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Agroecological Transition of farmer collectives in the Pilat Natural Regional Park

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Note to the reader

This Master Thesis has been written during a 6-month internship at the Pilat Regional Natural Park establishment in France. The internship consisted of supporting the development of an Agroecology and Livestock program and the establishment of a Pastoral Plan in the Park with farmers. This research project was defined to meet the Park's goals and to confront these practical issues with an academic perspective. Its relevance was therefore co-determined with the Park's technicians and stakeholders met during the internship, who are also the primary beneficiaries of the findings. Beyond their theoretical relevance, the findings of this study should help the Park's actions towards its agroecological development.

Abstract

As our contemporary intensive agricultural models readily approach the biophysical boundaries of the Earth system, social and technical innovations are inevitably required to meet future food demand. Agroecology can be a promising approach to design and manage more sustainable agroecosystems, but it requires a major reconsideration of farmers' knowledge construction processes. Bottom-up initiatives, farmer-to-farmer exchanges, and peer learning groups play a key role in generating this knowledge. Collective initiatives of farmers aiming at experimenting alternative practices on farm and supported by external actors can therefore favor the agroecological transition. Ethnographic observations and qualitative interviews were conducted with two farmer collectives from the Pilat Natural Regional Park in France, in order to describe, evaluate and further the agroecological transition occurring in these local groups. The results of the study showed that agroecology is usually a silent but existing concept in farmer collectives, but doesn't necessarily lead to the whole transformation of agricultural systems. This study identified how professionals from the agricultural sector could favor the agroecological orientation of farmer collectives.

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List of Abbreviations

AET: Agroecological transition

GAEC: Groupe Agricole d'Exploitation Commune (joined agricultural group)

NRP : Natural Regional Park (*refers to a geographic region, while 'Park' is used to designate the Natural Regional Park's institutional entity)*

GIEE : Groupement d'Intérêt Economique et Environnemental (Environmental and Economic Interest Group)

ADEAR : Association pour le développement de l'emploi agricole et rural (association for the development of rural and agricultural sectors)

CUMA: Cooperative d'Utilisation de Matériel Agricole (Farmmachinerycooperative)

PDO : Protected Designation of Origin

CAP: Common Agricultural Policy

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1. Introduction

Today, the majority of the world's staple food is provided by industrial modes of agriculture inherited from the post-world war period. While this model has succeeded in supplying large volumes of foods, owing to the adoption of modern technologies, expansion of irrigation infrastructures, and extensive farming techniques, these progresses where achieved at great environmental costs, as recently warned by UN scientists from then the Intergovernmental Panel on Climate Change (IPCC 2019). The development of industrial farming systems has also brought a wide range of negative outcomes on farmers' socioeconomic conditions, ranging from high income inequalities, loss of local autonomy, dependency on external markets and finances, as well as health hazards (Lobao and Stofferahn 2008). Worldwide, the emergence of global food markets leading to farm specialization and expansion have pushed farmers to lower their production costs in order to adapt to a competitive environment (Ilbery and Bowler 1998). This process drastically increased farmers' vulnerability in their professional and daily lives: in France the poverty rate of farmers (defined as a monthly wage of 846 euro) remains well above the population average, and 30% earn on average 350 euro per month, due to high level of debts (Chartier 2015).

The need to reorient intensive agricultural models towards environmental and viable alternatives is now widely recognized (Campbell et al 2017). In recent time, the concept of agroecology emerged in the sustainable agriculture discourse, proposing an alternative development of the food system based on ecological principles (Wezel et al 2009). Agroecology can be viewed as a tool to design sustainable and autonomous agricultural systems, adapted to local conditions, embedded in the economic activity of a territory, valuing biological diversity and natural processes (FAO 2018). Beyond its agronomic scope, agroecology calls for a real socioeconomic transition of the agricultural and agro-food sectors, by supporting institutional innovations between producers and consumers, in financial systems and in local politics (Dumont et al 2016).This transition relies on a transdisciplinary approach based on participatory work between scientists, agricultural professionals, local stakeholders, farmers as well as policy makers (Francis et al 2011). Several governance principles may favor the transition towards agroecological systems (Dumont et al 2016). One of them is to encourage learning and experimentation as a process for acquiring new knowledge, behavior and skills at the individual or collective level (Dumont et al 2016). A second one is to promote collective initiatives such as local farmer groups, so as to construct context-based adaptation strategies in partnership with farmers themselves (Darré 1999). The underlying assumption behind these principles is that 'situated' knowledge developed and shared in farmers' networks involved in experimentation processes fosters the adoption of agroecological practices (Compagnone et al 2018). The activity developed in these local collective initiatives is favored by the intervention of professionals from the agricultural sector,

scientists and advisors, called ‘supporting actors’ (Naverrete et al 2018). Thus, many authors have pointed out that the development of farmers’ networks could be a promising way towards the agroecological transition (Navarrete et al 2018, Lucas 2017). Based on this assumption, the aim of this Master Thesis is to define to what extent and under which conditions do farmer collectives involved in on-farm experimentations favor farmers’ learning processes and their evolution towards an agroecological approach. In addition, this study seeks to investigate the role of “supporting actors” in the evolutionary pathways of these groups. The research took place within the Pilat Natural Regional Park in France, a small territory seeking to engage its agroecological transition by supporting farmers’ collective initiatives.

2. Rationale of the study and Research Questions

2.1 Scientific positioning

2.1.1 Collective dynamics in the French farming sector: historical background

The concept of *farmer collective* has an unclear definition in the literature, alternatively referred to as ‘farmers network’, ‘farmers groups’, or ‘collective experimentation’ (*collectif agricole* in French). It designates a group of farmers who may be associated to other stakeholders of the territory gathered around common practices, and sharing similar values and norm system (Goulet 2008). Before the Second World War, informal forms of local cooperation forged the French rural landscape, which consisted of arrangements for sharing resources, co-ownership of equipment, mutual assistance, straw-manure exchange or parcel exchanges between neighbors (Bernard de Raymon 2013). Progressively, these local work exchanges were turned into wage-labor under the rise of industrial capitalist farming models, contributing to the disappearance of the collective dimension of farm work. Other forms of farmer cooperation appeared after the second World War, based on the collective management of tangible resources through formal organizations called CUMA *(Cooperative for the use of farm machinery*); a status which allows farmers to buy and use farm equipment in common, or to share employees and work. Today, more than 12 000 CUMA exist in France and their function has now gone much further than simply sharing machines (Lucas 2017). These local cooperation networks provide room for knowledge sharing, resource exchange and experimentations which altogether support new forms of innovations (Assens 2002, Lucas 2018). Another form of farmer cooperation consists of local farmers groups seeking to experiment and exchange experiences in order to improve their individual performance and produce collective, situated knowledge (Darré 1999). This form of cooperation was recently encouraged by the French government who introduced a new status called GIEE (*Economic and Ecological Interest Group)*, conceived to foster collective initiatives engaged in sharing and experimenting practices linked to sustainable development. Any collective structure with a

majority of farmers and a project aiming at ameliorating their environmental, economic and social performances is entitled to the GIEE status. If accepted, the group can benefit from of a 5-year funding as well as access to animation, trainings and consulting with experts to develop their project. By fostering partnerships between a wide range of territorial actors, promoting farmer-to-farmer knowledge sharing and favoring transversal innovations, the government has bet that these collective initiatives could be powerful drivers of transition for sustainable food systems (French Ministry of Agriculture and Environment 2018, IPES 2018).

2.1.2 Farmer collectives and agroecological transitions

Agroecology is a polysemous concept defined in the literature as a a science, a practice and a movement, promoting the development of fairer and more sustainable food systems (Wezel et al 2009, Gliessman 2015). Agroecology advocates for a sustainable agriculture model that limits inputs, values biological diversity and natural processes, encourages joint management of natural resources and food production, while promoting farmers' autonomy (Stassart et al 2012). Therefore, a thorough restructuring of both production systems and the norms governing them is called for (Compagnone 2018). The adoption of agroecological principles in farming and food systems is a slow, uncertain and explorative process, referred to as the concept of agroecological transition (AET) (Gliessman and Engles 2015). Engaging in an agroecological transition requires both technical and organizational innovations, breaking with the traditional 'top down' knowledge transfer from agronomic development schemes (Lucas 2018). The AET can therefore be described as a product of social and technical innovations, existing or to be found, based on progressive, iterative learning processes, involving local knowledge and multiple actors over a long period of time (COTRAE 2019). A diversity of conceptual frameworks have been proposed to evaluate the performance of agroecological development in farming systems and institutional settings (Hill and McRae 1996, Gliessman and Engles 2015). This agroecological development can take two forms: one is considered as *weak* or "eco-efficient because it is based on the replacement of chemical inputs by biological ones and aims at increasing the efficiency of synthetic inputs through the implementation of standardized management practices (Magrini et al 2019, Duru et al 2015). The second one, referred to as "biodiversity-based agriculture" or "ecologically intensive agriculture" is considered as *strong* because it entails a radical redesign and significant biological diversification of agricultural systems (Kremen et al 2012). Hence, the agroecological transition can be assessed as a transition from a *weak* to a *strong* model, requiring a broad shift and territorialisation of the entire agri-food system (Magrini et al 2019).
Many authors have hypothesized that the AET is fostered by exchanges, experimentations and facilitation occurring in collective initiatives led by farmers (Navarette 2018, Lucas 2018, Goulet 2008). By fostering peer-to-peer exchanges and introducing a questioning process on agricultural

production methods and organization of farm work, on-farm collective experimentation is a way for famers to implement and develop new farming systems. For this reason, collective dynamics are being increasingly considered as springboards for the development of sustainable food systems, as evidenced by a growing body of literature on the topic (Gliessman 2009, Goulet 2013, COTRAE 2015). However, these local collective dynamics are diverse and multifaceted. Up-to-now, conceptual frameworks and indicators have been developed to assess the AET process at the field and farm scales as well as the territory scales, but not at the intermediary scale of these local collective projects (Duru et al 2015, Tittonnell 2014, Wezel et al 2016).

2.2 Context of the case study

2.2.1 Presentation of the case-territory

The Pilat is a rather small territory located in the South-East of France, nestled between three main urban areas (Lyon, Vienne and St-Etienne) and two industrial river valleys (the Rhône and the Gier). The Pilat Regional Natural Park was created in 1974, and today comprises 47 communes and about 54 000 inhabitants (Guirimand 2014). In France, Natural Regional Parks (NRP) have a dual purpose: preserving the cultural and ecological heritages of their given territory while ensuring land-use planning and economic development plans are made in a sustainable way (Fédération des Parcs Naturels Régionaux, 2015). Regional Parks' institutional structures play an important role in the local development of their territories, despite their absence of any regulatory power. They are politically independent and piloted by a mixed syndicate of local elected, which define in a charter various working programs. Today, the challenge of the Pilat NRP is to support the economic development of the territory while maintaining its typical cultural and ecological cohesion. Favoring sustainable agriculture and local food systems is one of primary workstream of the Park elaborated in its charter (Parc Naturel Régional Pilat 2012).

2.2.2 The Pilat, a territory engaged in an agroecological transition

The Pilat NRP has been identified as a territory favorable to the agroecological transition due to the existence of a rich informal network, a favorable historical context and an active formal structure, the Natural Regional Park, which has been strongly investing the notion of agroecology (Guirimand 2017). High objectives for the development of agroecology were established in the Charter of the Park set up for 2025: 40% of the farms certified organic, 100% of farmers engaged in high-environmental value measures, and 100% of the utilized agricultural area maintained (Parc Naturel Régional du Pilat 2012). To reach these objectives, the Park has traditionally been acting as a financial and administrative resource by implementing supra-territorial development schemes (Vandenbroucke et al

2019). As a bridge between European, national and regional institutions, the Park possesses different financial instruments to encourage the reorientation of agricultural practices or the development of local food systems outlined in various funding programs (mainly the LEADER[1] European program). For instance, the Park has been leading for many years the implementation of agri-environmental measures contracted with individual farmers to reward specific environmentally-friendly practices (such as the maintenance of pastoral areas, or the adoption of reduced fertilization plans). However the complexity, rigidity and length of these governmental programs have impacted the image of the Park, perceived as a heavy and bureaucratic institution not often adapted to the farmer's needs (Vandenbroucke et al 2019). Moreover, these programs are heavily dependent on political orientations at different institutional levels, giving little flexibility for the Park to engage in long-term planning. For these reasons, the technicians of the Park have now moved away from the implementation of supra-territorial procedures, towards the support of collective and local groups, without a fixed intervention mode. Considering the importance of participatory-driven, bottom-up action in the agroecological approach, the Park now seeks to identify projects carried out by local groups in accordance with the objectives of its Charter, and to propose an adjusted facilitation for each initiatives (from simple information, to operational assistance, animation, technical advice, training or the search of financial resources) (Vandenbroucke et al 2019). In that way, the Park's ambition is to promote intra-territorial networking and learning, by mobilizing local financial resources (such as crowdfundings) and creating interdisciplinary spaces for exchange. The Park's operational activities are piloted by one technician specialized in agroecology, in consortium with a development committee, featuring local stakeholders and political representatives. The development of agroecology within the Park's objectives has been questioning the role and intervention mode of its technicians. For instance, working with farmers' networks is now a major activity of the Park, which has bet these collective dynamics can be paving the way of the agroecological transition (Parc Naturel Régional Pilat 2019). If these collective actions favor farmers' innovation and adoption of new practices; they sometimes get bogged down in trivialized technical routes which do not interrogate the overall farming system functioning. In fact, the technicians of the Park have observed that collective projects trigger a changing process in farmers' trajectories but do not necessarily imply a long term AET process. For this reason, the Park questions how it can support these groups towards agroecological trajectories, and include their initiatives in the global transition of the territory.

2.3 Research Questions

[1] Liaison Entre Actions de Développement de l'Economie Rurale (meaning Links Between Actions for the Development of the Rural Economy) is a European Union initiative to support rural development projects initiated at the local level in order to revitalize rural areas and create jobs

The previous review of the literature has shown that farmer collectives are an important mode of knowledge production facilitating the adoption of innovative practices. However, do such types of actions necessarily induce an agroecological transition in the farming systems at play? What is meant by "a collective engaged in an agroecological transition" and how does a collective influence farmer' individual evolutionary pathways? Based on COTRAE[2] research project, this study assumes that farmer collectives involved in experimental activities are engaged in a transition process which is influenced by the group's internal dynamics, the modes of experimentations and its external facilitators (or supporting actors). However this transition occurs at different levels and speed between farmer groups. This study will therefore attempt to:

- Characterize the agroecological transition occurring in farmers group,
- Establish indicators and needed conditions to favor this process,
- Generate references for supporting actors working with farmers groups to further support the process of AET in collective initiatives

Taking the Pilat NRP as a case territory for the study, the following research question will be explored: **How to define, evaluate and support the agroecological transition occurring in farmer collectives in the Pilat Natural Regional Park?**

3. Material and methods

3.1. Research context and presentation of the groups

This research project was conducted during an internship in the Agroecology department of the Pilat Natural Regional Park. It was based on empirical interviews and participant observation of two collective initiatives of farmers occurring in the NRP:

- A GIEE of ten farmers created in 2017, named P.I.L.A.T.S (Innovative Project Linked to Soil Agroecology). The farmers (all conventional except one organic) have in majority mixed crop-animal systems and grow most of their required animal feed (maize, grass for silage and protein crops). Their project is based on experimentations around conservation agriculture practices: reduced-tillage, permanent vegetative cover and crop rotation,
- An informal group called Patur'en Pilat, bringing together about 20 livestock farmers seeking to experiment and exchange knowledge on technical itineraries promoting pastoralism. By pastoralism, they refer to extensive livestock production systems where natural vegetation (permanent pastures, rangelands, semi-open forests) is the year-round prior source of feed for

[2] Collectives Engaged in Agroecological Transition, action research project conducted between 2015-2019 in South of France, aiming at understanding how the interactions between groups, facilitators and experimentation impact knowledge production and may allow for the agroecological transition to take place

the animals. Producers from this group seek to gain more autonomy by optimizing grazing practices and maintain open landscapes.

These groups were primarily selected because the Park is a facilitator for both of them and is directly involved in their activities. Moreover, they are pursuing similar objectives, notably the improvement of farm autonomy (in particular with regards to animal feeding) and personal working conditions (decreasing workload, time spent on tractor). However the two collectives present radically different technical itineraries, types of experimentation and internal functioning. As seen in Figure 1, the GIEE members are all from the same geographic area while members from Patur'en Pilat are spread all over the territory. The experimentation processes undertaken in the two collective projects are unique in the Pilat and the Park sought to understand how agroecology was developed in the two groups, and how it could support their engagement towards AET.

