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Time-space dimensions of farmer practices: methodological proposals from surveys and modelling of sheep farming A case study in southern Massif Central, France

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Abstract

In situations where new stakeholders attribute a growing importance to land uses and landscapes, farming activities are faced with difficult readjustments, notably in less favoured depopulated areas. We propose methodological perspectives on the diversity and adaptations of the farming systems, notably in terms of land use over time. Our fieldwork consisted in several surveys and experiences in participative research in an area of extensive sheep farming (southern Massif Central, France).

We first identify livestock rearing modes with a focus on time-space dimensions of current farmer practices. This notion summarises the seasonal management patterns of flock life and grazing. The rearing modes respond to the functional coherences which structure the technical systems over time. They also help to understand the spatial organisation of farmland.

We then propose a representation of this spatial organisation by means of elementary graphic models called “*chorèmes*”. These models combine convergence patterns towards a focal point with patterns of contrast between plots. Indeed flock movements are linked in particular to the spatial position of sheep sheds and to the herding practices; they are adjusted to the farm’s land layout and to contrasts between plots that are or are not adjacent, fenced, sheltered etc. These insights into grazing management over time aim to contribute to a poorly referenced theme: the land configuration practices as farmer activities.

Changes in land use, as well as in production enterprises, diversification activities, life-styles etc. are a matter of strategic coherence, i.e. of managed relationship between the considered system and its specific environment. In this perspective, we designed a support system, using a GIS, for a concerted local project around a forested estate within the Cévennes National Park. Given the emerging multiple land use projects, farming and rural development needs spatial representations which can foster the dialog between farmers and other stakeholders.

Key-words

land use - land management - farmer practices - less-favoured areas - typologies - graphic model - sheep farming

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Farmer practices shape some of the major relations between nature and society, particularly in less favoured depopulated areas. The maintenance of landscapes and preservation of outstanding habitats are widely acknowledged as relying upon sustainable livestock farming, which is problematic. Even if farmers may still hold most land use rights, these economically marginal areas are now often gaining value for new stakeholders. As a result, farming activities are faced with difficult readjustments.

Based on repeated surveys in an area of extensive sheep production and on experience in participative research, the methodological perspectives we propose here concern the diversity and adaptations of livestock farming systems over time. Our research was conducted in a farming systems perspective, and was "rooted in real-life, on-farm development issues, and on-farm observation" (Gibon *et al.*, 1999). Our work addressed farm functioning, and focused on land use and farmland configuration, a poorly referenced standpoint. This issue needs to be considered in relation with the long-term change in production systems and with the social as well natural environment of farming activities (Osty *et al.*, 1994).

First we examine the functional coherences which emerge from common farmer practices. The seasonal management patterns of flock life and grazing are thus summarised into types of rearing modes. These rearing modes characterise dynamics in sheep farming over time. We then propose graphic models of the farmland layout and use, which highlight principles of spatial organisation. Specific characteristics need to be represented for local land use projects in order to facilitate the dialog between farmers and other stakeholders. We lastly present a support system, using a GIS, which we designed in this perspective.

The case study, its context and stages

Our work was conducted on a depopulated plateau of the southern Massif Central in France, part of which is included in the Cévennes National Park. The Causse Méjan represents a particularly interesting situation for analysing change in the management of a rural area which has become marginal for agricultural production. It covers some 340 sq. km, has less than 500 inhabitants and approximately 60 sheep farms. Half of the plateau offers unique open landscapes and habitats. These are however under threat from scrubs and trees encroaching on the steppe-like grazing land (Lardon *et al.*, 1995).

Our aim is to better understand local current trends in farming activities. It was initially developed as a contribution to the Archaeomedes II Project – on behalf of the European Union Commission's DG XII – which organised multiscalar analyses of the dynamics of natural and anthropogenic degradation of the circum-Mediterranean environment. We participated in a multidisciplinary study whose purpose was to characterise local processes affecting the conditions for farming and their effects on landscape changes (van deer Leeuw *et al.*, forthcoming). We now contribute to the DIVOR-DEF project - a FAIR programme co-ordinated by L. Kazakopoulos – and further develop diagnostic tools for the reorganisation of livestock farming activities.

