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Diversity of goat livestock systems in Livradois-Forez (France) and forms of ecological intensification

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Abstract. The Livradois-Forez (LF) is a small region of fairly low mountains in France where grazing livestock, mainly cattle, is largely based on grass. In this territory, goat farms are a minority but an attractive way to produce on small areas (fragmented and heterogeneous land) and use ecosystems with limited potential. The objective of this study was to analyse the diversity of goat farming systems (GFS) and assess their ecological intensification position. Semi-structured interviews were conducted with 18 farmers, a sample selected to cover the diversity of livestock forms in this territory. Our approach is constructed on three concepts: the farming system, the framework of the farming activity and agro-ecology for animal production. We identified four types of GFS operations discriminated by the place of goat livestock in the farm and the mobilization of available resources. We present and explain the correspondence between types of operations and ecologically-intensive practice profiles. We show the interest of the approach to identify what promotes or limits the development of these systems into more ecologically-intensive forms.

Keywords. Agro-ecology – Farmer practice – Livestock farming systems – Sustainability.

Diversité des fonctionnements d'élevages caprins en Livradois-Forez et formes d'intensification écologique

Résumé. *Le Livradois-Forez est une région de moyenne montagne où l'élevage d'herbivores, principalement bovin et largement basé sur l'herbe, prédomine. Dans ce territoire, les élevages caprins sont minoritaires mais apparaissent comme une voie intéressante pour produire sur de faibles surfaces (foncier éclaté et hétérogène) et utiliser des écosystèmes aux potentialités limitées. L'objectif de cette étude est d'analyser la diversité des fonctionnements de ces systèmes en cherchant à les positionner par rapport à une direction plus « écologiquement intensive ». Des enquêtes semi-directives ont été réalisées auprès de 18 éleveurs choisis pour couvrir au mieux la diversité des formes d'élevage dans ce territoire. Notre cadre d'analyse est basé sur trois concepts : le système d'élevage, le cadre d'exercice de l'activité d'élevage et l'agro-écologie en élevage. Nous identifions 4 types de fonctionnement discriminés par la place de l'atelier caprin dans l'exploitation et la mobilisation des ressources disponibles. Nous montrons la correspondance entre types de fonctionnement et profils de pratiques « intensives écologiquement » et l'explicitons. Nous discutons de l'intérêt du cadre d'analyse proposé pour comprendre ce qui favorise ou contraint l'évolution des systèmes d'élevage vers des formes écologiquement plus intensives.*

Mots-clés. *Agro-écologie – Durabilité – Pratiques de conduite – Système d'élevage.*

I – Introduction

The study was conducted with goat farmers in Livradois-Forez, a rural territory of low mountains, to the east of the Massif Central in France. The goat farms are scattered and form a minority in the territory, but because of this and the ecological intensification of the livestock activity they are

of interest. In fact, this type of livestock farming often makes good use of marginal areas with limited potential, of little interest to the cattle farms that form the majority in this region. These systems do not require much land and offer opportunities for low-volume production with high added value because processing can take place on the farm and sales on local markets.

Nowadays the ecological intensification (EI) concept is highlighted to suggest possible answers to the dual challenge of mitigating environmental impacts and increasing livestock production at global level, whilst at the same time incorporating the local dimension (Griffon, 2006; Steinfeld *et al.,* 2010). Ecological intensification is an evolution of agriculture that aims to produce without harming the environment and to make better use of ecosystem functions (Bonny, 2011; Griffon, 2013). The development of these new forms of farming systems needs to improve the integration of ecological processes into the operation of livestock systems. Thus, this paper describes and understands the diversity of goat systems in Livradois-Forez and identifies their position into more ecologically-intensive forms.

II – Method

Surveys were conducted with eighteen goat farms, selected to cover as large a diversity of systems as possible in terms of dimension (surface area and herd), goat grazing, production orientation (milk or cheese) and association with other animal units. Semi-structured interviews addressed the trajectory of farmers and farms, the management practices of herds and lands and their justification, marketing and valorisation of products, and farmer perspectives.