Distribution of the farmers members of the GIEE and Patur'en Pilat in the Pilat Natural Park territory

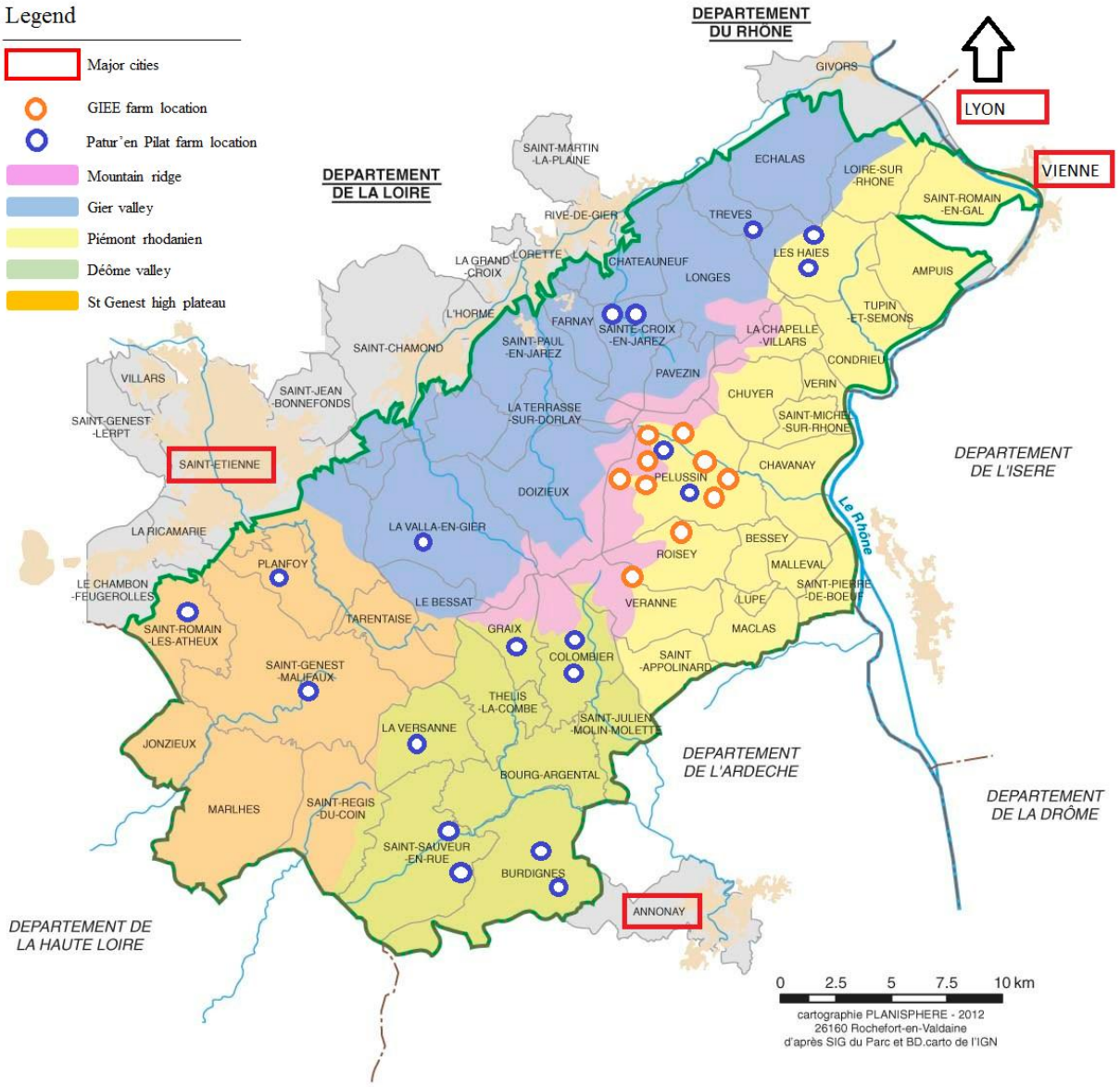

Figure 1. Map of the Pilat Natural Regional Park featuring the location of farmers from the GIEE and Patur'en Pilat collectives

3.2. General methodology and data collection

The methodological framework of this study is based on a qualitative research approach, carried out under a comparative case-study design, defined by Yin (2014) as "*an empirical enquiry to investigate a contemporary phenomenon in real-life context, especially when the boundaries between phenomenon and context are not clearly evident*". The study consisted of gaining a deep understanding of the two farmer collectives selected, constituting the *cases* of the analysis, or the objects of experimentation. Data was collected through ethnographic fieldwork through participant observations during an extended period of time (3 months), and in-depth open-ended interviews. By providing rich, holistic insights into people's views and actions, ethnography provides an in-depth understanding of particular social phenomenon (Suryani 2013). As Hammersley (1995) states, "*The task [of ethnographers] is to document the culture, the perspectives and practices, of the people in these settings. The aim is to 'get*

inside' the way each group of people sees the world"'. A key element of ethnographic fieldwork is the direct engagement with the social context under study and the triangulation of data collected with external concepts or theories (Reeves et al 2008). This approach was respected in this study through a continuous back and forth between the real-world perspective and the scientific world (Figure 2). The research topic and questions were jointly elaborated with the technician of the Park in accordance with their specific challenges and questions. An initial literature review of the field of research was then conducted, using French and English key words such as *collective experiment, agroecology, farmers' learning, facilitation, innovation.* Two semi-structured interview guides, one for farmers and one for group animators, were prepared before the interviews (Appendix A). For each group, three farmers (presenting diverse levels of involvement in the collective) and two animators were chosen with the insight from the Park. The ten interviews were carried out directly on farms or at the facilitators' working places, lasting between one or two hours and recorded with the consent of interviewees. The complete description of interviewees is presented in Appendix B (for the sake of anonymity, the names of interviewees were replaced by letters in the study). In addition, information was collected through direct participant observation of farmer groups meetings, farm visits, trainings, and an involvement in the diverse activities conducted by the Agroecology technician of the Park (administrative procedures, meeting with partners, internal meetings…). The discussions occurring within these settings, description of attendees and behaviors of participants were recorded in a field notebook, accompanied by individual feelings and reflections on these observations. Appendix C presents the list of participant observations completed in the study and the main themes investigated. Finally, to share the findings of the study with the Park, a resource document was written in French (Appendix D) and presented during a meeting with the Park's workers at the end of the internship.

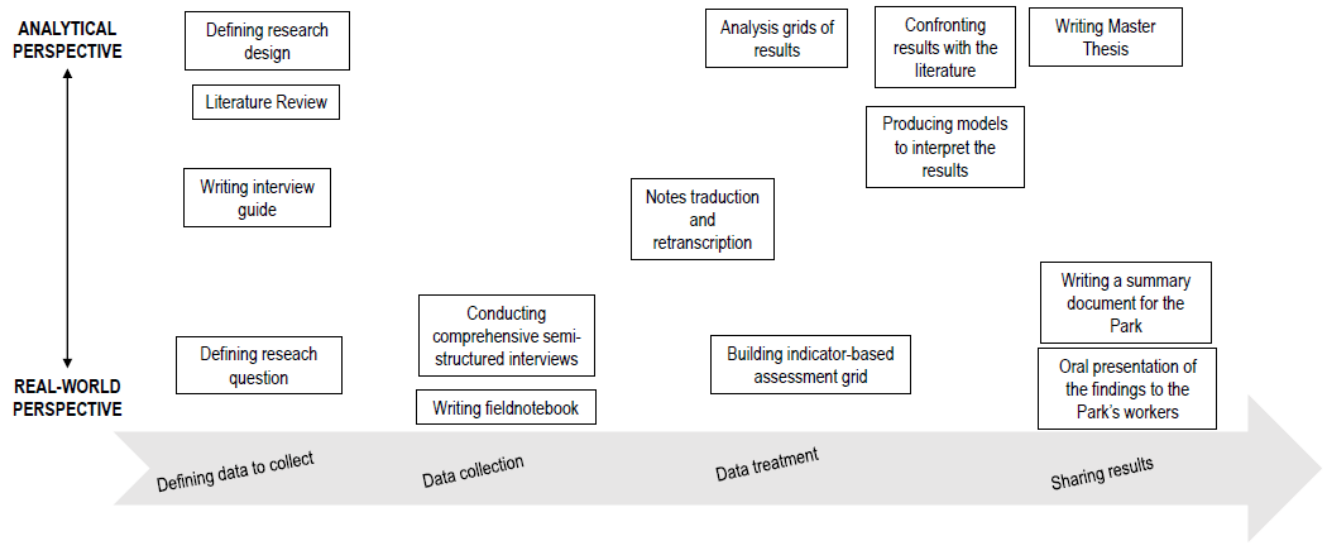

Figure 2. Methodological approach followed in the MSc Thesis

3.3 Data analysis

All interviews recorded were manually transcribed and translated in English. The notes from participant observation were also transcribed and organized in different categories with the emerging key themes and issues. A thematic analysis of the interviewee's responses based on analysis grids established in the COTRAE's project was then conducted with four main categories: internal organization, experimentation, facilitation and change induced by the collective (Appendix E). These results were then visually represented through a SWOT table, a diagram featuring individual farmers' trajectories, and a model of the learning processes for each groups. A second analysis grid was also built to be used by the Park, to evaluate the stage of agroecological development reached in these projects, based on existing scientific frameworks. Rather than a performance assessment, the grid is proposed as a methodological tool for the Park to clarify the theoretical principles of agroecology and translate them into concrete practices for the collective initiatives they accompany. The indicators chosen to assess the AET in farmer collectives were classified in two variables: *Variable 1* called 'Institutional innovation' to assess how farmers learn, and *Variable 2* called 'Technological innovation' to assess what farmers learn about (i.e the content of the group's activities). These main variables were declined in a set of under-variables with two modalities associated to a binary numeral system (0/1): the modality more favorable to sustainability scored 1, the other less favorable scored 0. The best-fitted modality for each under-variable was scored accordingly for the two collective studied together with the Park's technician, based on data collected. Final scores for the two main variables were obtained by adding up the scores of all under-variables. These scores were then plotted in a graph, using *Variable 1* in the Y-axis and *Variable 2* in the X-axis, which visually positioned the farmer groups on a weak to strong gradient of agroecology. The complete analysis grid with the description of variables is presented in Appendix F.

4. Results

4.1. Functioning of the collectives

4.1.1 The GIEE 'P.I.L.A.T.S', a collective oriented towards the development of conservation agriculture practices

History of the group

The GIEE P.I.L.A.T.S is a heterogeneous group of 10 farmers who have been involved for many years in the same CUMA. The group features a diversity of farming systems: three animal husbandry farmers (pigs and suckler cows, carrying on-farm transformation and direct marketing), two conventional dairy cow farmers (long chain distribution), two dairy goat farmers (for PDO cheese production), one cereal farmer/baker (on-farm bread production), one field crop farmer and one

organic dairy cow farmer. In spite of their diverse backgrounds, the farmers face similar environmental challenges: sandy soils prone to erosion with declining fertility, and small, fragmented parcels difficult to mechanize. Increasing soil protection and farm's autonomy triggered their interest in conservation agriculture practices "*we have no choice than to change our practices when we see the intensity of weather events growing with climate change"* (G1). The creation of a collective was an opportunity for the ten farmers to share direct-seeding equipment "*it's always interesting to work with others and we can have access to equipment"* (G2). Initially, the group partnered with a private consulting firm to structure their objectives and find investors. They rapidly replaced this structure by the Park "*for us it was logical that the Park had something to do with landscape conservation, and could therefore help us in the project"* (G1). The Park carried out with the group the application for the GIEE status, which was finally approved in 2017. To this end, the Park established individual farm diagnostics (based on economic, environmental and social aspects), budgeted the group's expenses and helped the group to formulate their action plans. Three main actions were planned during the length of the 5-year project: purchasing and sharing material (no-till drill, precision seeders); experimentation of new cropping practices at individual's farms (reduced tillage, direct-seeding, cover cropping, crop rotations, co-composting); exchanging on experimentation (networking with other groups, field visits, training days) and finally diffusing results with broader public (informing farm's clients, sharing results with other farmers).

Activities and internal dynamics

During the application process, some farmers from the group were already experimenting direct seeding techniques by renting equipment on their own, without necessarily reporting results to the group *"I didn't share my results because I couldn't quantify them at that time, it was purely subjective trials"* (G3). However the group was meeting frequently to decide on which material to purchase and, due to their relatively close location, were interacting informally on a regular basis. Farmer G3 was designated the president of the group "*just because we needed one"* (G3). As the legal representative of the group, he is in charge of organizing group meetings. However, his role is mostly fulfilled by the Park due to his lack of time. Other responsibilities such as external communication, managing trials were attributed in the early stage of the group to its members but are today not concretized *"our internal organization is not our strength"* (G1). Thanks to the GIEE funding, the group benefited from several theoretical courses with experts (on soil science, plant nutrition, cover crop management, direct seeding techniques). The Park also organized field visits in experienced farms with conservation agriculture outside of the territory. Since 2019, the group has contracted a partnership with a specialized technician (AG2 from Maison Cholat) to help them set up some experimentation protocols for developing trials with the machinery purchased (choosing parcels, selecting cover crop species,

rotations, type of cover crop implementation…). The first formal experimentations, planned for summer 2019, will be capitalized and shared with the national GIEE network by the Park.

SWOT analysis

The SWOT analysis conducted (see Appendix G) revealed that obtaining the GIEE status was a fundamental opportunity for its ten members, which allowed them to purchase equipment, and also to clarify their objectives, as noted by the Park's technician "*The GIEE structure encouraged the group to see further than just the experimentation, to think more systematically on their actions"* (AG2). This status has opened the group to a national network of innovative collective projects, providing them external sources of inspiration and references. Because the ten farmers share similar environmental conditions and have been together involved in the same CUMA for many years, they all know each other quite well and interact informally on a regular basis *"we have a lot of informal exchanges, text message, email, meetings in the evening, mostly to discuss the choice of material"*(G2). The fact that they all have different production systems brings rich discussions and exchanges of worldviews "*we thought we had nothing in common - although today I realize I can share tips even with the organic farmer in the GIEE"*(G1). However, their focus on material-oriented issues and lack of holistic perspective could be a threat for the group "*they got the machinery and now that's set*" (G1). Economic profitability is a recurrent driver of change observed amongst farmers from the collective, which result in difficulties to accept risk and an unequal willingness to conduct experimentations between members *"Most of the guys are waiting for others to experiment because they don't want to take risks*" (G3). Additionally, the lack of internal organization in the group and external communication strategies inhibit their visibility and integration in the territory "*the group clearly lacks of internal organization"* (AG2). Finally, due to their different production systems, the farmer's individual objectives are contrasted and could prevent some decisions to be taken *"I feel because we have divergent objectives in the group we are not moving fast enough in the same direction"* (G2). For example, during a course on cover cropping management, the organic farmer expressed his disappointment at the end of the day about not having learned technical alternatives to the use of glyphosate (to terminate cover crop). Two other farmers agreed on his point *"farmers are seen as polluters and consumers want something else today"*. However their argument is not shared with the other farmers, who highlighted that *"if glyphosate is forbidden, other products will be allowed on the market"*. They are less concerned by the ecological impact of glyphosate than by the destruction of soil through tillage management *"we already improve our environmental impact by reducing tractor use"*. Moreover, they pointed out that *"if glyphosate is forbidden, other products will be allowed on the market"*. This discussion emphasized the divergent long term objectives within the group: for some, conservation agriculture appears as a final objective whereas others (including organic farmer) would like to go further for instance by exploring alternatives to glyphosate.

4.1.2 Patur'en Pilat, an informal collective revitalizing pastoralist practices

History of the group

The collective Patur'en Pilat emerged following an initiative from the Park that sought to protect and promote permanent pastures in the NRP. In 2012, the Park organized an agricultural competition to reward farmers with the most biodiverse pastures of the territory, which was the opportunity to partner with several experts from pasture vegetation, including Scopela, a consulting and training company specialized in pastoralist activities. When the program came to end, the Park saw an opportunity to work further on these questions, and to develop a reflection with livestock farmers on how to manage their landscapes more ecologically by favoring natural vegetation as a source of feed for animals. The partnership with Scopela was the starting point of several training days open to any farmer, on the valorization of permanent prairies and natural vegetation in animal farming systems. Farmers were individually subsidized by public funds, taken in charge by the departmental ADDEAR[3]. The training courses were initially in two different sectors: the "High Pilat" where the technical days were tailored to cattle/sheep farmers and the "Low Pilat" to goat farmers. Progressively, the two sectors merged into a consistent but heterogeneous core group of about 20 participants with mixed productions *"there was a great enthusiasm within members of the group, we all wanted to learn more at the end of the day"*(P1). The common goal of the collective is perceived differently amongst its members: some refer to the technical objects discussed in the trainings *"to promote woody vegetation grazing"* (P3), *"to maintain landscape open through animal education"* (P2),"*to manage natural vegetation through grazing"* (AG1); while others refer to the collective's activities: *"working together, meeting with each other, exchanging on what we do"* (P1), *"searching for matter to reflect, to experiment"* (AG2). Similarly, the farmers' individual motivations to join the trainings were quite various amongst interviewees: some mentioned the achievement of technical objectives *"decrease time spent on a tractor"* (P2), and others brought up the learning of new competencies *"for me grazing is a challenging know-how"* (P3), "*it really opened my eyes on a new field of knowledge*" (P1). In April this year, the Park organized a collective day to reflect on the future of Patur'en Pilat. During a brainstorm exercise, the farmers present in the meeting had to summarize in one word what they define as the main objectives of the group. Interestingly, most responses referred to the social aspects of the project: "*sharing experiences, exchanges, group, territorial dynamic, history, recognition, good time, support, communication"* and fewer concerned the concrete objects of experimentations *"weather, gaining technical skills; woody vegetation, landscape recovery* ". This meeting was an opportunity for the group to discuss a potential formal structuring, since up to now they are still an informal collective.

[3]The ADDEAR is a national network represented in each French department, promoting peasant farming practices, notably by organizing public farm visits, facilitation farm's transmission, and animating collective networks.

An official juridical status could bring them more funding opportunities, for instance through the creation of a Territorial Pastoral Plan by the Park. However, this procedure doesn't reach a consensus amongst farmers "*creating a formal structure for a Pastoral Plan would be reductionist"*. While some farmers would like to see the collective grow and have a stronger integration in the territory, others would rather keep it small and informal, mostly to avoid administrative procedures. The animators of Patur'en Pilat have identified two main profiles of farmers attending the collective days *"those searching for a long term commitment, and constant improvement, always asking questions which make them come back and those coming to solve a specific problem and don't come back"* (AP1).

