respond to demand from consumers.

In agro-sylvo-pastoral systems in general: The main activity of the Hauts-Bassins region is agricultural production. As mentioned earlier, cotton is the driving force behind this agriculture, which benefits from the advantages linked to the organization of the cotton sector (access to input credits and marketing managed by cotton companies). Producers in this area are also major maize producers. The climatic advantage compared with that of other regions of the country allows the development of other crops such as high-consumption legumes such as cowpea, soybean, sesame, and voandzou/bambara peas. Livestock production is also almost always present in these agricultural systems: in the form of production units for draft cattle, sometimes for milk, for fattening cattle, almost always for small ruminants (sheep and goats), and finally for poultry and quite often for pigs. Poultry farming is also growing thanks to the availability of feed and good sanitary supervision. The production of fruits and vegetables occupies many young people in Kénédougou. Cashew nuts, sesame, mangoes, and citrus fruits are also income-generating products that are mainly intended for export. The hydrographic network has favored the development of fishing activity, especially for local

consumption and supply to major centers. The water reserves of the Bala and Bazon ponds and the Samandéni dam are the main fish supply points. Basketry made from rônier leaf and the transformation of non-timber forest products (soubala and wild fruit juice) are sectors of activity that occupy many women and young people. Finally, gold panning, which unfortunately remains poorly organized, attracts many young men. In the south of the Hauts-Bassins region, agriculture is very diversified, dominated by arboriculture (mango and cashew trees, and citrus fruit), cereals (maize, sorghum, millet, and fonio), legumes (groundnuts and cowpeas), and roots and tubers (yams and cassava). Livestock are also present. Agriculture in this region is experiencing relatively favorable rainfall conditions, better than those encountered in the old cotton-producing basin. However, little cotton production occurs there and arboriculture occupies vast areas. Further west in Kénédougou, arboriculture is the main cash crop (mangoes and cashew nuts), followed by cowpea. Next come peanuts and occasionally fonio, some of whose production is marketed. Livestock (often used for animal traction) are present on the farms, but the equipment rates seem lower than in the cotton-growing areas (the animals seen, often bullfighting zebu crossbreeds, are in very good condition at this time of the year). The natural pastures are rich and abundant.

In milk production systems in particular: The diversification of production involves the fate of calves and old cows, the valorization of milk, and the culling of mothers. Most young bull calves are raised for a long time with their mothers and are sold when they reach the age of 3. The heifer calves, on the other hand, generally form part of the reproductive nucleus of the herd. Milk is partly used to feed the household and the surplus is sold directly in the local market or to a dairy. The money from the sale of the milk goes to the women. However, we have observed that women often lose control of the money, to the benefit of the husband, when the milk is sold to a dairy. Traditionally, milk is sold in the form of liquid milk or curdled milk products. In the local market, it is valued at a very good price (0.8 to 1.0 €/L depending on the season), but this usually concerns small volumes (a few liters per day per household).

2.8 Knowledge sharing

Principle: Enhance co-creation and horizontal sharing of knowledge, including local and scientific innovation, especially through farmer-to-farmer exchange.

Agricultural research is increasingly experimenting with participatory co-design approaches with farmers. This concerns all areas of agriculture and livestock production. In the field of milk production, we can cite the thesis of E. Sodré (defended in 2022) on the following theme - “Co-design in the cascade of technological innovations in the feeding of milk cows for a sustainable increase in dry season milk production, in western Burkina Faso” - and these results will be very useful for supporting the activities that we intend to carry out in this project.



Many local structures responsible for supporting the development of farmers work in this spirit of sharing and co-designing knowledge. A selection follows:

- The Regional Chambers of Agriculture, NGOs, and many partners organize training for the benefit of young breeders on the management of various products (production and processing).
- The National Union of Mini-Dairies and Local Milk Producers in Burkina Faso (UMPLB), through its branches, organizes training to improve the quality of milk. These training sessions are frameworks for sharing experiences among the different actors.
- The many NGOs (see the list in the Annex) working for the development of agroecology in Burkina Faso by promoting alternatives to conventional intensification (conservation agriculture and organic farming).