The three exhaustive farm surveys we carried out in 1975, 1983 and 1992, showed that most farmers have been able to maintain their activities in a changing socio-economic environment. Almost all farmers have increased both flock sizes and production, although in different ways, specialising either in dairy farming or lamb production for the meat trade, some of them developing specific high-quality food products and/or tourist accommodation. While they have built modern sheep sheds and bought milking and forage harvesting machinery etc., most of them have also extended their land sizes, removed rocks and stones from the fields, and fenced their grazing lands to avoid herding.

Given the nature and complexity of the observed change, the "farm trajectories" could not be adequately identified by considering the usual production functions. They were referred to the qualitative notion of technical system (Osty, 1994). From our surveys, we specifically qualified the different ways in which farmers rear their sheep and we obtained thus new insights into the stakes of sheep farming and their dynamics since the seventies. We also investigated the spatial structure and land use on four farms, chosen as strongly contrasting in their production practices and other features

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such as land tenure and ecological conditions. The different patterns of their spatial organisation were graphically modelled using the “*chorèmes*” approach proposed by Brunet (1986). This approach provides a reference frame of the spatial organisation of farmland and suggests land use patterns at the local level. Last, we supported the design and the carrying out of a concerted management project for multiple use of a forested estate. The Cévennes National Park initiated the project, the first-line stakeholders being the owner, three neighbouring sheep farmers and the local representatives of the State Service for Agriculture and Forestry. A GIS was the basic tool for the building of shared space representations and management scenarios.

Change in farming activities : the technical systems and their functional coherences

Since the seventies, farming activities display a wide diversity of responses, in particular regarding production and land use. We assume that this diversity of farm functioning in the long run expresses, and results from, the search for continued functional coherences. These coherences lie at the heart of what we call the technical systems. We thus argue that in coping with the bio-technical constraints involved in managing these hill farms, farmers’ responses have been stable and characteristic enough to be identifiable. In other words, any given farmer implements a technical system as a practical solution to a specific management problem. Our goal is thus to produce a model of this problem, on the basis of observed practices (Osty *et al.*, 1998).

As a hill farming area, the Causse Méjan is subject to weather conditions which demand substantial winter fodder resources. The constraint is especially severe for the 50% of livestock farms producing milk on a plateau where four fifths of the land consist of rough grazing lands, with more or less encroaching woody species. However, farmer practices show synchronic differences and farm trajectories are contrasted. Besides considering farm dimensions and other conventional structural factors, we looked at the contrasts in husbandry practices over time and interpreted them in terms of functional coherences. These technical systems are structured by two strategic axis which mark out respectively the flock life cycles over the seasons and the space-related feeding priorities.

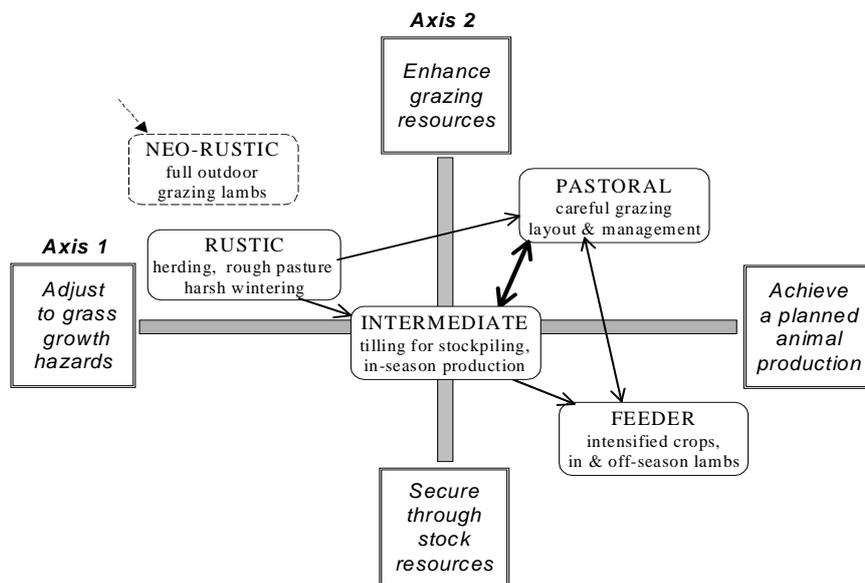


Fig. 1. Livestock rearing modes: strategic axis and features of typical practices.

