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# Agenda for research-development-training actions regarding the future of pastoral activities in French Mediterranean territories

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## INTRODUCTION

In France, from the last general agricultural census of 2010 performed by the Ministry of Agriculture, the rangelands occupied 4 millions of hectares, i.e. 7 % of the national area. They supported the activity of 35 000 livestock farms, i.e. 18 % of the total of livestock farms, and contribute to feed 1.5 million of Livestock Units (suckling cattle and sheep, dairy sheep and goats). They are located in mountainous areas (*Alpes, Pyrénées, Massif Central, Vosges...*) and Mediterranean, with a high diversity of land cover, from Mediterranean shrublands to alpine meadows.

Livestock is an important economic sector in Mountain and Mediterranean areas, generally since a long time. Beyond the delivery of animal commodities (meat, milk...), livestock farming systems are known for providing multiples services at territory scale, assuming their multifunctionality (Moulin, 2014). Pastoral farming provides animal products of high quality, recognized through various signs of quality (Aubron et al., 2014) and supports local economic activities (farmers, operators of the commodity chains...), contributing to the vitality of the territories. Pastoral farming contributes also to environmental quality. It maintains open space, enhancing the biodiversity, preventing forest against fire, and building agropastoral landscape (CEN L-R, 2017).

But pastoral farming is also facing serious challenges in France. The rangelands are the support of multiple uses, such like hunting or hiking, limiting their access. Pastoral activity is often labour intensive, with many works constraints (Aubron et al., 2016). The farmer incomes depend highly on European subsidies (Bataille et al., 2015). Climate change decreases the biomass production and the climatic hazards increase, in frequency and magnitude. The presence of large predators, under a strict status of protection, is also a threat (Meuret et al., 2018). All these points of weakness threaten the viability of pastoral farms and may lead to their disappearance. In consequence, the positive impacts of pastoral activities would decrease.

In this context, several institutions shared their resources to create in 2015 a new group, called Technological Mixed Unit (UMT Pasto) dealing with the pastoral farms in the Mediterranean areas. The aim is to produce knowledge and methods to support pastoral farming to cope with those challenges and to enhance its contribution to a sustainable development of Mediterranean areas. In this presentation, we depict the organization and the agenda of the UMT Pasto. Then we illustrate some ongoing activities of the group.

## ORGANIZATION AND AGENDA OF THE UMT PASTO

### *The UMT Pasto*

In France, research, education and extension are historically distributed in different institutions. So, actors supporting the development of pastoral activities were embedded in various structures, in national institutions (research and education) or in structures organized at local level (extension). They used to cooperate through projects and built shared knowledge, for instance about grazing systems based on rangelands (Girard and Hubert, 1999). But the objectives and the actions needed to be discussed again for each new project, at the initiative of one of the partners.

The lack of formalized relationships did not enable a strategic thinking of the action programs to be carried on.

Since 2006, the French Ministry of Agriculture developed an instrument to organize partnerships (<http://agriculture.gouv.fr/les-unites-mixtes-technologiques-umt>), called Mixed Technology Unit (UMT). It is a modality to develop in-depth working relationships between public research organizations, public higher education institutions and professional technical institutes, in charge of national programs of applied research and extension. The UMT "Pastoral livestock farming in Mediterranean territories" (UMT Pasto) was labeled in 2015 by the Ministry, showing the national interest for the pastoral issues in France.

The aims of the UMT Pasto are to i) consolidate a French applied research group building pastoral competencies, at the Mediterranean scale, ii) to integrate research and extension actions in partnership with all the actors of pastoral activities, iii) contribute to the training of the actors of livestock farming and environment management.