Activities

The training days animated by Scopela are usually organized twice a year, once in the Spring and once in the Fall. They take place in a different host farmers throughout the Pilat, who decide on the thematic to be covered during the day, relevant to their own situation; for instance adapting grazing practices to manage encroachment in a parcel, building a farm calendar adapted to vegetation's growth or increasing productivity of permanent pastures through grazing practices. Concretely, the first part of the day consists of the host farm visit and presentation of farmers' objectives, followed by a collective discussion animated by Scopela on how to reach these objectives. Throughout the day, the technician from Scopela (AP1) feeds the discussion with technical inputs (ecological diagnostic of natural vegetation, bio-indicating plant species in the parcels, ecological processes, animal behavior…). Scopela's animation consist of transmitting a methodological framework based on 5 successive steps: agro-ecological characterization of the fields, agro-ecological characterization of animal feeding strategies, defining objectives for the evolution of the fields, proposing concrete herd's management adaptations to reach these objectives and finally implementing these practices (see Figure 3).

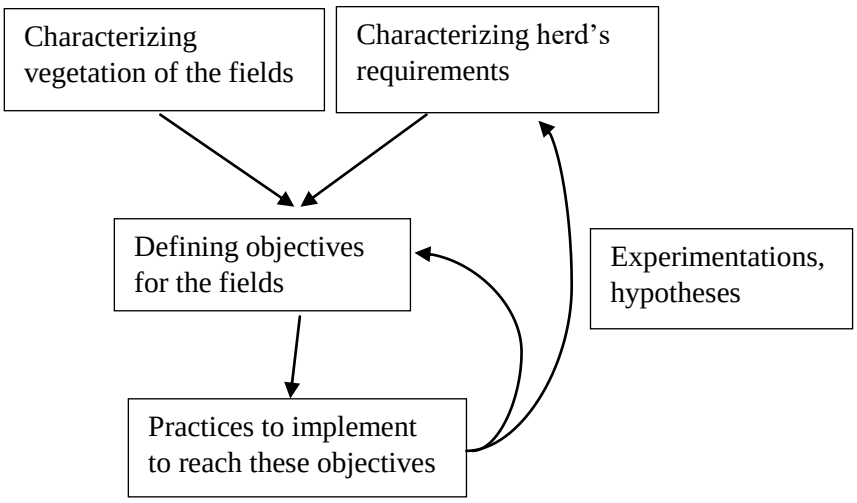

Figure 3. Scopela's methodological approach

At the end of the day, farmers and Scopela have elaborated different plans of actions to meet the host farmer's objectives. The theme and location of the next training day is also decided collectively. The discussions and topics explored during the day are summarized in a text format (often with pictures) and reported to the group by email. Since 2015, the Park has obtained to directly contract with Scopela, which has enabled more farmers to participate, and limited bureaucratic procedures. With this fund, Scopela also started to conduct individual farm diagnostics, with volunteer farmers. The result of these individual farm visits is shared with the farmers as a report summarizing Scopela's technical observations (vegetation dynamics in different plots, health of pastures using biological indicators, animal feeding costs, farmers' objectives…) and suggestions for possible strategies to meet farmers' objectives. These recommendations can trigger farmer's motivation to construct their own experimentations or to adopt new practices, which they often report in the next collective day. Although there is no formal follow up of these individual experimentations, Scopela chooses two or three specific farm cases of interest each year, to be analyzed through a scientific and/or economical lens. These in-depth case-studies propose quantitative analyses to compare for instance workload, costs or gain of grazing days between different practices. The results are published in a bi-annual review "Return from the Field", edited by the Patur'Ajuste network[4]. Some famers from Patur'en Pilat attend the yearly gathering of the network, each time occurring in different farms, which is the opportunity for them to exchange with other farmers at the national-level.

SWOT analysis

Since its creation, the group has benefited from a strong institutional support (notably from the Park and the ADDEAR, but also from an agricultural highshool in the High Pilat, and local municipal representatives). The participation in the national network Patur'ajuste facilitated by Scopela has been a determining opportunity for Patur'en Pilat, stimulating exchanges of practices and fueling farmer's motivation to experiment innovative practices. The current development of a Pastoral Plan by the Park can be an opportunity for them to gain recognition and influence in the territory through the creation of an official juridical status, which was often mentioned as a weakness for the group : some farmers have mentioned that the group is seen as closed, exclusive, alternative "*the collective aspect can appear confidential and dissuade other farmers to join*" (AP1).Yet, this informal setting has contributed to create a friendly and safe atmosphere *"I think the group is alive, friendly, I am always excited to see them before a training day"* (P1). Coming from different geographic sectors, farmers feature heterogeneous productions and environmental contexts (from low to high altitudes, flat to steep

[4] Patur'Ajuste is a collaborative network of farmers, agricultural and environmental advisors initiated by Scopela. Its objective is to provide, at the national level, a forum for the exchange, capitalization and dissemination of experiences on the valorization of natural vegetation in livestock production.

landscapes). However, the group is strengthened by a shared philosophy and vision of agriculture "*it's comforting to share the same ideas and objectives even if we are all from different sectors and don't see each other every day*" (P2). The uncertain future of Patur'en Pilat, linked to its unofficial status and dependency on public funding can be as an external threat. Because of the lack of internal organization or delegation of tasks, the group's dynamic is highly dependent on its animators *"I doubt that we will be totally independent one day, we need someone to shake us and help us organize"* (P1). Finally, farmers' lack of commitment in the organization of the group prevents its external recognition and visibility of the collective in the territory. An overall summary of the SWOT analysis conducted is presented in Appendix G.

4.2. Group experimentations

4.2.1. Experimenting in the GIEE: formal protocols aiming at validating scientific hypotheses

Object and implementation

Experimentations in the GIEE relate to the introduction of new crop management (mixtures of summer cover crops adapted to local soil and climate conditions), new cropping systems (conservation tillage, direct seeding, crop rotation strategies) and equipment type (optimal seed implementation with different tractor's implements). These experimentations are based on agronomical protocols developed by Maison Cholat and evaluated through multiple indicators, such as workload, farm's autonomy, fossil fuel usage (see example of experimentations in Appendix H). Improving soil quality and economical performances were the main motivation for farmers undertaking experimentations *"it was mostly a question of saving time, because most of us are in direct transformation - and also gaining in soil quality (improve soil life)"*(G1). The technician from Maison Cholat elaborates formal experimental designs for voluntary farmers of the group during individual farm visits which are then presented to the whole group. Some farmers were more reluctant to conduct on-farm experiments *"we let the others try things and then we will see what happens for us"* (G2). It appears that there is a contrasted willingness to take risks amongst the group: *"trials are interesting but we cannot afford mistakes in our system"* (G2); *"I am not afraid to fail, it is part of the deal"* (G3); *"they have too much personal pride, they are afraid of failure"* (G3). The farmers who experiment on their own are inspired by external networks (French network for Conservation Agriculture), Youtube videos and exchanges with other farmers (farm visits, agricultural chamber trainings, agricultural fairs) *"I discovered the specific machinery in an agricultural fair and I was really curious to learn more about it"* (G3); "*I started renting equipment in 2017, I have heard about direct seeding from a neighbor"* (G2).The experimental design proposed in the GIEE follow a scientific pattern: several practices are tested and

compared one to another or to a control plot. Farmers manage crops during experiment and record cropping practices in an observation grid provided by the technician.

Indicators of performance

The observation grid provided by the technician to the farmers enable them to monitor precisely the cropping systems under experimentation (date of seed implementation, seeding rate, method of implementation, herbicide treatment, other product application such as fertilizers, harvest/destruction date of the cover crop). At the end of the experimentation, several scientific measurements are planned to be conducted in the trial plots (foliar analyses, soil testing). The result from farmers' observation grids will be analyzed by Maison Cholat and compared altogether using different indicators (yield of cover crop, workload, use of fossil fuel, amount of external feed purchase if animal production). These results will be used as a baseline for future years' experiments, and shared in the GIEE network by the Park. Up to now, farmers individual indicators of performance rely on economic profitability "*If I can get a bit extra feeding for the animals from a cover crop it is positive, as long as it doesn't cost me too much"* (G2); "*They want to find appropriate technical solutions without impacting economical performances"* (AP2).

Changes induced on individual farming systems

For the GIEE farmers, being in a collective has allowed exchange of ideas, knowledge, practices which brought them new perspectives on their work *"it is by discussing with others that you improve, that you open to new things"* (G1); *"having an external perspective is always beneficial, whether from the collective or the facilitators"* (G2). The GIEE's funding and purchase of equipment had concretely impacted farmers' working conditions "*we have access to modern technology which enables us to gain comfort, we are not as tired at the end of the day"* (G3). Their official status was also a tool to partner with more public institutions, for instance with the municipality to receive green waste, used as compost or bedding for animals "*with the GIEE label we have more recognition with public institutions"* (G3*); "people contact you more easily, we have access to a better network"* (G3). However Farmer G2 is less involved in the activities of the group and has not yet implemented any changes, and seems satisfied by his system *"I already have a lot of grass in my rotations compared to other members of GIEE"* (G2). Yet, he recognizes being influenced by the group's activities "*I wouldn't say I have changed but maybe evolved, work differently"* (G2) and wishes *"to have more meetings"* (G2). On the other hand, the other farmers interviewed emphasize that the group have catalyzed their motivation to conduct more experiments "*working with a group makes you move faster"* (G1). An individual analysis of the evolutionary pathway of Farmer G1 is presented in Figure 4. Livestock Farmer G1 took over the dairy family farm with his two brothers, but decided to abandon the milk production due to price's instability. He replaced his herd by suckler cows and started a pig production on a rather intensive rearing model (on-farm production of corn silage, hay and cereals,

external purchase of protein). Soon after, he decided with his brothers to develop direct-marketing, and invested to build an on-farm transformation workshop and farm shop. The farm today runs with several employees and sells all its production through local distribution channels (farm shop, markets, and local cooperatives). In 2014, following a major rain event which severely damaged its fields, he started to reflect on alternative cropping practices to limit erosion on its land. After attending a training from the agricultural chamber, he rented equipment to experiment direct-seeding a pea/barley summer cover crop between two cereal crops. As the cover crop didn't yield very much, he sought to wrap it in bales and use it as silage for pigs, but for his brother *"a cover crop like this, you don't make any bale with it.* Farmer G1 abandoned that experiment this year, but progressively has introduced more and more changes in the farm's cropping system *"now I've been direct-seeding my cereals for 3 years, it is just growing nice cover crop that remain an issue"* (G1). For him, professional norms in the agricultural world create many prejudices against conservation agriculture *"we have a lot of wrong benchmarks here"* (G1), but he has always been open to change *"I try not to have blinders on"* (G1). Finally, the collective has allowed Farmer G1 to legitimize his personal trials with his brother, and to develop technical skills *"I had to set all my knowledge aside and start everything from scratch"* (G1). Nonetheless, this enthusiasm to work with the collective has not necessarily changed his long term professional objectives, which remain quite elusive *"who knows where I'll be in 10 years, I don't have big plans, just adapting the system"* (G1). His individual trajectory seems driven by external events, imperatives coming from consumers' expectations and the effects of climate change *"those changes, either we make them ourselves or we will be forced to make them"* (G1).

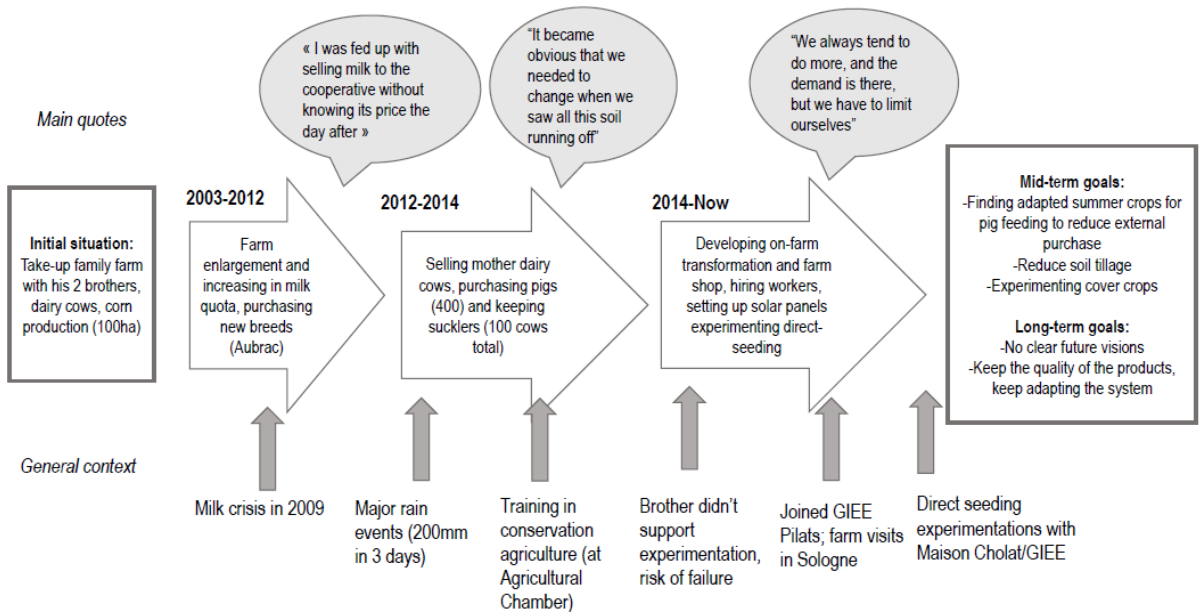

Figure 4. Individual evolution diagram of farmer G1 (adapted from Coquil et al 2013).

4.2.2. Experimenting in Patur'en Pilat: a sum of individual experiences validated by the collective

Object and implementation

The experiments developed in Patur'en Pilat aim at valorizing natural vegetation (permanent prairies, semi-open forests and rangelands) in livestock production systems (meat and dairy), by using natural resources as the prior source of feed for animals *"I think a cow can eat everything from Natural and I work on this"* (P1). For the technician from Scopela, this shift requires *"an adjustment of practices to reach equilibrium between farmer, animals and vegetation*" (AP1). The benefit of favoring grazing practices is the reduction of external inputs (feed purchase, mineral fertilization, fossil fuel) and gain in free time (less tractor work). The concrete strategies experimented in the group encompass multiple elements, which are usually combined by farmers. These include adaptations in grazing practices (intensity, frequency of rotations), herd education (introducing woody species in animal's diet, multi-species grazing), grass management (rehabilitating old pastures, introducing permanent prairies, transforming the peak of production time), or in whole farming system design (adapting births calendar/milking frequency to vegetation's growth). A specific practice often experienced by farmers is stockpile grazing: instead of cutting grass and storing it as hay, forage is left in the pasture and allowed to accumulate, providing late grazing resources. Another example of experimentation is presented in Appendix I concerning the different rehabilitation strategies of a former forested parcel by livestock farmers. Most of the inspiration for these types of experiments is Scopela's input; either through collective days or individual farm visits *"for me, the driver of Patur'en Pilat is the technical trainings provided by Scopela"* (P2). However, exchanges within the group (especially during farm visits) and traditional practices are also sources of stimulation for farmers' experimentations *"We learn to make our animals eat, we recover the practices of our grandparents"* (P1); *"We exchange with other farmers on what plants could be seeded, finding new varieties" (P3).* None of the experiments are formally designed by Scopela, nor systematically followed up by an external structure. Most of the experimental choices are adapted during the course of the experiment, depending on the system's functioning. Farmers' qualitative observations are shared in the collective days through pictures, or stories *"we always come with personal observations to feed the discussion"* (P1). These singular observations vary from very technical-oriented remarks *"goats don't like rain - when it rains I have to move them inside otherwise they will not eat and won't produce any milk for the day"*(P3) to general statements *«last summer I was able to take 3 weeks of vacation by letting the cows in the forested parcel"* (P1).

Indicators of performance

Scopela prescribes the qualification of a "bad" or "failed" experiment and extract positive learning from each of the farmers' return of experience. As such, an indicator of a positive result can be a qualitative observation *"the bramble was not as invasive this year"* (P2), "*there is less parasitism with*

the animals" (P3) or quantitative "*I have really spent less time on the tractor*" (P2). The increase in number of grazing days is generally used by farmers to present positive experiences *"for me, the latter I put the cows back in, the better I feel*" (P1); *"stockpiling grass allowed me to gain 10 days of grazing last year"* (P2). Economical performances, such as improving farm autonomy (amount of external feed purchased), increasing added value of the production, reducing farm's functioning costs and workload are also put forward in Scopela's analyses. Lastly, plants' species are fundamental indicators of performance used by Scopela to evaluate the effect of different grazing practices on pasture quality. Indeed, the length of grazing/rest periods, the dates of grass cut, and amount of fertilization influence the species composition of a pasture "*dandelions and rumex species are indicators of over-grazed, compacted pastures while the development of broom and blackthorn is a sign of under-grazing*" (AP1). Scopela's recommendations for farmers are always based on the characterization of a parcel's vegetation during field visits *"here the Calluna vulgaris is an interesting fodder resource for sheeps but should be grazed in the Fall because it is a slow growing specie which maintains its leaves and quality at maturity*" (AP1 during a field visit). In the approach developed by Scopela, plants are therefore qualitative indicators of the parcel's respond to grazing practices, rather than fixed indicators of performance. In that way, Technician AP1 emphasizes that there is not a "good" or "bad" composition of pastures; each situation leads to different best-fitted practices depending on farmers' objectives.

