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Indicators of environmental impact in livestock systems (LPM 3)
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Sheep farming systems and environmental management of rangeland in French Mediterranean mountain areas. What challenges for the identification of agri-environmental indicators?

Relations between agriculture and environment are usually tackled from the angle of seeking to limit the negative effects of farming practices, in particular as regards the spreading of pollutants. Concerning herbivore farming activities in the French Mediterranean region, it is essentially the positive effects of farming activities that are envisaged, such as the maintenance of natural spaces by grazing, with a view to maintaining the biodiversity of open environments. It is in this framework that the Natural Regional Park of the Luberon (P.N.R.L.), in cooperation with the pastoral services of local Chambers of Agriculture, has undertaken operations aimed at developing the management of pastoral environments by livestock farming (essentially producers of sheep meat).
Our contribution to thoughts on perfecting indicators of the environmental impact of farming practices will be based on observations made in this context on sheep farms in the P.N.R.L.. In particular, it involves evaluating the contribution of agri-environmental measures in the medium term development of farming practices towards better environmental management of pastoral lands.
We will return in the first part of this text on the context of the study by developing in particular:
- an analysis of questions raised by present environmental problems in the study of farming activities in general and of Mediterranean sheep farming in particular,
- the conceptual framework that we have chosen for the study of farming practices and their transformation,
We will then analyse from a case study how the question of relations between farming practices and environment can be formulated in our area of study (second part).
Finally, we will discuss the form that indicators could take enabling a territorial organisation, the P.N.R.L., to assess, in dynamic terms, the farming practices to support their transformations.

I. Context and problem

I.1. Sheep farming, rangeland management and environment.

As with the whole of national agriculture, sheep farming in the hills of the Provencal hinterland has undergone profound changes over the last few decades. The most noticeable

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feature of this evolution is the emergence of specialised holdings. This specialisation started to operate between the 1950s and the late 1970s in a context of considerable growth for sheep production: a protected national market with insufficient supplies. In the South Alps, farming systems adapted very well to the context of rural exodus and decline. The practice of herding, based on cheap manpower, enabled the freed areas to be made use of without the need for very much investment. The intensification of cultivated forage productions allowed for considerable growth in flock numbers. Measures specific to the mountains, such as setting up the special mountain allowance (in 1974), intended to compensate for the competition handicap with lowland areas, reinforced this situation (Bazin, 1986).
From the end of the 1970s and during the following decade, this situation allowance was brought into question by the establishment of the Common Market Organisation. This European organisation led to the development of international and also inter-regional competition. To adapt to this new context, Bazin and Chassany (1985) describe two ways:

- growth in flock sizes and work productivity to remain competitive and the search for more financially-rewarding markets for regional productions, in particular the production of winter off-season lambs.

- setting up specific systems enabling costs to be reduced, in particular by making good use of pastoral resources that are cheap and available.

These directions were supported by the development of a « mountain policy» and the Estates general of development. These called for the working out of references specific to these areas to make best use of what could be assets. Decentralisation brought the means of regional development programmes to define a type of rangeland management that contributed to the development of the hinterland and to developing new techniques (control of sheep reproduction, for example, to enable off-season production to develop). Until the mid 1990s, it was essentially increase in flock sizes and work productivity that directed development actions. In fact, in spite of the active presence for about 20 years of a development structure dedicated to rangeland management, features specific to the locality, such as abundant grazing land, were never really considered as a competitive advantage by players in the regional sheep sector. During those years, profound changes could be observed in the sheep farms: from the structural point of view, a significant increase in flock sizes and from the functional viewpoint an intensification of forage and the development of off-season lambing. These restructurings of the regional sheep sector showed that it was possible to develop modernised holdings. But there were doubts as to the contribution of these farms to resolving problems of scrub invasion on land less favourable for farming activities, and on their capacity for growth on such resources. So this type of farming did not completely escape what Poux (2004) calls the cerealisation of agriculture. Even if this phenomenon manifests itself in far lower proportions than for other livestock sectors.
All the same, a change in these developments could be seen after the implementation of the common agricultural policy of 1992. Although specialisation and growth in flock sizes continued, it was no longer only in favour of forage intensification. The introduction of the grass premium limited the economic interest of increasing the productivity of land that could be ploughed and made natural lands attractive again. The development of agri-environmental schemes, aimed at favouring the maintenance of natural areas by grazing, accompanied this restructuring both financially and technically. What was happening was the emergence of a « modern management of rangeland », with farmers reincorporating marginalized resources into their production systems, and devising new know-how and innovative practices.