These data were used to build variables according to three concepts: the farming system (Gibon *et al*., 1999), the framework of the farming activity (Terrier, 2013) and agroecology for animal production (Dumont *et al*., 2013). We define the operation of a livestock system as an association between family and farm system configurations (available dimensions and structures, labour force), the chosen production project (animal production type, investment for processing and marketing the products, and combination of economic activities) and the combination of management practices (crops, herds and valorisation of products), and the trajectory of the farmer (who manages the goat herd) and of the farm has been introduced to take into account the dynamic aspect of this. We used the five major agroecology principles for the design of sustainable livestock systems proposed by (Dumont *et al*., 2013) to describe the practices implemented on the farms and build an ecological intensification (EI) profile for each of them; they are: (i) Health, adopting management practices aimed at improving animal health; (ii) Inputs, reducing the inputs needed for production; (iii) Pollution, decreasing pollution by optimizing the metabolic functioning of farming systems; (iv) Diversity, enhancing diversity within animal production systems to strengthen their resilience; and (v) Biodiversity, preserving biological diversity in agro-ecosystems by adapting management practices.

A typology was carried out on the operation active variables by Bertin's graphical method (Bertin, 1977) and each type of systems reflecting specific logics of operation that are characterized as prototypes (Girard, 2006).To characterize the EI profile of each system, five variables were built, one for each principle (Health, Inputs, Pollution, Diversity and Biodiversity). The system typology was then cross-referenced with the characterisation of the EI profile. Thus for each type of system we built an EI profile, retaining for each variable (principle) the modality which was the most represented among the farms of the type.

III – Results

The typology in 18 goat farms identified four types of operation systems, which are discriminated by the importance of the goat activity in the farms and the mobilization of available resources and corresponding to different ecological intensification profiles (Fig. 1).

In the first type called “resource-centred” the farmers settled on the family farm when a parent took retirement. They aim for production quantity and deliver all of their goat’s milk to a dairy unit. Farms that have expanded since the farmer’s installation are relatively large for the sample and in addition to the goat unit, they include another beef cattle or sheep activity of the same importance in terms of income and labour. The interaction between these herds is thought to be the best way to manage the territory of the farm (nearby fields for the goats). The logic of the operation is centred on plant resource management and the assignment of the best feed to the goats. Diversity of surface area (temporary and permanent meadows, cereals) achieves forage self-sufficiency and covers part of the production of concentrates for the animals. The ecological intensification profile of “resource-centred” farms is out of balance. It is characterized by the importance of “ecologically-intensive” practices linked to the management of surface areas including those that can reduce inputs (rotations, choice of plant species, grass-legume integration, organic fertilization, organization of fields to reduce movement of stock). On the other hand, animal management favours quantity of milk production over the integrated management of goat health; there is no diet transition, drying-off is sudden, pesticides are used systematically, and animal housing is poorly adapted.

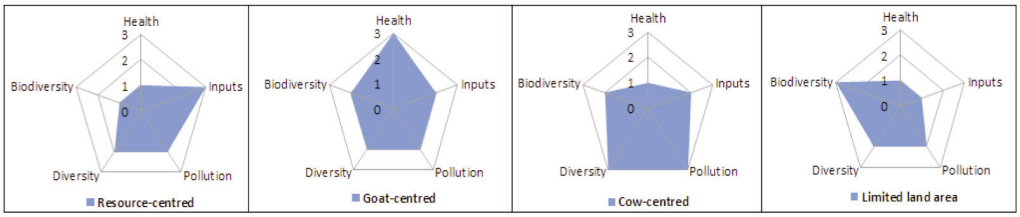

Fig. 1. Ecological intensification profile of each type of operation of goat livestock systems (Degree of ecological intensification: high = 3, medium = 2, low = 1).