Changes induced on individual farming practices

In Patur'en Pilat, the experimentations have led to concrete results in individual farming systems *"the improvement of grazing management has significantly made us gain time"*(P2). The farmers who are the most involved in the group are constantly adapting their practices, and looking for long term progression while those coming punctually are rather looking for single technical advises. For most of them, the collective is an entry point to a new approach, which brings them different perspective on their work instead of a set of recommendations "*Scopela really opened my eyes on a new field of knowledge"* (P1). Sharing experience and knowledge is often mentioned by Patur'en Pilat farmers as a strength of the collective, motivating their will to experiment. Some of them refer to the social pressure of their relatives or colleagues as a common barrier hindering change "*at the beginning all my neighbors thought I was crazy"* (P1); "*my associates where very skeptical on what I was doing*" (P3). Therefore, the collective has played an important role for farmers to comfort their own initiatives "*it legitimized what I was doing on my own"* (P2). Farmer P2's individual trajectory of change presented in Figure 5 shows how Patur'en Pilat has driven him to continuously evolve his grazing management. Initially from the non-farming environment (trained as a carpenter and forester), Farmer P2 has always been interested to become a farmer. In 2005, he decided to quit his job as a free-lance construction worker to follow a professional course in butchery and snail production "*I was working crazy hours as*

a carpenter" (P2). At the end of the training, he was offered to integrate as an associate member the farm where he was working as an intern. That farm, although certified organic and diversified (snail, beef, bees, pigs) was driven by economic performances and a logic of investment, which didn't correspond to farmer P2's vision of work *"the objectives of the farm were incompatible with my family life"* (P2). The situation deteriorated until a divorce with his wife made him leave the farm. Rapidly, he had the opportunity to join a neighbor farm, also as an associate. At that time, the farm had a small organic production of chicken and beef, certified organic, with a quality-oriented logic of development "*the idea was to bring new competencies at the farm rather than new productions"* (P2). By bringing an expertise in butchery at the farm, they hoped to increase the added-value of the beef production, by selling on-farm transformed meat. Last year, a beekeeper integrated the farm, and this year another associate came in to develop pedagogic activities. Farmer's P2 long term objectives are to simplify manual work at the maximum, to limit the mechanization of the pastures (which are very steep and dangerous to work with the tractor) and to keep similar level of performance without high investments. Since his association in the new farm in 2015, Farmer P2 has joined Patur'en Pilat, seeking for strategies to reduce time spent on tractor to maintain the pastures "*it is a loss of time that you need to repeat each year, while we have animals working for free!"* (P2). His objective is to improve the farm's autonomy in animal feeding, especially to reduce external purchase of hay. This year, Farmer P2 asked Scopela to conduct an economic comparison of various feeding strategies (making hay from temporary pastures versus dedicating those to grazing). Scopela concluded that the size of the farm would be too small to ensure a complete pasture-based feeding for beef, which opened some new ideas for Farmer P2 "*I could think of mixing herds with my neighbor, who has sheeps and much more land than us"* (P2), and potential new experiments *"there is this parcel of Brachypodium which has low spring productivity I could set aside for late summer grazing"* (P2).

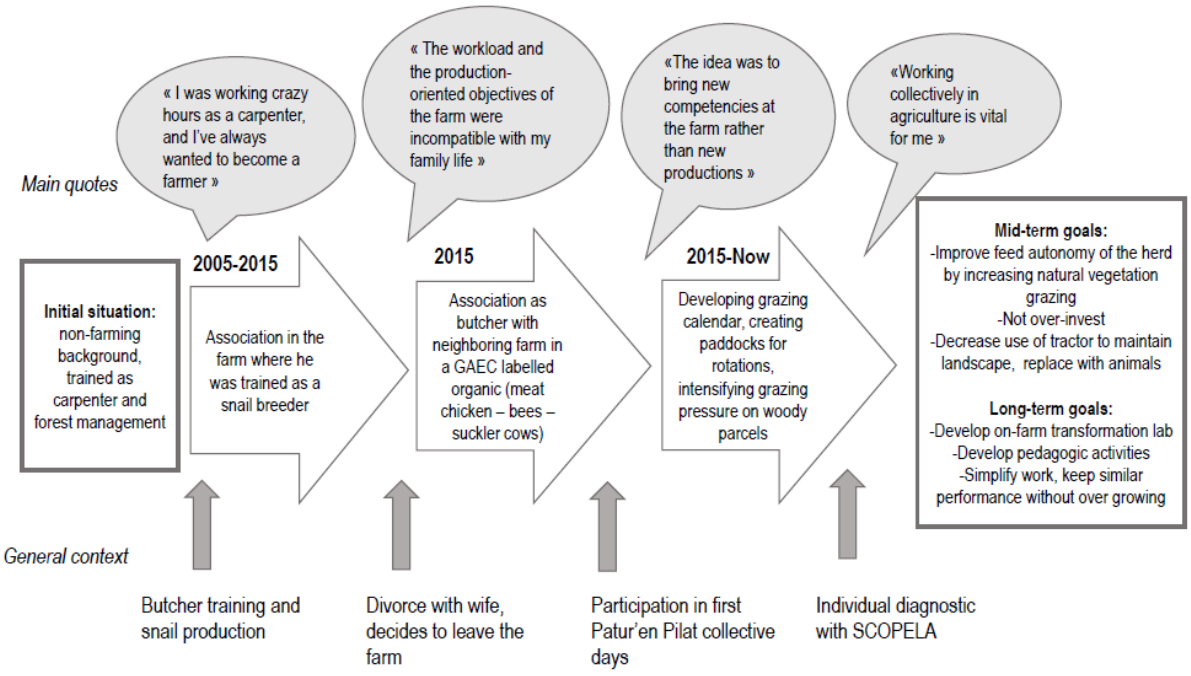

Figure 5. Individual evolution diagram of farmer P1 (adapted from Coquil et al 2013).

Patur'en Pilat has had a significant impact on Farmer P2's trajectory of change; however it is not the case for all farmers interviewed. For instance, Farmer P3 attended some trainings and benefited from an individual follow up with Scopela, but hasn't developed much technical changes due to lack of time "*since our associate left, I don't have enough time to attend the meetings"* (P3); and different personal objectives "*their experiments arenot adapted to animals with high feed requirement such as milking herds"* (P3). Farmer P3 mentioned to have recently constructed a new barn-drying unit, which allowed for the making of high quality fodder, adapted to his milking goats. Today, the farmer prioritizes maintaining high production levels to reimburse this investment, and has little time to dedicate to experiments "*it is much easier to have them inside, in the summer it takes up a lot of time to make the paddocks and to move them twice a day to the milking area*" (P3). To summarize, members from Patur'en Pilat feature different levels of individual changes attributed to the collective's project, which could be explained by different personal objectives (quality or quantity, production goals or ethical goals).

4.3 Group facilitation and internal knowledge circulation

4.3.1 Learning processes in the GIEE: science as authority, driven by external experts

Role of animators

The main animator of the GIEE is the Park technician (AG1). Its activities consist of following up administrative processes, contacting partners, facilitating exchanges within the group to define common objectives and conducting individual multi-criterion farm assessment of all group members *"at the administrative level, the Park really helped us"* (G1). Although the Park has been a strong motor of the group's project since its creation, the animator feels there is a lack of recognition of his work from the group "*they don't realize how much work I put in"* (AG1). Indeed, the Park would like to support the group beyond administrative and financial tasks, but is constrained by the bureaucratic image of the Park's institution. His objective would be to intervene more on technical questions, and objects of experimentations "*to enlarge the focus of the group on other subjects than purchase of material*" (AG1). Technician AG2 from Maison Cholat is the second main animator of the group. Coming from the agricultural world, he was trained as an agricultural adviser specialized in farm mechanics, and has been working as a commercial at Maison Cholat for 6 years. Maison Cholat, a private and family-owned enterprise, specialized in the cereal industry (commercialization of farm equipment, flour transformation, supplying agri-food sector). They have recently developed a new branch of counseling tailored to collective projects, to support agroecological practices *"Tomorrow we won't sell as much phytosanitary products, we need to diversify today and change our economic*

model" (AG2). Technician AG2 started in 2019 a 2-years contract between the GIEE and Maison Cholat to provide them technical assistance in setting up individual experimentations and analyzing results. His expertise is very appreciated by the farmers as it comforted their experimental process and allowed them to benefit from scientific analyses "*we don't have enough experience on which way to set up experiments, that is how AG1 can help us"* (G1). The technician's activity is perceived very positively by the farmers "*we are lucky to have found AG2 to assist us, even if comes from private sector, he is a strong motor to help us move forward*" (G3).

Knowledge production and circulation

The role of animators is central for knowledge production and circulation within the GIEE, as illustrated in Figure 6. The technician and animators intervene in the whole experimental process (design, monitoring, and capitalization). Moreover, the main learning sources for farmers are scientific inputs from external agents, namely the technician from Maison Cholat, external experts and the animator from the Park. They facilitate a transfer of specific knowledge to the group through their respective activities, which allow farmer to deepen their knowledge on specific topics (soil functioning, cover crop species, technical vocabulary related to direct seeding). For the farmers, the advisor's input is an essential source of information *"I learn more during a course than a collective day where we visit our fields; they are tailored to answer our questions and help us move forward with concrete information"* (G3). The animators also facilitate a transfer of generic knowledge outside the group (mostly in the GIEE network), by building technical references from the result of experimentations. Technician AG2 is responsible for gathering and analyzing result of farmers' experiments. The Park's animator AG1 conducts a general monitoring of all farmers from the group during a 5-year period, which will be reported in the GIEE network. Peer exchanges occur during collective days (training courses, informal meetings or collective meetings with Maison Cholat) and are the opportunity for farmers to exchange on their experimentations. At the end of the trials this year, a collective visit of the experimental parcels will be led by Maison Cholat which will allow farmers to share their own experiences. These personal returns of experience are specific to each farmer and provide them actionable knowledge, linked to subjective observation and local situation. Overall, as illustrated in Figure 5, the learning processes within the GIEE are rather linear and driven by scientific input from external agents.

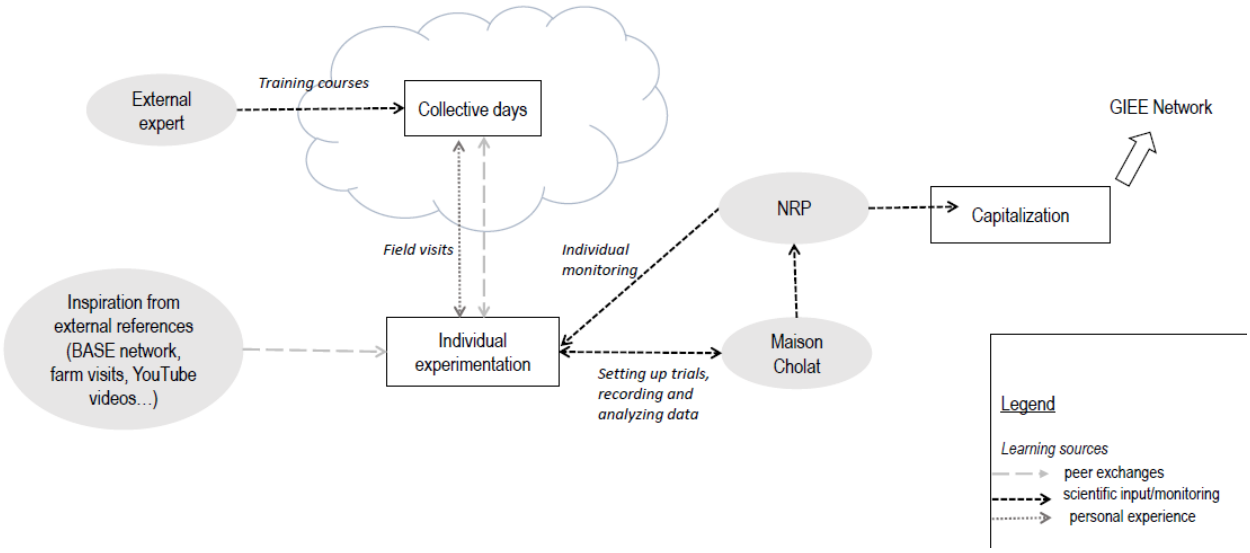

Figure 6. Activities, key actors and learning sources in the GIEE

4.3.2 Learning processes in Patur'en Pilat: a back and forth between generic and empirical knowledge

Role of animators

Technician AP1 has a central role in the facilitation of the group. His expertise in grazing management and animal nutrition derives from his 10-year career as a researcher in the National Agronomic Research Institute (INRA). He founded Scopela in 2011 together with three associates. The pedagogical approach of Scopela proposes a framework for farmers to analyze their personal situation and to link their practices with the biological functioning of their agroecosystem. During training days, Technician AP1 invites farmers to create their own links between some particular management decisions and field observations, without providing them systemic answers "*my usual answer to farmer's question is: it depends on your objectives"; "AP1 answers our questions by more questions"* (P2). By alimenting farmers' discussions, Technician AP1 tries to be vector of information rather than a source *"my facilitation strategy is to catalyze exchanges, to make farmers interested in others"*(AP1). His concrete inputs consist of introducing to farmers what he calls "the fundamentals", referring to knowledge on the biological processes governing animal's behavior and natural vegetation dynamics (for instance the main types of grass found in pastures and their different growing properties). Farmers' common beliefs and observations are used to introduce these "fundamentals". His pedagogical approach consists of transforming empirical experiences described by farmers (e.g "*my cows don't like bramble*") into generic statements (e.g*"cows prefer what bring them a positive nutritive reward"; "the heart of my work is to resituate what farmers say; to make them see the*

genericity in their singular observations" (AP1). Another important animator of the group is Animator AP2 from the departmental ADDEAR. Animator AP2 is the general group facilitator; he animates discussions during meetings, support the group's internal organization, writes reports from collective days *"I don't define myself as an instructor but rather as a facilitator, acting for the group's dynamic, more like a change-incubator, a particle shaker";"I like to be at the interface of discussions - to facilitate them and then be more like an observer"*(AP2). Lastly, the Park is another important supporting actor for Patur'en Pilat. The Park has been hosting and organizing several activities, contributing to the visibility of the project in the territory (publishing journal articles, communication in the media) and is today leading administrative procedures with the group to support their formal structuring process "*the Park has a will to catalyze change, they have good knowledge on local partnerships and administrative procedures"* (AP2). This support from multiple actors has been a valuable asset to develop the collective; but the durability of such functioning is questioned by Animator AP2 *"it is a bit a rich project; we have way too much animation means compared to the farmers we reach"* (AP2).

Knowledge production and circulation

Scopela is the strong motor of knowledge production in Patur'en Pilat, as a provider of technical references during training days and individual farm visits *"for me, the driver of the collective is the technical trainings provided by Scopela"* (P2). The participatory and informal nature of the collective days allow for continuous interactions between farmers and animators "*everyone keeps coming back because they are all more interested by the group than the subject itself"* (AP2). The pedagogic approach of Technician AP1, far from delivering ready-made recipes, promotes collective learning, which probably corresponds to farmer's search for autonomy in their decision making "*they are fed up to be told what to do*" (AP1). By favoring farmer's know-hows prior to generic models, Technician AP1 stimulates individual learning processes "*it is by doing that I improve my practices*" (P3). As illustrated in Figure 6, the learning processes in Patur'en Pilat are dominated by peer exchanges during collective days "*we know the technical side: concretely we don't really get technical training anymore but we rather learn from other's experiences, sharing results…"* (P1). These collective interactions shape a three-stage cyclical learning cycle, starting by collective days where farmers confront their objectives and individual experiences, which are converted by Scopela into generic discourses "*what we gather from the field and collective days is an hybrid knowledge between scientific and empiric, which we call generic*" (AP1). These generic concepts are then potentially implemented by farmers through concrete experimentations on their own farms. Farmers sharing their experiences and confronting them with the group is the final stage of the learning cycle, looping back in the collective days *"we share with new members our experience, we always come with personal observations to feed the discussion"* (P1). In parallel to this informal peer circulation of information, scientific knowledge is

provided by Technician AP1 during the training days, through the reference to fundamental biological processes encountered in the host farm *"we learn to "read" the vegetation, what the pasture's composition tells you on the productivity, quality, and timing of grass' growth*" (P2). Scopela also facilitates the emergence of farmer's objectives (regarding their farming system, personal lifestyle, ecological landscape, economical performances) which often happens to be challenging *"At the beginning is that they didn't know they had objectives"* (AP1). Overall, the learning processes leading to knowledge production and circulation in Scopela are intertwined and circular.