ROPPA (an initiative specific to peasant and farmer organizations) recognizes the usefulness of dialogue frameworks and spaces. However, it is aware that these frameworks and spaces for discussion face cultural, legal, climatic, and political issues and challenges that hinder the agroecological transition: (i) diversity of perceptions on the origin of conflicts; (ii) discrepancies between practices and established law at the sub-regional, national, and local levels; (iii) scarcity of resources due to climate change; (iv) resurgence of insecurity; and (v) securing pastoral routes, animal grazing, and the integrity of transhumance herders are some of the most important challenges to be met in a sub-regional context of generalized insecurity, etc. As explained above, the dynamism of consultation frameworks and spaces for dialogue is also dependent on the various projects that are the basis of their creation. The latter play an important role in optimizing their operation and revitalizing them, but, once closed, the frameworks and spaces find themselves alone faced with a real problem of funding. The challenge of appropriating and sustaining these frameworks remains unresolved.

On the educational level, training focuses on the transmission of responsible practices to agricultural and food chain professionals. This is explained by the fact that several trainers carry out their actions in agricultural production and in the education of young people. These trainers focus their actions on the transmission of sustainable agricultural practices to farmers and residents of training centers. The education of children plays an important role. It takes the form of guided tours of farms for the benefit of children, and even educational gardens.

2.9 Cultural values and diets

Principle: Build food systems based on the culture, identity, tradition, and social and gender equity of local communities that provide healthy, diversified, and seasonally and culturally appropriate diets.

In agro-sylvo-pastoral systems in general: Urban growth and changes in the demand of the urban population for food products lead not only to an increase in demand for food products (both animal and vegetable) but also to new requirements in terms of product quality and diversity due to the emergence of a middle class. This urban demand concerns as much basic products as animal products, fruits, and vegetables. On some livestock farms, this results in the establishment of intensive specialized workshops (milk, fattening stock, poultry, and pigs). On other farms, this translates into an increase in the share of cereals such as maize and rice, which are more productive, but require more inputs than traditional cereals (millet and sorghum). Climate change, and in particular the climatic deterioration that accompanies it, increases the risk of problems with crops and animals (droughts, floods, proliferation of pest and disease vectors). Faced with this, agricultural producers distribute their fields on the toposequence to spread the risks (drought in highlands or flooding in lowlands). This results in limiting purchases of inputs and avoids the risk of indebtedness in the event of a problem.

In milk production systems in particular: Apart from the Fulani herders, for whom milk is a diet staple, the population of western Burkina Faso is not a population of major consumers of dairy products. Average consumption is low (<20 L/capita/year) in the form of liquid milk or yoghurt. Nevertheless, in this population, some consumers are keen to consume dairy products made from local milk that do not have the same taste as products made from milk powder (which constitutes the largest part of yoghurts and curds consumed currently). These consumers also want to have better access to a range of more diversified traditional dairy products (dégué, gapal, wagasi-type cheese, milk soap, and milk oil). An important objective would be to succeed in replacing a large part of the imported milk powder with locally produced milk, while producing quality products that are affordable to the greatest number of households to satisfy the demand of these consumers.

2.10 Fairness and connectivity

Principle Fairness: Support dignified and robust livelihoods for all actors engaged in food systems, especially small-scale food producers, based on fair trade, fair employment, and fair treatment of intellectual property rights.


Principle Connectivity: Ensure proximity and confidence between producers and consumers through promotion of fair and short distribution networks and by re-embedding food systems into local economies.

In agro-sylvo-pastoral systems in general: The professionalization and organization of producers means that farms are increasingly well connected to the market. In the case of certain sectors, membership in cotton producer groups guarantees direct access to synthetic inputs (fertilizer, herbicide, etc.) that are also used on crops other than cotton. However, access to organic inputs or other agroecological products is much less organized.

With privatization, the support services that are being put in place are undoubtedly a little more professional and more available, but they are accessible only to those who can pay for them (microfinance, agro-supplies, etc.). In some cases, the transfer has made it possible to lower prices (this was the case when the blacksmiths took over from the agricultural equipment industries). But not all products can be produced locally. In landlocked areas or where the potential clientele is too dispersed, private services are not profitable and these areas are deserted by private individuals. With the withdrawal of the state from agricultural support services, one of the main difficulties consists in covering the unprofitable segments of demand. As a corollary, we are witnessing a concentration of services in less landlocked areas, which could lead to islands of intensive production areas. However, the improvement to infrastructure (roads and markets) and the development of telecommunications promote access of producers to services and to the market, and this decreases isolation. This type of development can have an indirect but powerful effect on the intensification of production by creating opportunities. Technical innovations are always potentially an important

driver of intensification. This point has been addressed above. What is changing now is rather the demand from producers. In the past, they were content with a relatively rustic and universal technical offer. Demand is now evolving toward more specific techniques in terms of phytosanitary products, transportation and tillage equipment, and livestock equipment. This trend should be encouraged.