Analysing and taking account of the conditions under which these innovations emerged, and proposing methods to support and assist, are important components of research into relations between agriculture and environment..

I.2. Environment and pastoral farming: how are their inter-relations to be questioned?

Preoccupations of an environmental nature on these lands and expectations as regards agriculture have been specified and organised around the problem of preserving biodiversity. Ecologists have developed numerous inventories to identify sites at risk because they are home to endangered animal or plant species. These observations then give rise to territorial diagnoses enabling lists to be drawn up of farming practices to be encouraged or banned so as to protect these species. Specifications are drawn up serving as a framework for contracts proposed to farmers. As stressed by Mermet and Poux (2000) : from agriculture, these practices which have in common their impact on biodiversity, are presented as lists of disparate items. In particular, little knowledge is mobilised to analyse the farming consistencies which underlie them and then help in their modifications. Very often the end result consists of catalogues of field pattern measures proposed for contracts for the farmers.
Concerning the « natural lands of Mediterranean areas », from the observation that these particular environments have been fashioned by pastoral societies, and that grazing by herbivores plays a favourable role, most of these proposals relate to the development or maintenance of grazing land, including its periods, modalities and intensities, fixing contractually the results to be obtained on the vegetation in terms of the impact of grazing. Although many studies concentrate on this land pattern level in order to work out objective references as to the means of intervention, few of them concern the analysis of reasons for practices used by farmers and what the desired changes involve.
It seems that, in the present context, a widening of these issues cannot be avoided. Beyond questions directly formulated in the matter of environment, farmers are confronted by wider questions of the management of biodiversity in the issue of sustainable development. These new questions require them to come out of this standardised framework which aimed at the detailed study of animal/vegetation interactions to work out the correct standard. It is now a question of looking at support for the transformations of practices over long periods of time. It seems in fact increasingly necessary not to isolate questions of the environmental impact of activities from the definition itself of these forms of activity. This problem of management of biodiversity is based on incomplete knowledge, uncertainty and a necessary taking into account of dynamics. As underlined by Hubert (2002), it is no longer a question « of absolute objectivity of the things of the world » which interests us, but a question of consistency and the management of balance in the long term.

In terms of the study of relations between livestock farming activity and environment, the work of research is not simply to work out new models of land pattern reference to qualify real situations in terms of deviations from this model. The change in farmers' practices is then posed not only in terms of transfer and power of conviction, it is also a subject of study of the relations between agriculture and environmental questions.

I.3. The study of the transformation of livestock practices and environmental questions

This question of sustainability widens the question, which cannot be strictly limited to environment dimensions, but which supposes linking them with economic and social dimensions. The study of capacities for reinvestment by grazing natural areas cannot be

totally isolated from an analysis of the socio-economic mechanisms that have very often presided over agricultural decline and abandonment (Poux, 2004). On the other hand, the sudden emergence of environmental issues in the professional farming sphere sends questions back to farmers in terms of the very redefinition of the meaning of their work (Leguen and Sigwald, 1999, Lémery, 2003). This work of reconstruction which is operating at the very heart of the profession and in interaction with players involved in the environment, contributes to the different arbitrations concerning practices operated by farmers between what seems to them to be possible, desirable, or not to be considered. If investigations cannot be limited to the field usually covered by technical disciplines, the farming systems specialist must nevertheless not abandon this field of investigations to the economic and social sciences. Analysing in what way this new context of agriculture modifies how to approach farming work, C. Laurent et al (2003) underline the interest in tackling it via the farm holding considered as a component of a social system. In this model the practices of individuals are not analysed within the holding taken in isolation, but in association with the social insertion of the farmer. This same author also stresses the weakness of analyses that focus on the technical operation of the holding integrated in a social system, underlining « the difficulty of structuring environmental problems to economic and social dimensions classically treated by this approach. Mermet and Poux (2000) too underline this lack of research concerning the management of biodiversity.

Analysing the change in practices of farmers faced with a problem of water pollution by nitrates, Barbier and Lemery (2000) too, incorporate this social dimension of practices and propose to analyse this change via three dimensions in strong interaction: local practices and standards, the meaning and values of the work, and social integration and professional relationships. The analysis of the process of change then consists of identifying in what way a modification to the conditions of exercising the activity affects these different dimensions of the analysis. This theoretical framework of analysis makes it possible to combine different scientific approaches to work out a comprehensive analysis of the change.