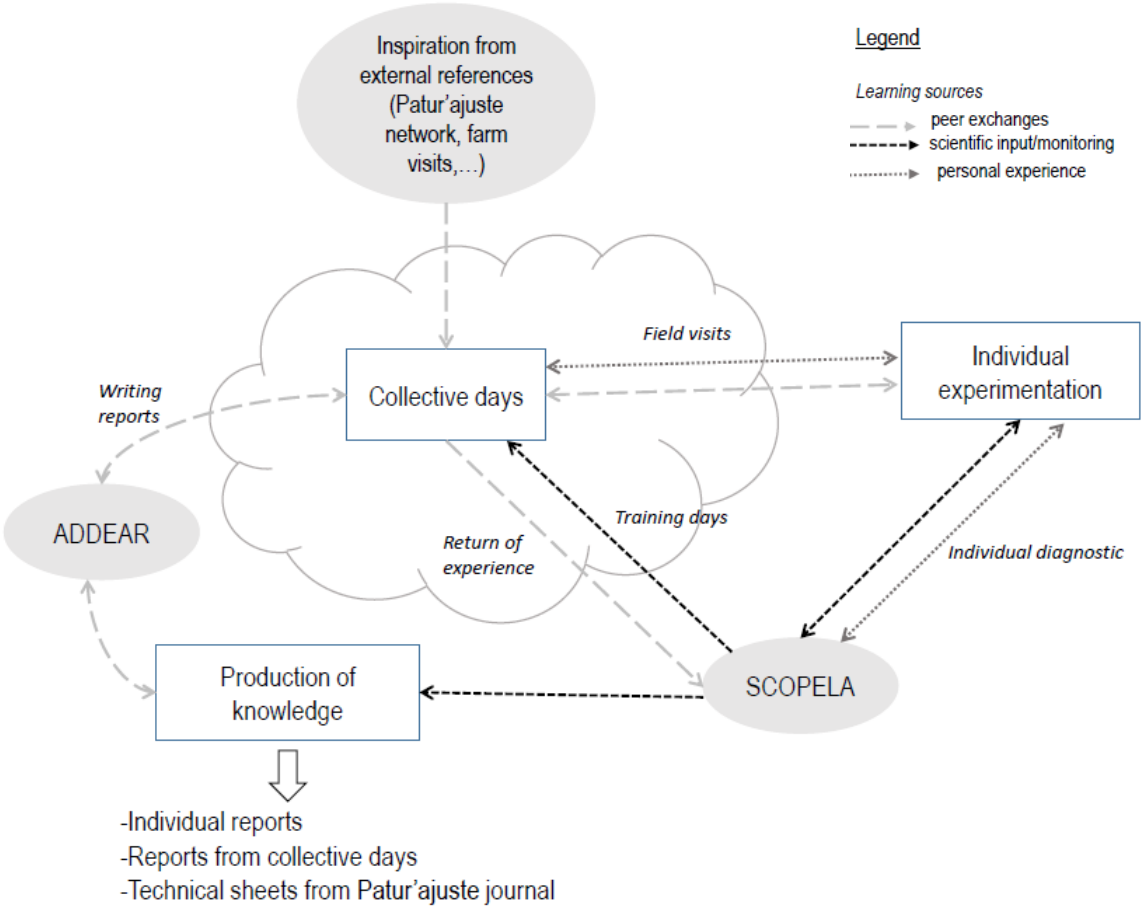

Figure 6. Activities, key actors and learning sources in Patur'en Pilat

4.4 Assessing the AET process in farmer collectives

4.4.1 An agroecology that is not a federative concept

If the farmers interviewed expressed in various ways their impression to achieve environmental performance by developing new practices, they rarely mention the concept of agroecology. For the P.I.L.A.T.S GIEE members who explicitly have referred to the term in their group's name, agroecology is described as a set of environmentally-friendly practices, valorizing biodiversity "*for me agroecology is to manage to grow nice crops with happy birds around*" (G1); "*manage to diversify your system to bring more biodiversity*" (G3). Indeed, the larger network they get their inspiration

from (BASE[5] network) has begun to claim that agroecology can be applied to conservation agriculture. As a result, farmers surveyed perceive the notion of agroecology as a public acknowledgment of their practices, deriving from external standards "*it is an adaptation to climate change, to consumer's expectations and environmental constraints"* (G2). For these reasons, if agroecology is claimed in the GIEE, it seems that the concept has not been equally and equivalently internalized by its members. According to animator AG2, the experimentations of the group (tillage reduction, cover cropping) can be considered as entry point towards their agroecological transition "*they are concerned by biodiversity, soil fertility, and their environmental impact*" (AG2). However, the second animator emphasizes that the group still lacks a "*system's approach"* (AG1) and would like to move the focus of the group towards deeper reconsideration of the farming systems. Contrastingly, in Patur'en Pilat, agroecology is never directly mentioned, as stated by one of the farmers "*we don't really talk about AE but we practice it"* (P2). In their own terms, agroecology is defined as a holistic and systemic approach, integrating both social and ecological dimensions *"for me it is working for ethics and conviction*" (P1); *"letting Nature work for us*" (P3). For animator AP1, the way the group function illustrates their agroecological approach "*they have acquired experience in the biological functioning of their system*" (AP1). In addition, a study conducted on the interplays of knowledge within farmers networks included Patur'en Pilat highlighted that "*If the group [Patur'en Pilat] doesn't claim to be agroecological, they are confronted to similar questions that are raised in agroecology by putting biodiversity at the core of their actions"* (Girard and Magda 2018). However, one farmer of the group claimed to avoid the notion of agroecology in his discourse, for the reasons that the term has no legitimacy in the traditional agricultural sector and derives from political spheres "*agroecology is not used in the peasant world, it is a term inherited from above, a tool to get public subventions"* (P3). Overall, the interviews have revealed that farmers surveyed have low or partial knowledge on the concept of agroecology, which is therefore not a federative concept within the two groups.

4.4.2 The objects of technical changes induced by the collective on farming systems

During the interviews, farmers were asked to rate from 1 (low) to 5 (high) the impact of the group on their own farming system, for several criterions: improving autonomy, reducing operational expenses, work satisfaction, increase in production, increase in biodiversity, and adaptation to climate change. The average of these grades for each group is presented in Figure 7. The figure highlights that the collective has indeed generated a range of questionings and changes in individual farming systems, both environmental (increase in biodiversity), social (work satisfaction), and economical (improving autonomy, reduction in operational expenses). These changes were evaluated at different levels between the two groups, as shown in the diagram, but overall, it appears that both groups facilitate a

[5] Biodiversity, Agriculture, Soil and Environment network, association of professionals developing conservation agriculture practices, located in France and UK

multidimensional evolution of farming systems. This provides evidence that an underlying agroecological process is occurring within the two groups, involving various dimensions of innovations.

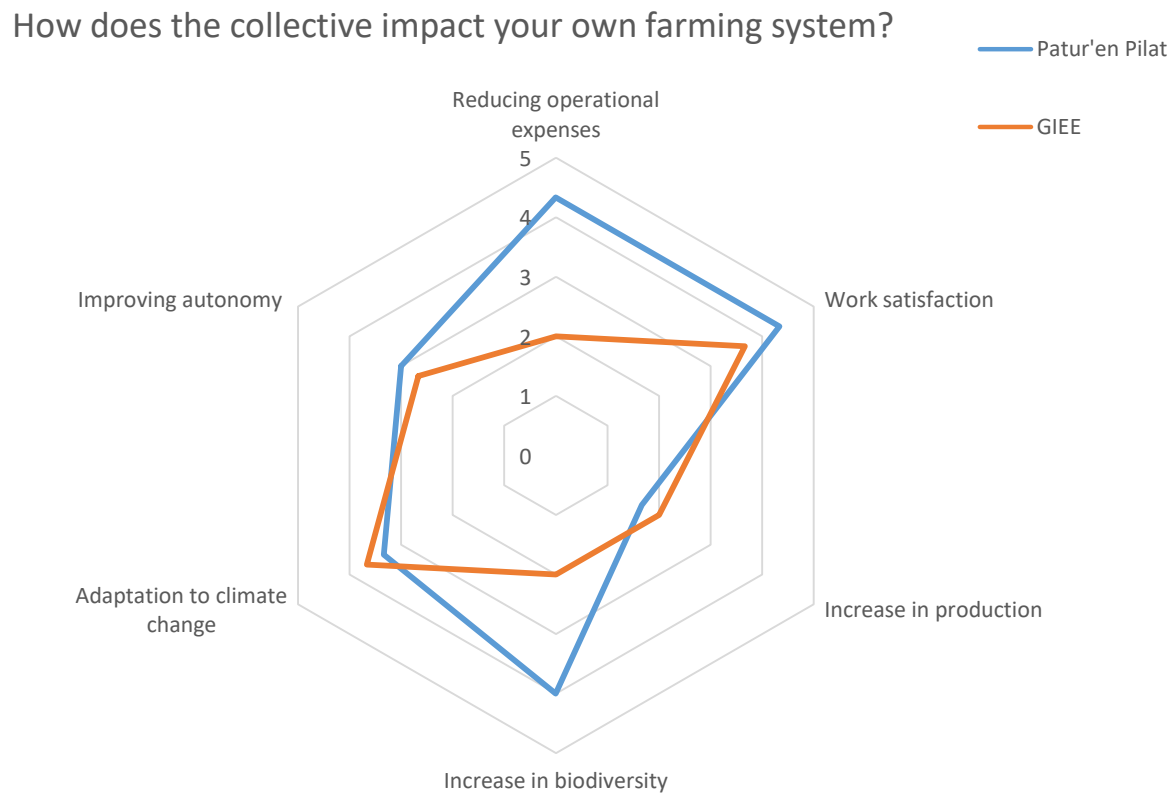

Figure 7. Evalution of change induced by the collective on individual farming systems estimated by farmers

4.4.3 Agroecological transition as a multi-level process in the collectives

The conceptual framework developed to evaluate the agroecological development of the two collectives is presented in Figure 8. The final scores of the two groups are plotted on a graph according to the variables assesses (Technological and Institutional innovations), which position them on a gradient from ‘weak’ to ‘strong’ form of AET. On Variable 1 (Institutional innovation), the GIEE scored 1 while Patur’en Pilat scored 4. On Variable 2 (Technological innovation), the GIEE scored 2 while Patur’en Pilat scored 7. According to the indicators used, the group Patur’en Pilat features a more advanced stage of transition towards a strong form of agroecology than the GIEE.

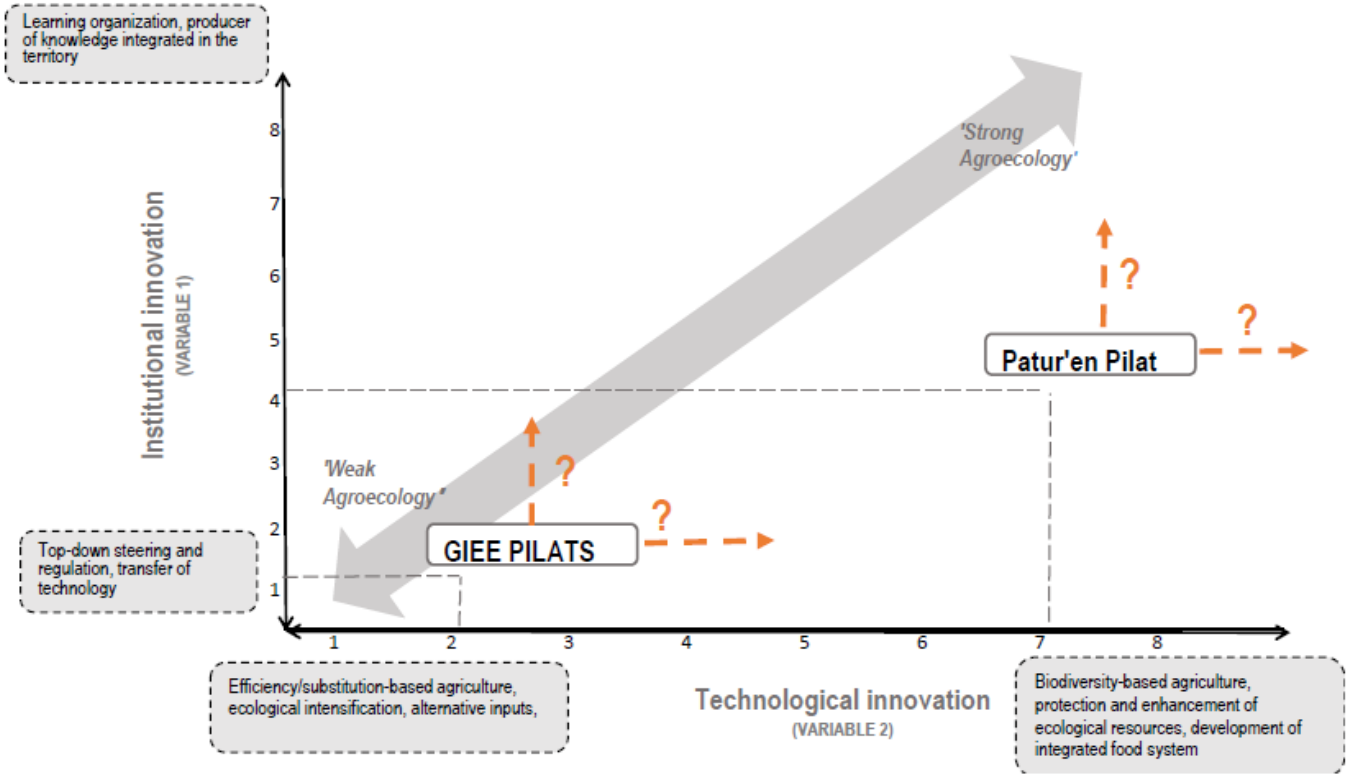

Figure 8. Assessment of the level of AET in the two farmer collectives

5. Discussion

5.1 Agroecology within farmer collectives, a silent but concrete process at work

The study revealed that agroecology is not used in the first place by farmers in the collectives investigated, which can be interpreted as a reluctance to use this term seen as attached to an ecological movement or a political sphere. Farmers involvement in collective initiatives seems rather motivated by a search for autonomy (technical and economical), and solutions to agronomical issues (declining fertility, soil erosion, dependency on certain inputs) which could be defined as a “silent” agroecology,

a concept pinpointed by Lucas (2018). This form of unvoiced agroecology is characterized by the long-term change processes triggered by the collectives on farmer's systems that sometimes lead to the questioning of their entire functioning (Pignal et al 2019). Confronting the in-depth analysis of the two groups with key principles of agroecology cited in the literature allowed to define more precisely this form of silent agroecology according to three dimensions:

(1) The first dimension is technical. Farmers from both collectives are concerned about their environmental footprint and seek to ameliorate their ecological performance, whether by applying sound agricultural practices (such as conservation agriculture in the GIEE) or mobilizing natural processes (such as multi-specie grazing systems in Patur'en Pilat). In their discourses, farmers often refer to biodiversity as an indicator of performance (increasing earthworm population, seeing birds, flowers…). They also seek to minimize inputs (reduce use of fertilizers and pesticides, greenhouse gas emissions) in order to reach a certain independence from the larger agri-food system. Through their experimentations, they are trying to recreate metabolic interactions within agro-ecosystems, for instance by developing animal grazing to manage invasive plants in Patur'en Pilat, or by introducing nitrogen-fixing cover crops in rotations to replace chemical fertilizers in the GIEE. Both groups are searching for "autonomous" modes of production, notably through agricultural diversification and the extension to other activities (on-farm transformation, local distribution…).

(2) The second dimension is social. Researchers in the field of agroecology have emphasized that transition towards sustainable agriculture challenges both technical and socioeconomical dimensions, as grasped by Coquil et al (2017) *'agroecology requires moving away from the dominant professional norms of intensive agriculture'* (Compagnone et al 2018, Duru et al 2016). In France, conventional farmers are locked in the services of advisory organizations and agricultural extensionists which define a set of professional norms. These norms encompass both the rules of actions (for instance "a cover crop cannot be baled") and the subjective conceptions that explain and justify these actions (for instance "cows don't like woody vegetation") (Darré 1999). Professional norms are at the same time constraining, for those seeking to explore alternative systems, but they are also resources for knowing what to do in local contexts. In rural landscapes, the norms of conventional systems deriving from modern agricultural standards and transmitted from generation to generation are hindering farmers' individual evolution (Coquil et al 2017). Farmers from the GIEE and Patur'en Pilat groups have often mentioned that before joining the collective, they were seen as outsiders and sometimes crazy from their neighbors or families. What they have in common is the desire to introduce an alternative to their local norm systems and to create a shared understanding of this new variant. This is why farmers all mentioned that the collective gives them a safe and friendly space to share similar ideas, values, and a new framework of references. In that way, the group strengthens them to experiment alternatives, and

to reconsider the functioning of their systems. By supporting the creation of alternative norm systems generated by farmers themselves, the collective therefore introduces new realm of possibilities, which are key drivers of agroecological transition (Coquil et al 2017).

(3) The third dimension can be qualified as epistemological as it deals with how knowledge is produced and circulated within farmers groups. Indeed, the evolution towards agroecological systems questions how knowledge is distributed across different spaces and among social actors (Compagnone et al 2018). In the literature, enhancing the diversity and exchange of knowledge between local actors is a fundamental principle of agroecology (Duru et al 2016, Gliessman 2009). Bottom-up initiatives and horizontal exchanges from farmer to farmer are central features of agroecological initiatives (Brives et al 2015). In the two groups studied, farmers are searching for a certain decision-making autonomy and political independence in the sense that they question the traditional knowledge transfer from agricultural research and development apparatus. Developing their own cooperation networks therefore offers them a new space to share specific know-hows and to produce contextualized knowledge applicable in their situations. This "actionable" or "situated" knowledge produced through the collective experimental processes can be described as context-based, intuitive, and sometimes even tacit because it is formalized and transferred by external actors. By building social relationships and promoting shared learning processes, farmer groups therefore contribute to the diversity and exchange of knowledge by local actors, which can be assessed as a key element of agroecology.

Through their experimentations and exchanges, Patur'en Pilat and the GIEE are involved in a long and adaptive process of change, in a risky and uncertain context. They are sharing a mutual commitment towards a common goal, and are engaging multiple learning loops between individual experimentations and consultations with external experts. For these reasons, they can be qualified as "learning organizations", a term coined by Argyris and Schön (1996) and used by Brives (2019) to define farmer collectives engaged in an agroecological transition according to the following principles: solving problems, experimenting, capitalizing learning, learning from each others, and transferring knowledge. These organizations place the quest of knowledge production at the heart of their internal functioning by relying on exchanges of practices and empirical experiences between their members (Brives 2019). Indeed, the two collective studied feature a diversity of learning mechanisms characterized by multiple sources (personal experiences, peer's inputs, scientific inputs, feedbacks from external partners…) and steps (sources of inspiration, implementing new practices, developing standards of comparisons…). The heterogeneity observed between farmers within the group (i.e production systems, geographical locations…) and their belonging to different territorial networks (cooperatives, agricultural syndicates, local political bodies…) are important social resources for the

group, following the principles of learning organizations (Pignal et al 2019). The results of this study suggest that the concept of learning organization can be an appropriate definition of the silent agroecology occurring in farmers group, described according to the preceding criterions.