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Around these strategic axis, we then constructed livestock rearing modes as a synopsis of contrasting choices. For any studied period, these rearing modes express the ways of rearranging and running things so as to secure resources that are vital for the flocks. Discriminating features emerge, in particular from observing lambing schedules, breeding choices, indoor feeding, equipment and land developments. In Figure 1, we schematised the most typical rearing modes - respectively as Rustic, Intermediate, Pastoral, and Feeder -. The sharpest contrast lies between the “Rustic” mode, in which flock life heavily depends on grass growth, and the “Feeder” mode which aims to achieve a planned animal production. In particular, intensive milk production has explicit production objectives and exacting specifications. Quite different coherences base the recent full outdoor “Neo-rustic” mode.

This set of rearing modes characterises the principal dynamics in sheep farming over the last three decades. The main trend since the seventies evolves from the “Rustic” mode to the “Feeder” mode, through “intermediate” steps. But there are different levels for, and different ways of, achieving food security. The “Pastoral” mode thus makes the most of grazing land resources. Generally speaking, in the farm trajectories, the rearing modes reflect in particular the major impacts of changes in the production schedules. The meat producers other than the “Rustic” have often introduced major yet reversible shifts in dates, numbers, and quality of lambs produced, whereas the feed year profile in milk production becomes rigidly constrained by the cheese industry requirements. All of these issues are in direct correlation with forage and crop requirements, and to the corresponding equipment.

Table 1. Rearing modes, main productions and grazing days in 1991.

Main production	Meat				Milk			
	Rustic	Intermed.	Pastoral	Feeder	Rustic	Intermed.	Pastoral	Feeder
Rearing mode								
Number of farms	5	9	13	4	3	7	7	7
Mean number of ewes	284	372	453	518	125	245	284	405
Ewes heads / 100 ha	52	67	84	104	66	62	66	85
Lambs heads / 100 ha	59	84	117	137	76	72	81	106
Milk hl./ 100 ha	-	-	-	-	52	74	93	118
Estimated grazing days of equivalent ewe / year	370	250	280	170	260	180	220	125
Grazing days / ha / year	191	168	236	177	171	111	145	104

The rearing modes thus shape the grazing needs at the whole-farm scale, and structure the diversity of situations and farmers’ options concerning shepherding or fencing, managing animal groups or the flock as a whole, deferred grazing etc. The quest for greater animal productivity lowers the yearly grazing uptake of each ewe. But depending on the rearing modes, this trend may, or may not, be compensated for by growing stocking rates (Table 1). Modernised animal husbandry interestingly may coincide with careful management of rough grazing resources. This is an important point in the current debate about livestock farmers’ leeway in coping with the prevailing intensification models.

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The rearing modes also reflect in concrete terms the ways farmer activities adapt to various external constraints over time. Changes in land use as well in production enterprises, diversification activities, life-styles etc. are a matter of strategic coherence, i.e. involve managed relationship between the considered system and its specific environment (Osty *et al.*, 1998). Following Mintzberg (1987), we consider the strategies realised rather than the production plans declared. Constructed from farmer practices, the rearing modes point to investigations needed into strategic coherence. This coherence of course implies watchfulness on added value and flexibility in coping with unstable markets and varying subsidies. It also implies co-ordination with other uses and new users of land. Spatial dimensions of farming activities are also social dimensions.

Spatial organisation in farming: proposals for graphic modelling via “*chorèmes*”

Our hypothesis was that spatial features are involved in the practices which livestock farmers use to manage their territory both in dairy production for the cheese industry and in extensive meat production (Osty *et al.*, 1994). Given the land cover heterogeneity, when extending their territory livestock farms often need far-reaching spatial reorganisation. About this process, few references are available to date. We undertook to identify the underlying organisational patterns and principles, and to represent them in spatial terms.