Starting from a methodological corpus used in anthropology (Darré, 1999) and widened to agronomy and animal science (Darré et al, 2004) we propose to characterise the diversity and dynamics of farming practices at the micro regional scale. At this scale, the content of local discussions among farmers has been characterised by the construction of styles in the meaning defined by Van Der Ploeg (1994). These styles are directed at a synthesis of the different positions identified in the discussions: they are distinguished one from another by the argument developed about the appropriateness of such or such a practice and are associated with a system of thought and a particular point of view.

II. Case study.

Under the agri-environmental measure « dry grasslands of the Luberon » which was operative between 1996 and 2000, 23 sheep breeders contracted, from among the 95 livestock farmers that we have listed, grazing on the territory of the National Regional Park of the Luberon (P.N.R.L.). We carried out two series of surveys with these farmers. During the first two years of setting the operation up with contracting farmers, a first survey concentrated on the general characteristics of the holding, and the conditions of its development. The second series, conducted with a sample of 13 farmers, concentrated on the material practices of production management and land use. In 2003 we carried out another series of surveys with 8 farmers who may or not have contracted within the local operation (Mouret, 2003). The objective of these interviews was to characterise, after the event, the farmers' point of view on local

operations implemented on their area as well as on changes in practices and the meanings that they might attribute to them.

The analysis of interviews carried out with farmers in the Luberon makes it possible to characterise three ideal-types, taking account of the diversity of its livestock farms and their respective positions regarding the agri-environmental measure. They all agree in recognising the capacity of their flocks to « clean the hills », according to the reformulation they have of the purpose attributed to livestock activities under this measure. All the same, the pattern of their flock change over time, the professional identity that they have forged for themselves and the system of practices that they have put in place, three dimensions intimately linked with the ideal-types that we have identified, make it possible to understand the different positions taken by these farmers regarding the measure, and the role that can be played by technical objects such as the enclosed paddock and the roller grinder in the changes of practices observed.

II.1 the diversity observed

We distinguished 3 types of livestock farming on the basis of the present characteristics of the farms, their evolutions and the professional history of the farmers. These types correspond to different categories, recognised by the farmers themselves.

The *lamb producers.* In the 1980s, some farmers of local origin organised their flocks with the aim of achieving sustained productivity, basing feed for the flock exclusively on cultivated forage. This situation was made possible thanks to the development of irrigation. They are producers of milk lambs and have adopted a reproduction timetable aimed at enhancing the value of these lambs (lambing in the autumn, even in the summer).

In the last five years, these young farmers have doubled the numbers of their flocks, which presently account for about 1000 ewes. Very often it involves two legal entities: a couple or a father-son G.A.E.C.. At the same time as these increases in flock numbers, the farmers have increased the areas suitable for cultivation by buying or renting land. All the same, because of the lack of available land suitable for cultivation in the area where these farms are to be found (cantons of Reillanne and Forcalquier), it has proved necessary to use rough pastureland for grazing. But the use of these rangeland forage resources must not bring into question the production logic which demands considerable skill in controlling the physiological states of the flock at the key periods of mating and lambing.

In these holdings, flocks have always grazed near the sheep house where they are systematically brought in at night. These habits as well as the care given to the animals restrict the flock's mobility in spite of perceptible management changes.

As the preponderance of cultivated land results in a heavy work load, and they are used to enclosing animals on cultivated areas, these farmers are led to consider the use of rough land essentially in paddocks.

The *new pastoral farmers*. Over the past ten to twenty years, farmers who have come from outside the region where they are now established, and even from outside the farming world, have developed a livestock activity that enables them to manage large-size flocks on a tiny land base.

As in the previous case, the flocks are of the order of 1000 ewes with a recent increase in numbers (installation of partners).

Flock management is envisaged so that it can make good use of the areas that these farmers have been able to mobilise locally (rough grazing or seasonal rental of cultivated fields (grazing catch crops), by organising great flock mobility. In fact, this mobility factor is indispensable, because of the distances to cover between the different fields grazed, the more or less availability of land and the precarious nature of its use (verbal leases).
Contrary to the previous situation, they do not aim at increasing the individual productivity of the animals, and the lambs produced are of the store lamb type, which do not fetch high prices in the "organised" sector.

The *local pastoral breeders*. Breeders of local origin, who have been established for a long time, or who have taken over a family holding and have always maintained a strong pastoral component in the land used. The essential difference with the first group identified, is in the maintenance of this pastoral component.
There are no more than 600 ewes in these flocks, and they have remained stable. The farmer is often the only person working on the holding.
The land used is spatially grouped, but the land status is very variable. In fact, fields in ownership alternate with fields subject to leases or in precarious rental. The flocks are not very mobile except during the summer period of transhumance practised by half of these farmers.