5.2 Drivers of AET in farmer collectives

The evaluation of the AET process in farmer collectives revealed that a stronger form of agroecology was achieved in Patur'en Pilat compared to the GIEE. This section will intend to explain the reasons of this phenomenon, and the possible conditions which could be defined to progress towards a 'strong' form of AET in collective actions.

Based on socioeconomic and methodological principles of agroecology reviewed in the literature, the Institutional innovation variable (*Variable 1*) aimed at assessing the approach of the project with regards to its internal governance, learning processes and integration in the territory from an agroecological perspective. It was therefore assumed that the collective presents stronger AET when it;

(1) Features an autonomous internal organization

(2) Presents an independence from external supporting actors (facilitators, animators, technicians)

(3) Induces profound changes on farmers' norms and values

(4) Is integrated in the territorial actors' networks

(5) Presents an adaptive and polycentric governance

(6) Favors horizontal learning processes

(7) Generates an hybrid of situated/generic knowledge

(8) Integrates multidisciplinary actions and goals

Patur'en en Pilat and the GIEE featured the characteristic of criterion (5) because they both present farmer-led initiatives and a hybrid network of actors (territorial structures, external experts, development agencies, high schools…). This criterion is relevant with Ryschawy et al (2019) which evidenced that AET '*takes place through the combination of different exchanges with an evolving social network*'. Criterions (2), (6), and (7) were also identified in Patur'en Pilat because the group's learning processes were assessed as more independent from external actors than the GIEE. For instance, in Patur'en Pilat, the experimentation processes are designed by farmers themselves whereas the GIEE relies on an external technician to conceive experimental designs. In addition, Patur'en Pilat mobilizes skills and traditional know-how from its own members as a prior resource for constructing new principles of action, through a continuous back and forth between peer's inputs and external experts, which was identified as a strong form of AET. Moreover, farmers systems in Patur'en Pilat are evaluated through qualitative and informal indicators (such as the state of vegetation, visual observations, and personal feedbacks). One the other hand in the GIEE, principles of actions are

constructed owing to direct scientific explanations, approved through formal indicators (yield, chemical input, workload etc..). These differences can be explained by the fact that the activities of the GIEE are centered around experimentation, and the appropriation of specialized equipment, whereas the activities of Patur'en Pilat are rather focused on field visits, exchange of practices, sharing ideas and knowledge through informal interactions. While the learning process of the GIEE converges towards predetermined goals (adopting conservation agriculture practices), Patur'en Pilat seeks to construct references and new knowledge in situations of uncertainty, by adopting divergent modes of experimentations. In that way, the informal setting of Patur'en Pilat could be one of his strengths compared to the GIEE, because it allows for more flexibility in the group, and exchanges within the territory. Each meeting of the group features different members (some old ones and new ones) enabling a continuous merging of experiences between external inputs and internal experimentations. These interactions are reinforced by the fact that all farmers come from diverse geographical areas of the NRP and present a wide range of backgrounds.

The second variable, Technological innovation (*Variable 2*) aimed at evaluating the concrete objects of actions in the collectives on a gradient from an efficiency/substitution-based agriculture (as the "weak" property of AET), and a biodiversity-based agriculture (as the "strong" property of AET), identified in Duru et al (2015). Biodiversity-based agriculture is defined in collective projects if it:

(1) Promotes the adaptation of agricultural practices and/or conservation of biodiversity and natural resources and/or development of embedded food systems

(2) Aims at reducing environmental impact by enhancing interactions and synergies in the agroecosystems

(3) Promotes exploratory-types of innovation with little pre-existing knowledge

(4) Develops experimentation processes inducing deep re-conception of farming systems

(5) Presents long-time history and evolving objectives

(6) Proposes activities involving external public (through education, pedagogical events, animations…)

(7) Valorizes traditional know-how, local knowledge and skills

(8) Mobilizes local and/or renewable resources and/or originating from circular economies

The first two criterions were ratified for both the GIEE and Patur'en Pilat because the analysis of their experimentations confirmed that their experimentations aimed at ameliorating environmental performance and increasing biodiversity indicators. Criterions (3), (4), (5), (7) and (8) were also given to Patur'en Pilat. By favoring collective exploration of new practices and belief systems, far from ready-made recipes, it was assessed that the group promotes exploratory types of innovations compared to the GIEE which exploits available knowledge and expands existing technologies.

Moreover, as highlighted by one of the facilitator from the GIEE, the experimentations of the group still lack a holistic perspective and are focused on technical changes; while the experimentations in Patur'en Pilat have led to deeper reconsideration of the farming systems (such as changes in the lambing calendar, adapting milking frequency, changing marketing strategies…). These profound changes translate that the farmers have gained a holistic perspective of their exploitations, which is a key element of biodiversity-based agriculture. Moreover, because the project of Patur'en Pilat isn't subsidized by a funding process for a finite length of time, it was defined that its objectives were rather prone to evolve compared to the GIEE which objectives can be limited to the lengths of its funding (5 years). Indeed, if the GIEE benefits from more financial means than Patur'en Pilat, it can be questioned how the experimentations of the group will evolve when their funding ends in 5 years, as the Park's technician emphasized that part of its members joined the group for having access to new machinery. Patur'en Pilat features criterion (7) because the practices developed in the group are highly integrated in the local environmental systems and their scope goes beyond the field level. Many of the collective experimentations are defined according to objectives at the landscape level, beyond farmers' properties, using grazing animals as ecosystem engineers to restore natural ecosystems. On the other hand the experimentations of the GIEE are limited to individual fields and although farmers seek to enhance agroecosystems diversity and resiliency, they are in continuity with the paradigm that agriculture is a separate and independent system from the larger environmental system. Lastly, the resources mobilized in Patur'en Pilat are mostly locally-based since one of the goals of the group is to develop grazing strategies aiming at managing natural resources, minimizing as much as possible external inputs such as fuel and concentrate feeding. Contrastingly, if the farmers from the GIEE also tend to reduce as much as possible their external inputs, the resources used in their project (cover crop seeds, machinery, fertilizers and herbicides) are not drawing from local geographic areas.

As assumed initially, the AET occurs at different levels in the two groups studied. The assessment grid was developed primarily as a tool for the Park to define standards and concrete representations of agroecology in collective projects; as such tool is inexistent in the literature. The next section will provide a deeper analysis of the role of external actors to favor the AET of farmer collectives.

5.3 The key role of facilitators to foster the process of AET within farmer's collectives, take-aways for the Park

The role of external actors to support knowledge generation in collective initiatives has been highlighted by several authors (Klerkx et al 2012, Ryschawy et al 2019). These external actors designate the range of public and private professionals in the agricultural sector who are supporting the work of farmers (consultants, extensionists, trainers, public officers). In the literature, these actors are

alternatively referred to as “developing agents”, “supporting actors”, “animators”, or “facilitators” (in French *“accompagnateurs*”). Their implication in the groups presents a range of styles, and determines the learning processes occurring in the group, as stated by Coquil et al (2018) ‘*the content, organization, and aim of farmers’ networks are influenced by agricultural training, agricultural development, and discussions between peers, research, and regulations’.* According to Brives et al (2016), the commitment of farmer groups in an AET requires an accompaniment to a research process, favoring farmers’ participation and “bottom-up” approaches, such as developed in Scopela’s approach. On the other hand, prescriptive consulting as delivered by conventional agricultural extensionists, founded on standardized transfer of technology can hinder the development of learning processes in farmers group (Brives et al 2016). In consistence with these conclusions, the role of facilitators in Patur’en Pilat and the GIEE has shown to influence the process of experimentation and knowledge circulation within the groups, and can be identified as an important driver of AET in the groups. By transferring a method rather than a set of generic statements, Scopela orients farmers towards an active posture where they are able to analyze their individual situations and construct their own practices ‘to act with the sitation’. Through this activity, Scopela encourages farmers’ acquisition of new knowledge, skills, values or references in situations of uncertainty. Indeed, it was found that the more experienced farmers within Patur’en Pilat have reached a high level of decision-making autonomy and independence in their learning processes, by the fact that some of them conduct and assess small experimentations on their own. The approach developed by Scopela can be qualified as relevant to an “epistemic work” because it fosters the production, evaluation and legitimization of knowledge through participatory and collective interactions with farmers (Cristofari et al 2017). These continuous back and forth between collective and individual experiences, singular and generic discourses shape a so-called experiential learning cycle where *‘knowledge is created through the transformation of experience’* (Kolb 1984). In the education and research sector, experiential learning was describe as a key strategy for building agroecology in future farming and food systems (Francis et al 2011). Based on the analysis of Scopela’s facilitation, our study proposes that experiential learning strategies developed by supporting actors in farmer collectives can similarly enhance the process of AET. Following this assumption, several recommendations can be set forward for the Park to promote the application of agroecological processes in collective initiatives.

(1*)* <u>Supporting internal organization of the group;</u> by maintaining a distant but continuous follow-up of the group’s activities, encouraging self-reflection moments, creating spaces for formal and informal interactions, facilitating the emergence of shared objectives, favoring concrete involvement of the members, and contributing to the territorial integration of the group (public event, communication, networking with other groups…)

(2) Supporting experimentation; by encouraging exploratory-types of experimentation, comforting situations of uncertainty, co-constructing research processes with the group, introducing questionings on wider objects or aspects of experimentation, valorizing farmers' own indicators of performance and linking agroecosystems management strategies with the local natural resources management

Based on the result of the AET assessment within the two farmer collectives in the NRP, particular actions could be undertaken by the Park to foster the integration of agroecology in these projects.

- In Patur'en Pilat, institutional innovation could be encouraged by supporting the official structuring of the group and internal organization (delegation of tasks, diversify sources of funding…). This could also help the group to gain more recognition in the territory and notably to establish grazing agreements with private landowners and municipalities. In addition, it could encourage more farmers to join the collective since today, the group is seen as exclusive and confidential due to its informal character. The Park could organize more events where the actions of Patur'en Pilat could be promoted such as special markets featuring "pastoralist" products, or public education events (guided tours of pastoral areas, partnerships with schools and highschools). Moreover, the Park could facilitate partnerships with other actors of the food system such as dairy cooperatives, slaughter houses, local distribution channels to support the integration of farmers' pastoral practices at the food system level (for example through local certification schemes). Lastly, the Park could support the development of eco-pastoralism, an increasingly popular practice in France enabling contracts between public institutions and farmers to manage municipal green spaces with grazing animals. Overall, the main objectives for the development of agroecological approaches in Patur'en Pilat are to encourage its autonomous functioning and integration in the territory both politically and environmentally.
- In the GIEE, further level of AET could be achieved on the institutional side by encouraging more involvement of farmers in the design of experimentations. If the external technician from Maison Cholat is a crucial vector of technical input and specific knowledge, its implication in farmers experimentations is still quite prescriptive. This could be mitigated in future years by increasing the integration of the group in the conception of experimental designs, for instance through specific in-depth collective days at one farmers' place. The fact that the farmers from the group are all within a close geographic area is a good opportunity to propose more collective days, discussions, and informal events among the group members. Moreover, the Park could develop the visibility of the GIEE in the territory by putting signs on farmers' experimental fields with the description of the experiment conducted. A public restitution of the results from these experiences could be conducted by the farmers themselves at the end of

the season. It could be also interesting to organize a field visit in a "model" farm from the BASE network. However, to move the focus of the group beyond conservation agriculture, the Park should promote the construction of a new paradigm system shared amongst the group's members. To this end, it is necessary to improve in the first place the cohesion of the group and establish new local professional norms belonging to the group, as suggested by Darré (1999). The Park could for instance propose agroecology-oriented serious games to help farmers apprehend the complex relationships between farm management, agricultural production, environmental impacts and economic results. Serious games have been highlighted as effective pedagogic methods to encourage the adoption of holistic perspectives and individual learning processes by immersing the participant in a virtual environment with no fear of doing mistakes and socio-related boundaries (Godinot 2018). By fostering creativity and expanding the field of possibilities, serious games could be a possible solution to enlarge the focus of the group beyond machinery-oriented objectives. In conclusion, the challenge for the Park to support the AET process in the GIEE is to strengthen the shared identity of the group around common norm and value systems, to mobilize more skills and knowledge from its members in the design and evaluation of experimentations, and finally to trigger creative and exploratory learning processes beyond the framework of conservation agriculture.

5.4. Limits of the study

Ethnography was identified as a relevant methodology to study the activity and learning processes of farmer collectives (Girard and Magda 2019). The choice of the two collectives was a realistic scope for the duration of the study, and provided relevant comparison elements because the two groups were located in the same territory and accompanied by the same technician from the Park. A high amount of time was dedicated to participant observation and immersion in the case territory by assisting the work of the Park's technician in the development of agroecological initiatives. This contributed to a deep appropriation of the case territory and to determine context-oriented research questions addressing the Park's issues. However a restricted number of farmers and external actors were interviewed, causing the risk that they are not to a representative sample of the community under investigation. In addition, both the data collection and analysis conducted gave strong importance to the researchers' own interpretation of facts, situations and discourses. This has possibly led to biased interpretations and erroneous conclusions. The risk of lack of information exist in ethnography because the research is conducted in natural settings and the researcher has few control over the variables investigated. Traditionally, this flaw is counteracted by the longevity of the data collection method, but in the context of our study, the data collection period was limited to 3 months. Finally, to check the consistency of their results, ethnographers usually conduct "multi-site studies" in order to generalize

their findings (Wiersma 1986). In our case, the validity of the conclusions was achieved through a continuous confrontation of the results with the scientific literature, even though these were not conducted in the exact same settings.

The AET assessment grid proposes a baseline for the Park to evaluate agroecology within collective projects and further support their transition processes. However, this tool is not exhaustive and doesn't intend to simply measure the AET performance of collective initiatives. Agroecology is a complex and ambiguous concept which is continuously being defined by practitioners and scientists through everlasting debates and disagreements. As shown in our study, agroecology often takes place through invisible and informal forms which is why our conceptual framework cannot replace qualitative investigations. Nonetheless, this tool can be used by facilitators of farmer collectives to endorse and advance agroecology in their actions.

6. Conclusion

This study confirmed the preliminary assumption that farmer collectives involved in experimental process are engaged in an AET. In farmer collectives, the concept of agroecology is rarely appropriated by farmers and can be defined as a set of social and technical progressive innovations, in an uncertain context, enabling the production of shared and situated knowledge. Agroecology in farmer collectives is a silent process, revealed by the evolution of farmers' professional norms, the improvement of individual environmental performances and the creation of new incremental learning processes based on 'situated' knowledge. However the analysis of the two collectives from the Pilat NRP has shown that these collective initiatives don't systematically trigger a questioning process on the whole agroecosystems functioning, which is a fundamental condition for the completion of the AET. The assessment tool developed proposes a framework to evaluate the level of AET in collective projects, on a gradient from 'weak' to 'strong' AET. In accordance with the literature and notably the COTRAE research project, the group's internal organization, experimentation and facilitation are driving the process of AET within farmer collectives. Specifically, facilitators' approaches supporting peer-learning processes and encouraging farmers exchanges can be identified as a driving force behind the group's agroecological transition. Several principles of actions to foster the AET transition in the two collectives studied were therefore suggested to the Park, namely to encourage farmers' institutional and technological innovations. This study focused on defining agroecology and agroecological transition at the scale of collective actions led by farmers. However, these initiatives are not exclusively the motors of AET, and are integrated within other dimensions of agroecology, defined at the farming levels and the territorial levels. Further research should therefore be conducted on the interactions between these levels of transitions, and how they can mutually reinforce each other to construct the food systems of tomorrow.

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8. Appendices

Appendix A. Interview guides

Guide enquête agriculteur

I. infos personnels personne enquêtée

Est-ce que vous pouvez vous présenter rapidement ? (âge, formation, parcours professionnel….)

II. infos exploitation

Depuis quand êtes vous installé en tant qu'agriculteur ? Pouvez-vous me présenter l'exploitation ? *Productions, surface, mode de production (bio ou pas, MAE, systèmes herbagers...), mode de commercialisation*

Quelles ont été les évolutions principales de votre système au cours du temps ? Quels ont été les facteurs de changements/d'adaptation ou cours de votre évolution ?

comment vous décririez-vous par rapport à l'agriculture locale ? en quoi vous distinguez vous des autres ?

A quoi aimeriez-vous que votre exploitation ressemble dans *10*ans ?

Quels sont vos projets en cours, ou vos idées de projet à venir ? Comment faites-vous pour y parvenir ?

Durant votre temps sur le territoire, qu'est-ce qui vous a permis d'apprendre/d'évoluer le plus ? Comment ?

III. Le collectif : constitution et adhésion

Pouvez-vous me présenter l'histoire du collectif? Comment va-t-il été créé ? par qui ? quand ?

Comment définiriez-vous l'objectif principal (la raison d'être) du collectif ?

Quand/ Comment avez-vous rejoint le collectif ? Quelles étaient vos motivations personnelles pour vous y investir ?

IV. Activité du collectif

Comment avez-vous rejoint le collectif ? Qu'en saviez-vous avant de le rejoindre, étiez vous impliqué dans d'autres groupes ?

Quel était votre objectif, motivation initiale pour rejoindre le collectif ?

Pouvez-vous me présenter les activités principales du collectif?

Comment se déroulent-elles ? Comment pourraient-elles être améliorées ? Comment communiquez-vous ?

Comment est animé le collectif ? Par qui ? Comment est-ce différent d'autres collectifs que vous ayez pu connaître ? Que souhaiteriez-vous voir dans la manière de faire ?