Three institutions participate to the UMT Pasto: INRA (French Agronomic Research Institute), Montpellier SupAgro, a higher education school in Agronomy, and the Livestock Institute, dealing with herbivore livestock sector (cattle, sheep, goat, and horse). The UMT Pasto is based in Montpellier and gathered 30 persons. Three domains with sheep pastoral farming are partners of the UMT, representing various pastoral environment and breeds (Le Merle, Montpellier SupAgro, near Salon de Provence, with a transhumant system between Mediterranean plain and the Alps; Carmejane, Ministry of Agriculture – Livestock Institute, near Digne, with a sedentary system using woodlands in the *PréAlpes*; La Fage, INRA, near Roquefort, using calcareous rangelands of the *Causse*). In Montpellier, the UMT Pasto has strong support from the Selmet (Mediterranean and Tropical Livestock Systems) Joint Research Unit, associating INRA, Montpellier SupAgro and CIRAD (French agricultural research organization working for development in the South). This unit addressed pastoral issues in various part of the World, in Sub-Saharan Africa, North Africa, and South America. Through Selmet unit, the UMT Pasto developed also collaborations with other research groups in France, dealing with animal sciences, such Genphyse (Toulouse) or UMRH (Clermont-Ferrand), or more broadly with dynamics of farming systems in the territories, such Innovation (Montpellier), AGIR (Toulouse), Territoires (Clermont-Ferrand), and LRDE (Corte).

#### ***Agenda for research, training and extension actions***

Three axes structure the actions of the UMT Pasto. The first one deals with the contribution of the pastoral activities to the sustainable development of territories. We consider that the diversity of livestock farming systems, and their dynamics, is a key tool to understand how the livestock activities contribute to sustainable development in a territory. It enables thinking the local governance policies that impact the dynamics of the pastoralism, according to the types of farming systems. We pay a peculiar attention to the integration of crop and livestock activities, at farm and at local levels. The contribution to local development could be analysed through various theoretical framework, such as multifunctionality or the providing of a bundle of services. Finally, we propose to investigate the various modalities of installation of pastoral farmers, in order to have a better understanding of the issues and the stakes to maintain pastoral farming in the territories.

The second axis deals with the design of technical and strategic management of pastoral livestock farming system, in line with agro-ecological principles, in order to support the development of productive and resilient systems. The research issues concern, in a holistic approach, the technical and economic performances, the workload and the labor organization, the environmental impacts of the activity and the adaptation capacities of the pastoral systems. All of these elements of analysis prove to be necessary in order to reinforce the viability of the pastoral systems with a future. In this axis, we pay a peculiar attention to the use of new technologies of information, that could facilitate the management of grazing, and the use of the trees in livestock systems, through agroforestry.

The third axis implies to think the devices for extension and training. The challenge is to take into account the specific pastoral situations in terms of training and advice (diversity of the farms and of the pastoral practices implemented, diversity of actors in the world of pastoralism) and improve the transmission of pastoral knowledge.

#### ***Two ways to build multi-stakeholders partnerships***

The research program of the UMT Pasto operates through projects, funding by several funding instruments of various institutions at regional, national or European levels. Most of the actions of the UMT Pasto is thus carried on through partnerships with stakeholders of the pastoralism and the management of the environment and with representatives of the local communities.

Those partnerships are based on historic and formalized relationships between members of the UMT and other stakeholders. For example Livestock Institute is engaged with local services of extension, in the Livestock Farm Networks (Jousseins et al., 2015). They are also based on inter-personal relationships, based on previous collaborations through projects, such about multifunctionality (Bernard et al., 2006) or silvopastoralism (Aubron et al., 2013). Beyond the collaboration of members of the UMT, which are from institutions at national level, we organize relationships with various kinds of stakeholders of the pastoralism at local levels. First, the UMT Pasto organized regular meetings with the pastoral advisory services in *Occitanie* and *Provence-Alpes-Côtes d'Azur* (PACA), to plan together the actions to carry on together. The UMT Pasto is also invited to participate to working group of the Livestock Farmers House in PACA, to have a regular view of the ongoing actions and to draw the future projects where collaborations could be relevant. The UMT wanted also develop relationships with institutions in charge of the management of the environment, such as National Park, in peculiar the *Cévennes* National Park, which is inhabited and is the support of permanent pastoral activities, or *the Entente Causses-Cévennes*, in charge to maintain the cultural landscape of Mediterranean agro-pastoralism, which has been nominated by the UNESCO at the World Heritage List. Colleagues of the UMT are members of the Scientific Council of these two institutions.