In milk production systems in particular: In 2016, the UPML/B set up the FairFaso advocacy brand. FairFaso is the brand through which certain mini-dairies, members of the UMPL/B, market their milk. This label aims to remunerate producers better: in addition to the price paid to the producer by the cooperative, part of the price paid by the consumer is redistributed to the producer by the cooperative. In Bobo-Dioulasso, the Milk Innovation Platform, with whom we will be working, has two objectives aimed at ensuring a fairer economy between milk producers and processors: (1) achieve the application of a harmonized milk price by collectors and (2) improve the system of distribution of milk collected according to the daily needs of processors.

 In landlocked areas or where the potential clientele is too dispersed, private services are not profitable and these areas are deserted by private individuals.

2.11 Land and natural resource governance

Principle: Strengthen institutional arrangements to improve, including the recognition and support of family farmers, smallholders and peasant food producers as sustainable managers of natural and genetic resources.

In agro-sylvo-pastoral systems in general: Decentralization and the establishment of local authorities in rural communes mean that rural participants are increasingly responsible for managing their own local natural resources. With the modernization of legal texts, this evolution gives them the possibility of setting up local conventions and adjusting local rules to manage the competition and access to resources better (the main role of Village Development Committees).

This type of device makes it possible to secure the investments and developments that can be carried out on crop plots or in grazing areas. The disengagement of the state and the privatization of agricultural and livestock support services have a direct effect on producers depending on their financial means and their geographic location (landlocked or not).

In milk production systems in particular: Securing the land of dairy breeders-producers is a major priority for IPROLAIT/BF because producers need cultivable land for fodder production, along with secure access (in all seasons) to pastures and water points. Land tenure security is an essential condition to guarantee a better future for peri-urban livestock farming. It needs to go through a good organization of the area that takes into account several parameters. The available space, the demographic and spatial dynamics of the city (as well as that of the villages), the specificity of livestock farming (especially traditional), and the presence of other activities must be considered. This will prevent reserved areas from being downgraded after 10 to 20 years. Spaces reserved for breeding must be equipped with infrastructure. This is above all a question of creating water points and opening cattle tracks to facilitate access to fodder and water resources.

Concerning the management and improvement of genetic resources, above all IPROLAI/BF envisages genetic improvement by increasing the importation and popularization of breeds with high potential for milk production. For its part, national research is working on setting up a community-based selection program for dairy cows, based on the local breed, in order to improve milk yield while preserving the hardiness of local animals.

2.12 Participation

Principle: Encourage social organization and greater participation in decision-making by food producers and consumers to support decentralized governance and local adaptive management of agricultural and food systems.

Burkina Faso has several hundred organizations working in the field of agroecology (See in ANNEX). The Hauts-Bassins region has many stakeholders whose efforts will ultimately affect the health and quality of life of the population (see Annex).

In milk production systems in particular: The Bobo-Dioulasso milk multi-stakeholder platform is made up of milk producers, collectors affiliated with milk collection centers, private collectors, milk processing units, public support/accompanying services (services handed over from the ministry in charge of livestock and agricultural and technological research), and private support (animal feed suppliers, artificial insemination service providers, and microfinance institutions). The platform seeks to forge partnership links with any other structure wishing to support it in achieving its objectives. The overall objective of the Milk Innovation Platform is to increase the production, collection, processing, and daily marketing of local milk in the Bobo-Dioulasso dairy basin by up to 18,000 L/day. Specifically, the aim is the following:

- To increase milk production on the farm and maintain this improvement through better feeding and health maintenance of dairy cows.
- To strengthen the intellectual and technical capacities of breeders.
- To ensure a reliable measurement of the quality and quantity of milk at collection by using adequate tools.
- To achieve the application of a harmonized milk price by collectors.
- To improve the system of collection, storage, and distribution of milk.
- To market a wide variety of dairy products resulting from the processing of quality milk using appropriate equipment and techniques.



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Annex

List of some structures working in agroecology in the Hauts-Bassins region, with contacts and links.

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CNABio; founding member of CNABio. Developed the organic label with Bio-SPG.

COASP-Burkina (West African Peasant Seed Committee).

CULTIVONS Burkina "Let's grow," a campaign led by OXFAM-Belgium and its partners for a better food system. Encourages decision-makers to invest more in family farming. Founding member of CNABio.

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