II.2. The nature of discussions on practices

The setting up of the O.L.A.E. (local agri-environmental operations) caused farmers to discuss the place of pastoral areas in feeding their flocks and how to graze these rangeland areas: in closed paddocks or by herding. We will take account of these discussions by characterising positions and arguments that can be attributed to each ideal-type of farmer that we have identified: *producers of lambs, new pastoral farmers and local pastoral farmers*.

The place of rangeland in feeding the flock.
The categories of resources and animals which are associated with them for the different types of farmers, and the argument they develop in this respect, informs us on the manner in which each one conceives the contribution of rough grazing to feeding the flock.
The *lamb producers*, when they present their activity, place great emphasis on the production of off-season milk lambs, justifying this by the needs of the organised sector. They operate a strict segmentation between the sheep housing and the nearby cultivated, often irrigated forage resources, which are associated with ewes at the end of gestation and suckling. The rangelands are associated with ewes that are not in production, defined « by default». Grazing is then qualified as hill cleaning and is not discussed from the angle of a feed ration. The period of use of these areas will result from production choices dictated by the sector. The specific feature of the activity of the *lamb producer* farmer involved in the agri-environmental operation is to combine these two facets of farming thus divided in space and time « *to clear scrub, an animal must be hungry and an animal in gestation or lactation has to be able to eat as much as it wants and the best thing, is one or the other. We try to combine them both*. (B) »

For the *new pastoral farmers*, the farmer's know-how combines flexibility and adaptation to environmental conditions (as against the control and programming of the *lamb producers*). The lambs that follow their dams to pasture will be marketed when they are ready, without any predetermination or alignment with a sector requirement. On the other hand, the sign of excellence is to have a fine flock in all seasons and does not refer to the production of lambs

(incidentally less central than for the *lamb producers*). This does not result in creating the dichotomy of the *lamb producers,* even if it is recognised that it is good in each season to reserve the best of resources for ewes in production. Know-how enables them to face up to various situations and for example have ewes grazing on the rangelands at the end of gestation or suckling. The question of « cleaning the rangelands » cannot be isolated from the coherence of the whole holding, and these farmers contest the idea that the challenge for sheep farming is to combine the two facets of the *lamb producers'* farming method.

Another important dimension that distinguishes the two is the *new pastoral farmers'* vision of pastoral areas as a forage resource which has to be preserved, in particular by grazing practices. The south-facing slopes with aphyllanthes, a fragile, symbolic winter forage resource, crystallise this opposition. Fragile, because overgrazing or grazing in another season can endanger the survival of the aphyllanthes. Symbolic, because it is a plant well-known to shepherds, who incorporate the management of these environments in their « traditional » knowledge, and because it is this type of environment that provides the winter grazing substituted for hay and feed indoors. And these are the symbol of farming that requires investment in time and capital, to which the *new pastoral farmers* are opposed in their idea of work.

For the *local pastoral farmers*, the ewes have to go onto the rangeland, when the cultivated area is being used for cash crops or the production of winter forage stocks (spring summer), or into the sheep housing in winter. This is independent of the physiological stage of the animals. The extension of lambing time associated with the production of milk lambs does not result in creating the division in time and space of the *lamb producers*, and the distribution of feed in the housing when they have to come in for the night makes up for any deficiency there might be in the grazing land.

The ways for using the rangeland : herding or paddocking

For the *lamb producers*, the old practice of joint herding is associated with waste of time and fatigue for both farmer and animals. The creation of closed paddocks enables the ewes to be placed there, and then they are free to do other things, such as for example cultivating forage for lamb production. Peace of mind comes from the knowledge that the ewes will not get out of the paddock, and the length of time of use depends more on the programming in the grazing timetable sequence than on the intrinsic evolution of resources. The farmer's work is limited to helping the ewes to clean the rangeland with the roller grinder, or to arranging the paddock.

The *new pastoral farmers* develop the idea that the work of the farmer (or shepherd) is to guard, « to master the science of herding » and guide the ewes, so that they derive the best from the rough grazing resources. The use of paddocks is nevertheless possible in rare cases, when the limits of knowing how to provide feed are reached, in herding, for example, for particular configurations of rangeland. It is also possible when the forage resource inside the area to be enclosed is sufficiently abundant for there to be a high correlation between the work of creating the paddock and the herding time saved. Nevertheless it will always be considered to be to the detriment of the expression of a specific know-how which constitutes « their own brand » and from their point of view gives them a particular skill in environmental management. This is the main doubt cast over the creation of the « everything in paddocks » practised by the *lamb producers*.