If partnerships are built and implemented especially in the context of research and development projects, the UMT organizes also an annual meeting of the pastoralism stakeholders. These meetings aim to gather the diversity of the stakeholders (livestock farmers, representatives of professional unions, staff of extension services or environment management services, researchers,...) in order to discuss specifically the implementation of the overall project of the UMT Pasto. The meeting is organised an all-day through in Montpellier. This day has a double objective: i) clarifying, with the partners, the concrete issues to be addressed by the UMT Pasto and ii) exhibiting the results of the ongoing actions. The first meeting day, in January 2016, gathered around 100 people who debated on five themes, in order to orientate the issues to be addressed and consolidate the relevance of future actions. Those themes concerned: i) the modalities of installation in pastoral activities, ii) the use of new technologies to support pastoral activities, iii) the place of the trees in pastoral farming systems, iv) the bundle of services provided by the pastoral activities at the territory scale, v) the stakes of extension and training in pastoralism. Two other days have been organized in 2017 and 2018, with the same level of participation. The synthesis of the discussion and the presentations of results made during the 3 meetings are available on the website of the UMT (<http://idele.fr/reseaux-et-partenariats/unites-mixtes-technologiques/umt-pasto.html>).

### **SOME ONGOING RESEARCH ACTIONS OF THE UMT PASTO**

We choose to illustrate each axis of the agenda of the UMT through three on-going research projects.

#### ***The bundle of services provided by a diversity of farming systems in a Mediterranean area in the south of French Alps.***

At a territory scale, the bundles of services provided by the livestock activities depend on the land occupation and the diversity of livestock systems. The crop-livestock integration, based on the diversity of the component of the farming systems and closing the nutrient loop, is potentially relevant to the multi performances of agriculture. In Mediterranean, specialization pathways of the farms had destroyed this crop-livestock integration, but dynamics at local level are arising with crop-livestock relationships between specialized farms. The purpose of the research is to analyse how integration of crops and livestock mediate the bundles of services provided at territory scale. We developed a simulation model depicting the farm and territory scales, without any explicit spatial representation. From a real case of a territory in *Provence*; we built a stylised territory with a reference scenario of the diversity of farming systems. From census data, we distinguished 6 farm types (3 specialized sheep farms, 2 mixed crop-livestock farms, 1 specialized crop farm). Then we assigned all farms (n=52) to one of the six types. Technical operations and economic results of farm types had been derived from the farm cases built in the Livestock Farm Network, describing 17 pastoral sheep farm types in the French Mediterranean (Bataille et al., 2016). Surveys (n=9) enabled characterizing the straw and manure management and the exchanges between farms in and out the territory. We tested two scenarios. First, we considered that all the mixed farms abandoned livestock and were replaced by specialized crop farms. In the second, we considered that all crop farms were replaced by mixed farms. We showed that the current situation maximized the number of farms in the territory. On one hand, the crop specialization decreased the total number of workers (- 18%), with a slight increase of the income per worker (+ 3%), and led to an abandon of 50 % of the rangelands used in the current situation. On another hand, the diversification with livestock enabled maintaining the amount of cereal production, increased meat production (+ 24 %) and use of rangelands (+ 44 %). The current trade-offs enabled maximizing the number of farms and workers with a good level of the average income per worker (rural vitality), but

at the expense of the use of rangelands (environmental issues). This analysis showed the interest of a diversity of farms in a territory, but also the difficulty to maximize all the services inside a bundle.