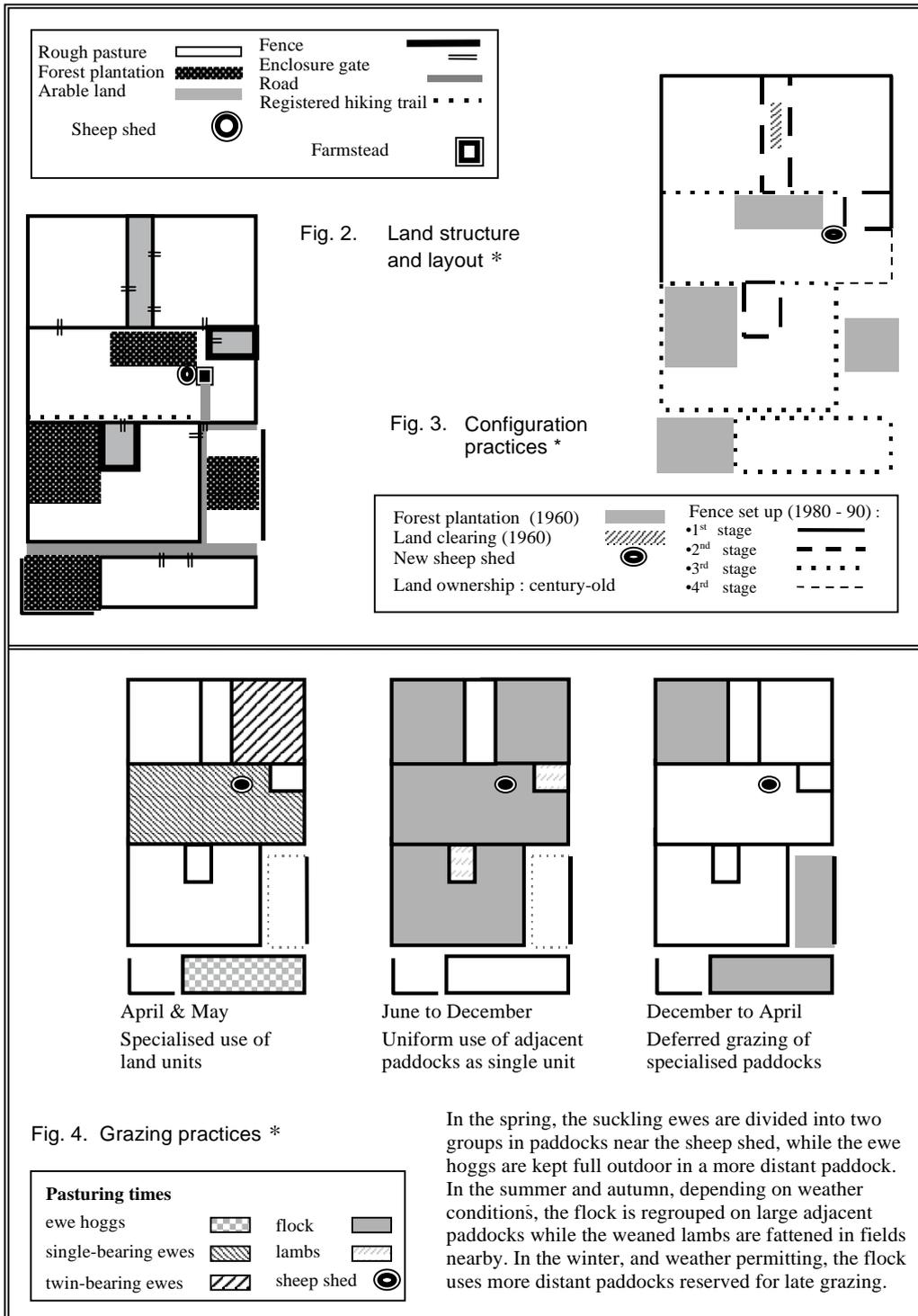
First we represented the spatial organisation by the farmland structure, showing the layout of plots with their vegetation cover types, and also locating sheep sheds, tracks, shelters, fences and obstacles, gates and watering points (Figs. 2, 3 & 4; from Naitlho, 1997). These features and facilities are related to spatial practices and we distinguished between “use” practices and “configuration” practices. The former are the ways in which livestock farmers call on and allocate resources during a campaign, and include cultivation, pasturing and land maintenance practices. The latter are the ways in which farmers transform an area over years, and include the different ways they build up and develop their farmland.