For the *local pastoral farmers,* the use of the rangelands is based on organising grazing in herding circuits, with return to the sheep housing, leaving a wide margin of choice to the

ewes who know what is good for them. In their opinion, paddocks are only justified on cultivated areas, because there is an abundant resource per land unit which justifies the investment in time and equipment. So for these farmers it is an interesting innovation for the grazed and irrigated area of the *lamb producer* farmers, wrongly extended by these same farmers to the rangelands, but only justified by the work load with which they are confronted to cultivate grass for grazing.

The promotion of enclosures by the operators of the measure, continuing actions to develop modern rangeland management, excludes the traditional farmers from the debate. An area for discussion and knowledge-sharing has nevertheless been identified between the *lamb producer* farmers and the *new pastoral farmers* on the highest common denominator between these ideas: the management of dry ewes in paddocks. All the same, the *new pastoral farmers* are attempting to reconstruct knowledge on the interaction between the animals and the forage resource inside the paddocks to feed the ewes as well as possible. The *lamb producers* are more interested in creating enclosures that will keep the animals in the paddock and on arrangements that will help the ewes to clean the scrub and find enough food in this area for as long as it is planned to be used.

III. The system studied and the change in practices indicators.

Our case study shows that the way in which sheep farmers envisage the practices they implement and possible changes to these practices, in reference to the idea they have of their work, depends very much on their history and on the way in which these practices are associated with positions strongly determined by social interactions within local professional groups. In a prospect of change in practices to make them more compatible with the resolution of environmental questions, of which we have underlined the local and developing dimension, the system that we have to study is therefore not just the farmer allocating the means of production which he has available on his holding according to an economic optimum and orders from outside. It is the transformation of knowledge and know-how in local associations in relation with incentives contributing to the reconstruction of technical consistencies by influencing practices it is locally recognised can be implemented. Faced with this essentially multi-disciplinary subject, the livestock research of farming systems is concerned too. Its subject of study is the characterisation of farming practices in their dynamic and diversity in reference to a local technical culture.
In this analysis framework, support and guidance in the construction by farmers of relations between agriculture and environment, in association with the development of technical consistencies worked out by these farmers; assessing the contribution to these developments of public policies, are questions that a territorial authority, such as a National Regional Park, has to analyse. So the indicators of relations between agriculture and environment cannot be limited to measuring deviations from a reference model, very often implicit and worked out in a laboratory, which in the case that interests us would take the form of optimum stocking rates, paddock areas, grazing seasons and the physiological stages of the animals.

In the case we have studied, analysing the implementation of agri-environmental measures only on the short term and according to the immediate impact on the lands grazed, would have resulted in favouring the contribution of farmers from outside the area of study in the form of service provisions, to the detriment of the contribution of farmers whose flocks have had a moderate impact on the vegetation of grazed fields, but about whom our analysis leads us to

think that in the medium term, their production in terms of new know-how will contribute significantly to rangeland management and the control of plant dynamics.

So it seems necessary to us to replace these farmers in the local context of working out reference models to have an assessment of current changes in practices. But it is not a question of developing a complete socio-anthropological analysis of ways of redefining activities, with for example a reconstruction of networks of interrelation of farmers and the content of exchanges. The virtues of an indicator according to Gras et al (1989) is to provide « information on other variables that are more difficult of access and which can be used as a marker to take decisions. We propose from a restricted number of non-directive surveys to analyse the diversity of farming practices at the micro-regional scale by the characterisation of the Local Livestock Farming System (Lasseur, 2001). This is the modality, particular to livestock farming, of a local technical system. It identifies the form and content of the discussions associated with a local technical culture. Its characterisation is based on the construction of ideal-types. Each of these ideal-types expresses a variant in the discussions and is characterised by:

- the identification of what constitutes a set of practice modalities. A system of practices in the meaning of Cristofini et al. (1978), but based on distinctions with a meaning for local farmers.
- links between these modalities and notions of the work.
- the social positions attached to these modalities.

This characterisation makes possible an analysis at local level, a scale of land about which a number of environmental questions are asked. On the other hand, it seems to us that it would make the challenges to farming practices much clearer for all the different people working in local authorities and associations set up to implement environmental protection measures. So we can also think that the discussions would be clearer too.

Werf (2002) proposes distinguishing methods based on indicators of the effects of practices from those based on the practices themselves, i.e. the means implemented. This same author develops the point of view according to which it is preferable to favour indicators based on effects to guide change. We postulate that in the conceptual framework in which we envisage the conditions of change in practices, in other words, considering the people concerned as being parties to working out these changes, these two approaches are complementary and are not substitutes for each other.

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