### **ROLE OF THE TREE TO ENHANCE THE RESILIENCE OF THE MOUNTAIN LIVESTOCK FARMS**

Tree functions in livestock farms are various: feeding and shelter for the herds, diversification of the incomes, etc. Those well-known functions are a lever to enhance farm efficiency and resilience. This issue came at the agenda of several research and development project in France and in EU those last years. The UMT Pasto has been solicited by the *Chambre d'Agriculture*, farmer advisory service, in *Ariège*, located in the Pyrenees mountain chain and a group of farmers valorising the wood-products from their trees. The project AGROSYL has been built with the UMT Pasto, through the framework of the European Innovation Partnerships, new instruments of European Union to foster the innovation through the synergies between stakeholders. AGROSYL, through a five-year work program, aims to develop the agroforestry practices in livestock farmers, valorising the already acquired knowledge in France and EU, and performing pilot action in *Ariège*. During the first year, we carried on a diagnosis in order to define the pilot actions. The area concerned by the project, in the Piedmont of the Pyrenees, gathered 585 cattle or sheep farms. The objectives were: i) to make an inventory of the trees and their uses in the farms; ii) to appraise the perception of the trees by the farmers, iii) to express the needs of the livestock farmers and the potential technical solutions implying the trees to fill those needs. The diagnosis was carried on through three steps, with meetings gathering farmers, advisors and researchers; face-to-face individual surveys (n=15) with farmers interested by the use of the trees; phone survey (n=62) with a randomly sampling of livestock farmers. The trees are very common in the livestock farms: 91 % of the farms accessed woodlands and 92 % had hedges around their permanent grasslands. On the contrary, only 41 % of the farmers had hedges around their cultivated lands (mostly with temporary leys) and the trees implanted in cultivated land are very rare. Trees are also extensively used: 81 % of the farmers detaining woodlands led their herds in those woodlands; 79 % used wood-products for self-consumption (wood heating, posts for fences) and 25 % considered that wood could be a source of income diversification. The multiples functions of the trees are recognized by the livestock farmers, from the classic one as shelter to enhance the well-being of the animals (92 % of the farmers) to the prevention against soil erosion or carbon storage (57 %). But the trees, hedges or small group of trees inside the grasslands, are also considered as constraints. The main constraint was to burden the workload (67 %). We identified 10 needs and 34 solutions implying the trees. In the end, we chose 5 solutions to be tested through 7 pilot actions with 5 volunteer farmers: i) plantation of fodder tree (n=1), thinning of woodlands to increase forage production and quality of wood (n=3), use of tree-leaves and fruits in woodlands to feed the herd (n=1), use of wood chips as litter to enhance the animal well-being and reduce the purchase of straw (n=2). Those pilot actions will be monitored for at least 2 or 3 years, to get data and build local technical references on those solutions. Visits on the pilot actions farms are also organised with farmers, stakeholders and researchers to disseminate the on-going ideas on agroforestry.

#### ***Rangeland Rummy: designing a new advisory and training tool***

“Rangeland Rummy” is a board game, including a computer model, to help pastoral farmers to develop a collective thinking of changes about their grazing systems, according to various objectives (increasing the herd number or the duration of grazing period, management of climatic hazards...). At the beginning, farmers collectively design a rangeland-based livestock system on a board with sticks depicting the feed resources available for combinations of vegetation types and their management practices and cards defining animal batches and their feeding requirements, throughout the year. Charts and balances are available to test the consistency of the system, enabling a first discussion between farmers and the animator. The second step thus consists in collectively and iteratively designing and evaluating rangeland-based livestock systems, while confronting the players with new contextual challenges or new farmers' objectives. The game have been adapted from a forage rummy developed by INRA (Farrié et al., 2016), through tests with pastoral farmers in *Occitanie*. Applications show that it tends to develop farmers' adaptive capacity by stimulating their discussions and the exchange of locally-relevant knowledge on management strategies and practices in pastoral livestock systems. It is also a relevant tool for training and use in various tracks in Bachelors and Master level in high education at Montpellier SupAgro. Training sessions are also proposed for professional public (advisors, etc.).

### **CONCLUSION**

To conclude, we point that the labellisation of the UMT Pasto by the Ministry of Agriculture allowed a new dynamic of collaboration about researches on pastoralism in France. Gathering the competencies of the three national institutions implied in applied research and education about pastoralism, the UMT Pasto constitutes a research group of critical

size, with a strategic definition of a research agenda. It allows maintaining the potential of competencies about pastoralism in these institutions. It starts a new cycle of collaboration with the stakeholders of pastoralism in order to design research projects and find funds to carry them on. Since its creation, new projects have begun, about the use of information technologies to help to the management of the grazing of flocks on rangelands, the grazing under perennial crops such vineyard or orchards, through relationships between farmers, the grazing of horse on rangelands... After a first 5-year program, the stake will be to maintain those collaborative dynamics inside the group, even without a financial support of the French Ministry of Agriculture. It is a condition to keep ahead the partnerships with a diversity of stakeholders of the pastoralism, in order put at the agenda the news issues relevant to support the resilience of socio-ecological systems based on rangelands.

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