Travaillez-vous en groupe dans le collectif ? En sous-groupe ? Comment est-ce organisé ?

Que vous a apporté le collectif jusque-là ? Quelles sont vos avancées que vous devez au groupe ?

Qu'appréciez-vous le plus dans ce collectif ? Le moins ? Pourquoi ? Qu'est-ce que vous aimeriez changer, et comment ?

Suivez-vous des formations ? A quelle fréquence ? Par qui sont-elles proposées, par qui sont-elles animées, conduites ? Que pensez-vous de ces formations ? Comment aimeriez-vous qu'elle soient ? Que pensez-vous des animateurs, des intervenants extérieurs ?

Quelles sont vos attentes/besoins en termes d'accompagnement pour soutenir les activités du collectif ?

V. Les essais

Quels types d'essais nouveaux expérimentez-vous dans le cadre du collectif ? Vous arrive t-il de faire des essais nouveaux ? Dans quel cadre: Chez vous ? Avec d'autres groupes ?

Qui a l'idée de l'essai ? Comment choisissez-vous les parcelles, les modalités pratiques à tester ?
Qu'advient-il des résultats ? Comment les partagez-vous ? Avec qui ?
Que qualifiez-vous d'un résultat positif/intéressant ? Dans ce cas, que faites-vous ensuite ?
Comment apprenez-vous des essais menés chez d'autres membres du collectif ?
Est-ce que vous avez changé certaines pratiques suite à vos essais ? Ou suite aux essais de quelqu'un d'autre ?
Vous arrive-t-il de conseiller d'autres agriculteurs en ce qui concerne les essais? Demandez-vous conseils à d'autres agriculteurs ? Qui ? Pourquoi ?
De quelle façon/comment le collectif vous permet d'atteindre vos objectifs personnels (i.e votre vision à long terme pour votre exploitation)
Selon vous, les changements opérés au sein du collectif auront un impact sur (noter de 1 – faible impact à 5 – fort impact pour chaque)

- Économie des charges opérationnelles
- Satisfaction de votre travail
- Augmentation de la production
- Amélioration de la biodiversité
- Adaptation au changement climatique
- Augmentation de votre autonomie

Qu'est ce que signifie l'idée d'agroécologie pour vous ? Y a-t-il quelque chose que vous faites que vous qualifierez d'AE ?

Guide d'enquête animateur

Info perso
age, formation, parcours pro, responsabilité/poste professionnel actuel
Description des missions professionnelles

I. Origine du collectif
Comment s'est construit le collectif ? A l'initiative de qui ? Qui avait-il au départ ? Y a-t-il eu un apport d'aide de l'extérieur ?
Quelles ont été les motivations, objectifs initiaux qui ont contribué à la genèse du collectif ?
Comment a évolué la composition et le rôle du collectif au fil des années ?
Qui sont les membres du groupe aujourd'hui, Que cherchent-ils dans le collectif ? Quelles sont les caractéristiques principales des exploitations et systèmes de production des agriculteurs engagés dans le collectif ?
Quelles sont les principales difficultés rencontrées par le collectif ? Comment arrivent-il les gérer, surmonter ?
A quel stade est le projet ? Quels sont les enjeux actuels/futures actions prévues ?

II. L'accompagnement du collectif

)uand êtes-vous arrivé dans le projet, pourquoi ?
uel est votre rôle précisément dans le collectif ? Quelles sont vos fonctions ?
omment communiquez-vous avec eux ? A quelle fréquence ? Est-ce peu, beaucoup, suffisant ?...
omment sont perçues vos actions de la part du groupe= feedback de la part des membres sur votre travail ? Que vous disent-ils?
uelles sont vos plus grandes difficultés dans votre travail ? Comment y faites-vous face ? Qu'est-

ce qui, au contraire, à l'air de fonctionner le mieux ? Pourquoi ? Qu'est-ce que vous voudriez changer, améliorer ?

ouvenir d'un succès marquant d'une action menée ? De quoi êtes vous le plus fier dans votre accompagnement ?

III. Expérimentations, essais

u'avez-vous recensé en terme d'essais/expé chez les membres du collectif ? Pourquoi les font-ils? Comment s'y prennent-ils ?

omment participez-vous à la mise en place des essais conduits par le collectif ? Vous demandent-ils de le faire ? Proposez-vous d'en faire ?

uelles sont selon vous les attentes du collectif de votre implication dans leurs démarches d'expérimentation?

uelles sont les modalités de mobilisation et/ou production de connaissances au sein du collectif (échange de pratiques, visites, conférences, essais…) ? Comment ces connaissances sont-elles capitalisées ?

vez-vous observé des changements induits par le projet sur les pratiques agricoles individuelles ? Sur l'organisation du travail ? Sur des incidences économiques de l'exploitation ? Sur les perceptions (ou le sens) du métier pour les agriculteurs ?

IV. Fonctionnement du collectif

uelles sont les sources de financement du collectif ? A quoi sont employés lesfinancements ? Sont-ils suffisants ?

omment les activités du collectif sont-elles mises en visibilité, quel travail cela implique-t-il, quelles sont les cibles ?

ravaillez-vous en réseau avec d'autres structures, qui vous permettent d'échanger sur vos méthodes d'accompagnement, ou sur ce collectif ?

uel intérêt d'être un GIEE/autre structure juridique (ou non ?) Quels sont vos objectifs pour l'évolution du projet, par rapport aux enjeux de votre structure ?Qu'est-ce que vous qualifieriez d'AE dans les activités du collectif ? Est-ce que des débats/discussions/questions autour des idées écologiques, agriculture durable, etc, ont lieu ?

uels sont, d'après vous les points forts et les points faibles du collectif pour aller dans le sens de la transition agro écologique ?

Appendix B. List of interviewees

Farmers

	Code	Farming system	Commercialisation
Patur'en Pilat	P1	Dairy cow farmer, organic, strong autonomy highly engaged in agroecology (grazing, food autonomy, biodynamic…)	Long chain (organic) and direct marketing raw milk
	P2	Livestock farmer (Limousine cows) in a diversified GAEC labelled organic (bees, meat chicken)	On-farm transformation (cured meat, paté, chicken breasts, honey, biscuits, gingerbread…), short supply chains (farmers' market, farm store) and long chain (Biocoop)
	P3	Dairy goat farmer in a diversified GAEC (laying hens, meat chicken, pigs, bees) with little autonomy in term of input, trying to graze animals but dependency on concentrate (partly produced on-farm)	Coexistence of long and short supply chains: part of the goat milk sold to local cooperative for PDO cheese production, the rest transformed on farm Meat, eggs, gingerbread, cheese prepared at the farm sold in farm store or specialized shops in Lyon
GIEE	G1	Livestock farmer with meat cattle and pigs, rather intensive, self-sufficient in hay and cereals but not protein	Production entirely on short supply chain (farm store, local markets); on-farm transformation (butchery)
	G2	Conventional dairy cow farmer with few or no agroecological practices (purchase of feed, limited grazing, mineral input…)	Long chain
	G3	Farmer and baker, mixed cereal/grain production with implementation of conservation agriculture practices (wheat, rye, ancient breeds) and some rotation with cover crops	Cereals entirely transformed, used for bread production sold at the farm and local stores

Supporting actors

	Code	Structure	Role
Patur'en Pilat	AP1	SCOPELA	Technical advisor specialized in grazing management integrating natural landscapes (permanent prairies, woodlands, high altitude parcours…), animation of a national network of farmers "Patur'ajuste" promoting farmer to farmer exchange of experiences
	AP2	ADEAR	Animator/facilitator in a regional public structure promoting peasant agriculture, mostly assisting farmers to develop their autonomy, diversify their production and ameliorate working conditions through specific trainings, individual advisory and collective days
GIEE	AG1	Maison Cholat	Technical advisor and commercial in a private agribusiness company specialized in the cereal sector (supplier of farm equipment, transformation for animal feeding, milling services) engaged in developing an agroecological approach
	AG2	NRP Pilat	Animator and coordinator of agroecology at the Nature Regional Park office, assist and support several collective and individual initiatives related to agroecology in the territory

Appendix C. List of participant observations

Date	**Place**	**List of attendees**	**Description of event**
20-02-19	Park's office	GIEE members Cholat technician External expert (lecturer)	Training day given for P.I.L.A.T.S GIEE "*Choosing, implementing and taking advantage of cover crops"*
11-03-19	Farmer's field (from GIEE)	GIEE members Cholat technician Park's technician	Field visit of individual GIEE farmer G3, visual analysis of soil profile in two parcels not tilled for 3 years
12-03-19	Park's office	Different political and agricultural territorial structures (department representatives, local mayors, agricultural chambers, development committees, farmers associations) Park's president and technicians	Reunion of the steering committee supervising the Park's initiatives regarding organic agriculture development
21-03-19	Park's office	Rhone Agricultural Chamber Animators from different GIEE groups Park's technician	Videoconference with GIEE animators from Auvergne Rhone Alpe region
29-03-19	Park's office	Two technicians from Maison Cholat Park's technician	Meeting with Maison Cholat
02-04-19	Park's office	Patur'en Pilat farmers SCOPELA technicians (facilitators) Park's technician ADDEAR Loire	Collective day with Patur'en Pilat *"Changing practices, YES, but at what cost and with how much work?"*
11-04-19	Park's office	ADDEAR Loire (facilitator) Park's technician Patur'en Pilat farmers	Collective day with Patur'en Pilat *" the collective invents its future"*
06-05-19	Park's office	Patur'en Pilat farmers Park's technician (facilitator) ADDEAR Loire	Phone call with Paturen Pilat members to decide the conditions of the group's juridical structuring
10-05-19	Park's office	Maison Cholat technician Park's technician	Phone call between P.I.L.A.T.S GIEE animators
17-05-19	Two farms from Patur'en Pilat	Two farmers from Patur'en Pilat SCOPELA technician Park's technician	Individual farm visits and diagnostic with SCOPELA

Appendix D. Resource document for the Park

Parc naturel régional du Pilat

Retour d'expérience

Stage de fin d'études Février - Août 2019

Les collectifs agricoles, moteurs de transition agroécologique?

En quoi les collectifs agricoles du Parc naturel régional du Pilat sont-ils acteurs de la transition agroécologique? Quel rôle peut jouer l'accompagnement dans un processus de transition? Ces questions ont été approfondies dans le cadre d'un stage de fin d'études, avec une étude de cas de deux collectifs agricoles sur le territoire pilatois.

EXPÉRIMENTER EN COLLECTIF POUR FAIRE FACE AU CHANGEMENT

La coopération des agriculteurs en collectif n'est pas un phénomène nouveau. Historiquement, cette coopération s'est construite autour de matériel (équipement, semences...) ou d'échanges commerciaux (coopératives laitières, céréalières). Aujourd'hui, certains enjeux technico-économiques tels que la dépendance à certains intrants, ou encore la pénibilité du travail, mènent les agriculteurs à se questionner et à réinterroger leurs pratiques. Face à cette situation de changement et d'incertitude, le collectif permet de conforter les individus en posture de transition. Le groupe permet aux agriculteurs d'échanger, d'interroger leurs pratiques, et devient un espace d'expérimentation contribuant à la production de connaissances adaptées localement. Si certaines de ces initiatives bénéficient de support politique, d'autres restent informelles (groupes locaux, réseaux d'échanges...). Encourager ces formes d'innovation collectives, est aujourd'hui nécessaire à la transition agroécologique.

La transition agroécologique

Elle désigne un processus d'évolution des systèmes agricoles, pouvant se mettre en place à l'échelle de l'exploitation jusqu'à l'ensemble de la société. Elle repose sur des principes de l'agroécologie tels que:

- **la mobilisation de pratiques agricoles viables et vivables valorisant des processus écologiques**
- **des apprentissages progressifs, conduits sur le temps long et aboutissant à une production de connaissances locales et partagées**
- **la reconnexion de la production agricole avec l'alimentation locale**

Comment caractériser la ressource fourragère des prairies permanentes pour mieux la valoriser ? Les éleveurs du groupe Patur'en Pilat se réunissent sur le terrain pour partager leurs expériences et proposer de nouvelles expérimentations

ZOOM SUR DEUX COLLECTIFS AGRICOLES DU PILAT

PRINCIPALES SPÉCIFICITÉS DU FONCTIONNEMENT DES COLLECTIFS

Le projet de recherche a porté sur l'analyse approfondie de deux initiatives collectives d'agriculteurs du Pilat : le groupe « Patur'en Pilat », ainsi que le GIEE[1] P.I.L.A.T.S (Projet Innovant Lié à L'Agroécologie du Travail de nos Sols) dont le fonctionnement est présenté ci-dessous.

- Patur'en Pilat est un réseau informel d'une trentaine d'éleveurs répartis sur l'ensemble du Pilat, échangeant, expérimentant et se formant pour une meilleure valorisation de la ressource fourragère.
- Le GIEE est constitué de dix agriculteurs (céréaliers, éleveurs) autour de Pélussin dont l'objectif est d'améliorer leurs sols en s'inspirant des techniques d'agriculture de conservation.

[1] *GIEE (Groupement d'Intérêt Economique et Environnemental) : engagement collectif d'agriculteurs dans la modification ou la consolidation de leurs pratiques en visant une performance économique, environnementale et sociale, bénéficiant d'une reconnaissance officielle de l'Etat*

L'AGROÉCOLOGIE AU SEIN DES COLLECTIFS....

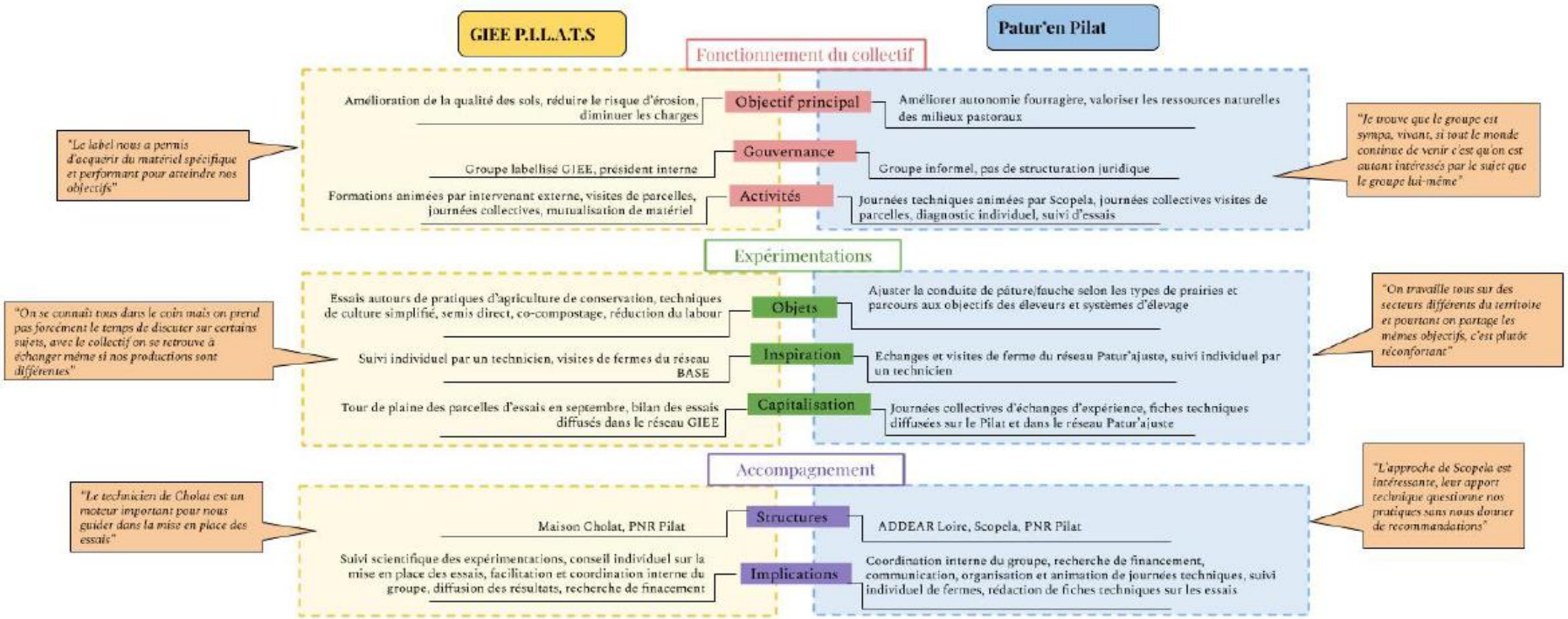
Si l'agroécologie n'est pas revendiquée dans les collectifs étudiés, elle est visible à travers plusieurs principes clefs :

- Quête d'autonomie, aussi bien matérielle, que financière et décisionnelle,
- Diminution de l'empreinte environnementale des systèmes agricoles, mobilisation de processus naturels (vie du sol, végétation naturelle, conduite du troupeau...),
- Amélioration de la qualité de vie, diminution de la charge de travail, apprentissages entre pairs, échanges de pratiques.

... UN PROCESSUS DE TRANSITION À PLUSIEURS ÉCHELLES

La transition agroécologique s'exprime selon un gradiant allant :

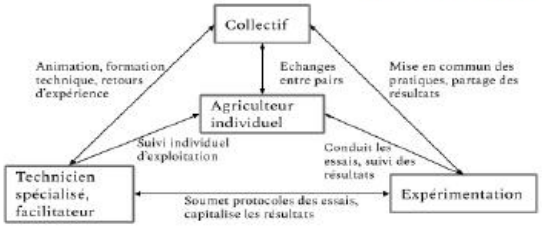
- d'une agroécologie dite « faible » où l'évolution des pratiques se limite à la substitution d'intrants par d'autres ressources, guidée par la science dans une logique de performance agronomique,
- à une agroécologie dite « forte », recherchant une production raisonnée et adaptée aux conditions locales, fondée sur l'utilisation de processus biologiques comme outil de pilotage des agroécosystèmes



DES PROCESSUS D'APPRENTISSAGES COMPLEXES

Comment les connaissances sont-elles produites dans un collectif agricole ?