The “goat-centred” type occurs in smaller farms managed by couples who became established outside the family framework more than 15 years ago because of their passion for the work. The system was built around the goat herd and the processing and marketing of goat cheese; it has gradually changed, without expanding, to include other activities (educational farm, farm accommodation, bed and breakfast, cottages) and other animal units. It has gradually improved the management of forage resources. In these systems, the diversity of resources, whether animal, vegetable or labour force, is thought to foster system flexibility and efficiency. The “goat-centred” farms are those which have the most balanced ecological intensification profile. Practices that can be described as “dense” from the EI point of view concern the whole system. Particular attention is given to the integrated management of animal health: the females do not suckle their kids, so as to prevent the transmission from goat to kid of the Caprine Arthritis Encephalitis Virus (CAEV); goats are returned to the building during rainy days to prevent lung problems; feed transitions are reflected, grazing is organized to reduce parasitism, trees in pasture and buildings provide goats with thermal comfort. Farmers have gradually changed their strategy for using animal and plant resources, minimizing inputs and playing on complementarities among animals (remote field for sheep or horse grazing, whey used for pigs).

The “cow-centred” type of farming is found in large family-based systems managed by a collective formed progressively by the arrival of new members (family members and employees). The system is designed around the main herd composed of dairy cows, following logic consistent with the dominant model in Livradois-Forez, i.e. intensified production with a forage system based on corn silage and with high use of feed concentrates and chemical fertilizers. The ambition of these farmers is to continue to extend their farms. The goats are secondary, providing added value for the cow’s milk

via the processing of mixed cheeses. In the 1950s, the majority of farms in the Livradois-Forez had dairy cows and a few goats to make “Brique du Forez”, a mixed cheese typical of this territory. The “cow-centred” farms have an EI profile that reflects their ability to promote synergies and recycling via the interaction between plant crops and two different animal herds, dairy cows and goats. The processing of mixed milk cheese enhances the value of the two dairy productions. The possibility of processing cow’s cheese when goats are dry also allows the farmers to keep their place on the market all year round. On the other hand, this type of farm is relatively intensive on land use and on animals, with the use of inputs (mineral fertilizers, phytosanitary, and health products).

In the last type called “limited land area”, the farmers set up their business outside the family framework, because it was their passion, challenge and desire to change their lifestyle. The project revolves around the processing and marketing of cheeses. The farmers have only recently set up their business; their land area is limited, and their fields do not allow them to produce enough forage to feed their animals, so they resort to purchasing forage and concentrates in varying proportions. They are still building up systems that have not yet found a balance between livestock production and the management of farm plant resources: at this stage the farmers focus more on the development of cheese processing and marketing. For the “limited land area” farms, land management is not or poorly implemented by farmers and food purchases are considerable. The priority of farmers who are starting up their system is to process cheese and develop a marketing network. One hundred percent of the utilized agricultural area is composed of permanent grass grazed or harvested in late mowing to make hay, but without seeking a high production, which promotes biodiversity (Dumont *et al.,* 2013).

IV – Discussion – Conclusion

The application of the approach has enabled us to describe the diversity of goat systems in Livradois-Forez. The absence of a specific goat technical model in this territory partly explains the high diversity of operations observed, within a framework of the livestock exercise: (i) combining this activity with other herbivores; (ii) managed by a couple or by wider forms of association. The approach showed that each type of livestock system operation was associated with a different ecological intensification profile. It also highlighted the impact of available land, the farm and farmer history, on the livestock system operation and the EI profile. This confirms the need to understand and analyse the farming system, taking into account the trajectory of these systems (Milestad and Darnhofer, 2003; Schiere *et al*., 2012): the systems with the most agro-ecological practices are those developed gradually within the trajectories of couples who were seeking self-sufficiency in food and reduction in inputs rather than farm expansion.

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