Les objets d'expérimentation, les modalités d'accompagnement ainsi que le fonctionnement interne du groupe sont des éléments déterminants de la production et la circulation des apprentissages au sein des collectifs



L'étude menée a permis de faire ressortir les éléments suivants :

- la circulation des connaissances au sein d'un groupe est divisée entre apprentissages individuels, échanges entre pairs, conseils techniques,
- les circulations de connaissances entre pairs ont une capacité à déclencher des processus de questionnement chez l'agriculteur, contribuant à un fort impact en termes d'évolution des pratiques,
- la posture de l'accompagnateur influe sur le type de connaissances produites,
- l'apprentissage se réalise pas à pas, selon une progression continue entre individuel et collectif, expérimentation et appropriation des résultats,
- l'expérimentation en collectif transforme les modes de construction et de partage de connaissances dans le monde agricole.

STAGE DE FIN D'ÉTUDE - Février - Août 2019

L'implication du Parc du Pilat dans les collectifs

- Contribution à l'émergence du groupe (dossier administratifs, offres de formations)
- Mise en place de partenariats inter et extra territoriaux, « institution passerelle »
- Animation de la vie du groupe (communication, réunions, statuts officiels)
- Mobilisation de sources de financement au travers de dispositifs régionaux, européens
- Suivi scientifique des exploitations et expérimentations
- Capitalisation et diffusion des résultats

Un des essais de couverts végétaux mené par le GIEE P.I.L.A.T.S dans leur réseau de parcelles test

Pour aller plus loin

Brives, H., Rousset, P., de Tourdonnet, S. 2015. Quelles modalités de conseil pour l'accompagnement vers des pratiques agricoles plus écologiques ? Le cas de l'agriculture de conservation

Vandenbroucke, P., Jabrin, M. et al. 2019. Le territoire, catalyseur de transition agroécologique ? A paraître

Guirimand, Lucile, 2017. Quelle(s) forme(s) de gouvernance territoriale favorise(nt) la transition agroécologique. Mémoire de fin d'études ISARA-Lyon

Accompagner les collectifs en transition écologique, Mai 2019, Travaux et Innovation N°258, Réseau Trame

ACCOMPAGNER LE PROCESSUS DE TRANSITION AGROÉCOLOGIQUE DANS LES COLLECTIFS AGRICOLES

L'analyse du fonctionnement des deux collectifs a abouti à plusieurs pistes de travail pour adapter l'activité de l'animateur aux situations des groupes:

Accompagnement du groupe

- Etre à l'écoute tout en encourageant l'autonomie décisionnelle du collectif
- S'inscrire dans la durée, « cheminer avec », garder une proximité tout en restant extérieur
- Contribuer au développement d'un réseau sur le territoire (partenariats, évènements publics...), créer des lieux de dialogues, des temps de rencontre informels
- Accompagner les membres du groupe individuellement, aider chaque personne à prendre sa place, favoriser des engagements concrets en les aidant à expliciter leurs objectifs concrets

Accompagnement à l'expérimentation

- Co-construire les processus d'expérimentation avec les membres du groupe
- Encourager à l'expérimentation exploratoire, rassurer dans les situations d'incertitudes, les discussions autour des erreurs, sortir du cadre habituel en stimulant la créativité
- Aider au questionnement des agriculteurs, reformuler, mettre en perspective, faire des liens entre les éléments des systèmes pour introduire d'autres objets d'expérimentation
- Adopter une posture d'accompagnement à la recherche, plutôt que de conseiller
- Favoriser le croisement d'expériences, l'échange avec d'autres collectifs.

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© : Parc naturel régional du Pilat - Date de réalisation : août 2019

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Le Parc naturel régional du Pilat est un territoire bénéficiant d'une reconnaissance nationale pour la richesse et la diversité de ses patrimoines naturels et culturels. Le Parc est aussi un groupement de collectivités. Elles agissent de concert en faveur de ce territoire d'exception, dans le cadre d'un projet politique ambitieux qui concilie activités humaines et préservation de la nature et des paysages : la Charte du Parc. Respect de l'environnement et bien-être des habitants motivent toutes les actions, souvent expérimentales, d'accueil, d'éducation, de développement socio-économique et d'aménagement conduites ici.

www.parc-naturel-pilat.fr

En partenariat avec

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Appendix E. Thematic analysis grids

Internal organization	History and main objectives of the collective	How was the collective initiated? Who was the driver of the initiative? Which external actors supported the creation of the collective? What did the members had in common at the beginning?
	Internal governance	How are decisions taken? How are tasks delegated? How are the members involved in the administration of the collective?
	Activities	What are the main activities of the project? Which concrete actions are undertaken? Through which format? Are the objectives of the group evolving since the project started?
	Opportunities, Strenghts	What are the main external opportunities of the collective? Internal strengths?
	Threats, Weaknesses	What are the main external threats faced by the collective? Internal weaknesses?
	Future improvements	What are the immediate changes planned for the collective? How can its functioning be improved?
Experimentation	Content	What are the objects of experimentations conducted by farmers?
	Source of inspiration	How are the experimentations designed? What are the main sources of inspirations for farmers' experiments? What is their main driver to participate in experiments?
	Monitoring	How are the experimentations monitored? Who is in charge of reporting results?
	Indicators of performance	Which indicators are used to evaluate results obtained? How are these results perceived by farmers?
	Capitalization	How are the results shared within and outside the group? Who is in charge of diffusing them? What type of information is produced?
Facilitation	Role of animators	What type of supporting actors are involved in the collective? What role do the facilitator play in the activities and internal organization of the collective? How do they influence the collective?
	Posture of animators	How do the animators perceived themselves in to the collective? What are their objectives for the collective? Which feedback do they have from the group?
	Difficulties, improvement desired	What are the main difficulties faced by animators? Which changes would they like to introduce?
Change induced by the collective	Individual trajectories	What were the farmers' personal motivation to join the collective? Does the collective help them pursue their own future objectives? How does the group contribute to individual change of practices?
	Conception of Agroecology	Does the collective contribute to an "ecologization" of farmers' practices? Is agroecology claimed by members of the group? Do the topics explored in the collective fit within the scope of agroecology?
	Learning processes	Are individual and/or collective learning favored in the group? What are the main sources of knowledge exploited (internal or external)? What type of innovation is stimulated in the group (socio, economical, technical)?
	Integration in the territory	Is the collective integrated in a territorial dynamic? Have its actions contributed to reach the broader public? Develop partnerships with other projects?

Appendix F. List of indicators used for assessing AET in farmer collectives

Main Variables	Under Variables	Score GIEE	Score Patur'en Pilat	Reference
V1. Institutional innovation				
V1.1 Project internal organization	V1.1.1 Internal organization and finances depend on external actors *(0)*	0	0	*Principle 12 from Stassart et al 2012*
	V1.1.2 Autonomous internal organization and finances *(1)*			
V1.2 Project facilitation	V1.2.1 'Strong' facilitation, stirred by supporting actors prescribing actions, based on their respective expertise *(0)*	0	1	*Brives et al 2015*
	V1.2.2 'Weak' facilitation, stirred by supporting actors fostering learning processes and peer exchanges *(1)*			
V1.3 Learning process	V1.3.2 Incremental and standardize change of practices, aiming at meeting a predetermined goal *(0)*	0	0	*Duru et al 2015*
	V1.3.2 Profound change in knowledge, norms and values, objectives are progressively adapted before searching for optimal solution *(1)*			
V1.4 Projects' partnerships	V1.4.1 Little external partnerships *(0)*	0	0	*Ryschawy et al 2019*
	V1.4.2 Integrated in a territorial network with several local actors of the food system (public, private, institutions…) *(1)*			
V1.5 Governance	V1.5.1 Regulatory agency, public policy, markets governance structures often high in bureaucracy *(0)*	1	1	*Duru et al 2015*
	V1.5.2 Adaptive and polycentric governance based on hybrid networks of actors or informal institutions favoring collective, bottom-up action *(1)*			
V1.6 Learning sources	V1.6.1 Vertical, stirred by external actors, science as authority, inspired from technical references *(0)*	0	1	*Cristofari et al 2017, Demoures et al 2019*
	V1.6.2 Horizontal, peer-to-peer exchanges, facilitate collective learning and systemic approach, mobilizing local knowledge and skills *(1)*			
V1.7 Production of knowledge	V1.7.1 Produce generic knowledge approved scientifically through formal indicators *(0)*	0	1	*Compagnone et al 2018*
	V1.7.2 Produce situated knowledge, locally-embedded, approved empirically through informal indicators *(1)*			
V1.8 Scale of the project	V1.8.1 Specific towards normative goals, focus on one component of the food system (production, distribution, commercialization) *(0)*	0	0	*Francis et al 2003*
	V1.8.2 Diversified, multidisciplinary, integrate the whole food system *(1)*			
SCORE V1		**1**	**4**	

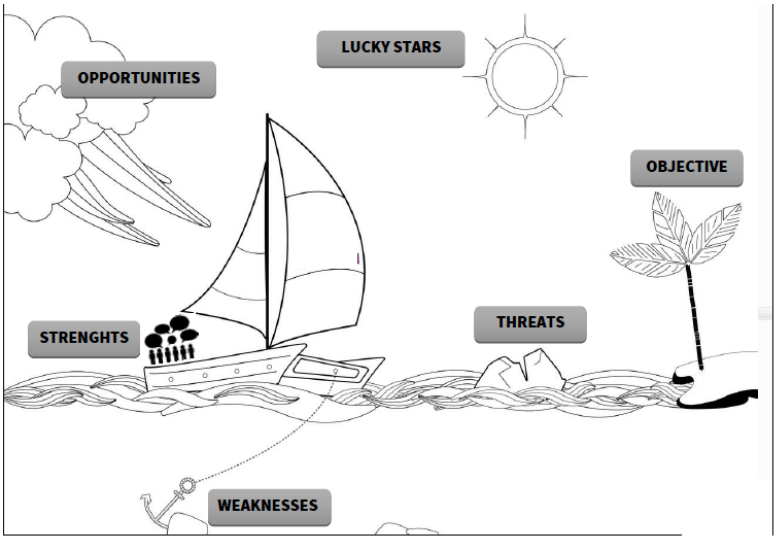
V2. Technological innovation				
V2.1 Object of the project	V2.1.1 Economical performance and/or technological development focusing on production issues *(0)*	1	1	*Wezel et al 2016*
	V2.1.2 Adaptation of agricultural practices and/or conservation of biodiversity and natural resources and/or development of embedded food systems *(1)*			
V2.2 Impact on farming practices	V2.2.1 Reduce environmental impact by optimizing current practices, substituting synthetic inputs with natural inputs, industrial ecology *(0)*	1	1	*Tittonell 2014*
	V2.2.2 Reduce environmental impact by enhancing interactions and synergies in the agroecosystem *(1)*			
V2.3 Innovation process	V2.3.1 Promote incremental innovation exploiting available knowledge and expanding existing technologies *(0)*	0	1	*Principle 9 from Stassart et al 2012*
	V2.3.2 Promote exploratory-types of innovation with little pre-existing knowledge *(1)*			
V2.4 Impact on farming systems	V2.4.1 Experimentations inducing technical changes at the field level *(0)*	0	1	*Hill and McRae 1996*
	V2.4.2 Experimentations inducing deep re-conception of farming systems *(1)*			
V2.5 Temporal scale	V2.5.1 One-time event or short-time project with definite objectives *(0)*	0	1	*Principle 7 from Stassart et al 2012*
	V2.5.2 Long-time project with evolving objectives *(1)*			
V2.6 Activities	V2.6.1 Activities involving primarily the actors of the project *(0)*	0	0	*Ryschawy et al 2019*
	V2.6.2 Activities involving external public (through education, pedagogical events, animations…) *(1)*			
V2.7 Landscape integration	V2.7.1 Agricultural practices decoupled from natural resource management, field-level oriented, aiming at reducing environmental impact *(0)*	0	1	*Duru et al 2015*
	V2.7.2 Developing practices improving ecosystem services and landscape connectivity, integrates whole ecosystem management and valorizes natural resources *(1)*			
V2.8 Resources	V2.8.1 Resources mobilized in the project (energy, material) draw from external geographic areas *(0)*	0	1	*Principle 8 from Stassart et al 2012*
	V2.8.2 Project valorizes local and/or renewable resources and/or originating from circular economies (fair trade, recycling) *(1)*			
SCORE V2		**2**	**7**	

Appendix G. SWOT analysis of the groups using Speed Boat tool

The Speed Boat is a serious game used in various contexts to foster collective intelligence within a team. The exercise takes the metaphor of a boat and gets players (the members of a same team) to think about what will cause them problem or help them moving forward in a project. The Speed Boat metaphor could be used similarly in the diagnostic phase of a project or retrospectively. It brings into play the following visuals:

- **The boat;** symbolizing the team
- **The island**; representing the objective to be achieved by the team
- **The sun**; illustrating the lucky stars or supporting agents of the project
- **The wind;** standing for the supporting forces of the team, the opportunities which will enable it to move forward
- **The anchors**; representing the weaknesses of the group which can slow them down
- **The crew**; is the element to show the strengths of the group
- **The reef**; representing the obstacles or threats which can appear on the boat's path

Once established, these elements enable four main themes to emerge, recalling the SWOT matrix (Strenghts, Weaknesses, Opportunities and Threats). The exercise is usually played within the team, all participants contributing to generating ideas on each topic. Here the visual medium are used to synthesize the elements gathered during both interviews and active observations.



	GIEE	Patur'en Pilat
LUCKY STARS	• PNR Pilat • Maison Cholat • GIEE Network	• SCOPELA • PNR • ADDEAR Loire
OBJECTIVE	• Improve farm autonomy • Decrease workload • Improve soil fertility • Reduce soil erosion	• Autonomy in the farming system • Sharing and exchanging experience on livestockgrazing management in natural habitats, especially permanent prairies and spontaneous vegetation
OPPORTUNITIES	• GIEE label • Access to material • GIEE network	• Development of a Pastoral Plan by PNR • Patur'ajust network • Support from several actors of the territory
THREATS	• Group focused on material-oriented issues • Dependency on animators for knowledge circulation • Lack of holistic perspective of the farming system	• Collective dynamic depends on animators • Dependency on public funding • Divergent visions for the future of the group • Group seen externally as "exclusive" – too alternative
STRENGHTS	• Similar environmental conditions • Members are close geographically • Clear common objectives • Different productions – rich exchanges	• Informal setting – less responsibilities • Friendly and safe atmosphere in the group • Shared philosophy • Different productions – rich exchanges • Autonomous learning process – multitude of individual experimentations to feed the group
WEAKNESSES	• Unequal individual involvement in the group • Different productions – different objectives • Performance rely on economic profitability • Little integration in the territory	• Lack of internal organization • Poor communication strategy • Little external recognition

Appendix H. Experimental protocol in the GIEE during 2019 growing season, *photo credits: Pilat Natural Regional Park*

For the 2019 season, six farmers from the GIEE are each hosting two trial plots. These plots are representative of the farm's cultivation system. They serve as a support during the observations, and will host different tests in order to achieve the objectives set by the group and to popularize certain innovative practices. Several experimental designs were adopted by farmers depending on their preferences, such as a strip test of different cover crop mixes being direct seeded as a summer relay crop in a cereal rotation. The objects of experimentations are the species selected in the cover crop mix (fenugreek, fodder radish, buckwheat, phacelia, Chinese radish, sorgho), and the type of implementation (stubble cultivator, disc tiller, seeding rate). The trials will be compared based on the resulting yields obtained for the different cover crop mixes. Farmers participating in the experiments are provided with monitoring sheets prepared by Maison Cholat for each of the trial plots, to record all of their actions (date and type of soil cultivation, date and type of crop implemented, date and type of fertilization, date and rate of phytosanitary intervention, date and yield obtained at harvest)

x  

Appendix I. Example of experimentation conducted in Patur'en Pilat (adapted from Pinsart et al 2018)

In the Regional Park, farmers have the possibility to use forest parcels after their clear-cutting. The conversion of the parcel from a forest to a forage plot raises several questions, especially on the cost of such process, which usually involves consequent investments for the farmer. Scopela compared the itineraries of two different farmers in the Pilat who both had access to clear-cut parcels but decided to reconquer it differently. One decided to rapidly implement a pasture, by removing all stumps, flair mowing branches and cultivating the soil to implement a temporary pasture. After two years, the parcel was productive: he was able to harvest 5ton of grass/ha in the spring and use it as fall pasture for cows. The other farmer decided to invest time in fencing a path and establishing paddocks in the parcel. In spring, he broadcasted pasture seeds and overwintered a few Highland cattle the next year. By using the Highland, his goal was to maintain the spontaneous regrowth of woody species with minimized costs. He aims to progressively obtain a productive parcel for grazing dairy cows in the spring, with fodder trees and spontaneous herbaceous cover. After one year the parcel was already used sequentially for spring/fall grazing, with satisfying productivity even if the year was especially dry. By conducting an economical balance of the two management strategies, Scopela highlighted that the first farmer's choice (implementing a temporary pasture), even if eventually more productive, led to a 7 years a return of investment, compared to 2 years for the choice of the second farmer (implementing grazing paddocks). This comparison didn't intend to provide generic conclusions on selecting the best itinerary to convert a forest parcel – but rather to provide quantitative reference for both farmers, depending on their individual objectives.

Photo credits: Scopela