Common farmer operations can be assessed from two main standpoints. On the one hand, flock movement depends on whether the flock overnights indoors, the ewes are milked, the flock is herded etc. The closeness and the central or peripheral position of sheep sheds are key points. On the other hand, grazing and other operations succeed each other depending on whether different or similar plots have specialised use, whether some animal groups are grazed separately, etc. Depending on contrasts within the plots and between plots that are adjacent or not, these practices may or may not favour uniform grazing intake and impact over time.

Focus and contrast thus appeared to be the two main principles underlying the spatial organisation of the studied farms, and we represented this organisation by means of “*chorèmes*” (Naitlho & Lardon, 1999). These are graphic symbols modelling both the observed elementary space forms and their functional meaning; their combination gives an account of any space configuration (Brunet, 1986). Previously we contributed to show the efficiency of this modelling for representing contrasted farming activities at different scales (Deffontaines *et al.*, 1994). From the functions of farm lands in the studied sheep farms, we worked out six basic “*chorèmes*” which symbol convergence patterns towards a focal point, and patterns of contrasts in spatial differentiation (Fig.5). A combination of “*chorèmes*” thus provides a reference frame for the spatial organisation of the farm.

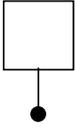
Organisational principles rather than specific characteristics thus are highlighted. This offers an original method for comparing farm lands, which we intend to develop for the design of new farmland configuration. Two important issues are involved: labour needs and long term land management. As farms tend to control vegetation dynamics less effectively, landscapes such as those of the area we investigated, come under increasing threat from scrub encroachment. The process of designing future farm developments would be much helped by highlighting land organisation in a range of real situations. Understanding the spatial combinations of farming practices may also lead to new ways of assessing land management patterns at the local level.

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* Case-study: a meat producing farm on the Causse Méjan, with a “Rustic” livestock rearing mode.

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Fig. 5. Basic "chorèmes"		Basic forms Surface (block) Line (track) Point (sheep shed)			
Principle of differentiation		Degree of differentiation			
		none		strong	
Focus	central		radial		concentric
	peripheral		sectored		gradual
Contrast	no focus		strung out		chequered

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Local land management: accompanying the design and implementation of a project

The studied land management project initially addressed the concerted silvopastoral use of a forested estate. We proposed to include the land use plans of the neighbouring farmers into the project and to use a GIS tool for identifying and characterising the total area concerned by the project. Our aim was to accompany the design and implementation of an integrated management project (Barthès & Lardon, 1998).

The study did not only involve the owner of the estate and the farmers, but also administrative bodies such as the Cévennes National Park, who initiated the project, and the Forestry Service charged with administering the forest management plan, and a working group including the research team. One key achievement has been the creation of this ad hoc working group comprising technicians of different institutions, and their effective co-operation. This informal setting built around the GIS tool firstly explored the stakes, conditions, and impacts of different management options of the concerned area, at relevant time-space levels. Initially the situation involved an informal agreement by the landowner to the grazing of flocks from the neighbouring farms, despite current forest regulations. The situation evolved when the working group succeeded in convincing the Forestry Service officer to discuss the principle of adaptations in the forest management, including forest grazing. Several options were then designed, adjusted and synthesised into scenarios to be submitted for validation to the stakeholders directly concerned - in this case, animal husbandry and forestry, plus landscape interests -. Figure 6 gives a schematic presentation of the steps and successive outputs of the project. Finally a shared scenario was proposed.

Such territorial management projects are emerging, notably in the framework of contract procedures which involve farmers and diverse agencies from the local level upwards. These procedures are rather new in France, and relevant spatial representations are missing, by lack of data, of framework, and of support media. Beyond the local project design, we clarified the functionality of GIS tools and the expertise of the GIS practitioner. GIS use involves skills and use costs, which need institutional support, since grass-root actors cannot afford to pay for this service. The required setting also needs legitimacy bases. Moisdon (1997) argues that any design of instrumentation for management relies on a co-ordinated action, and consequently involves a specific organisation. Our task is indeed broader than that of producing maps of management options.

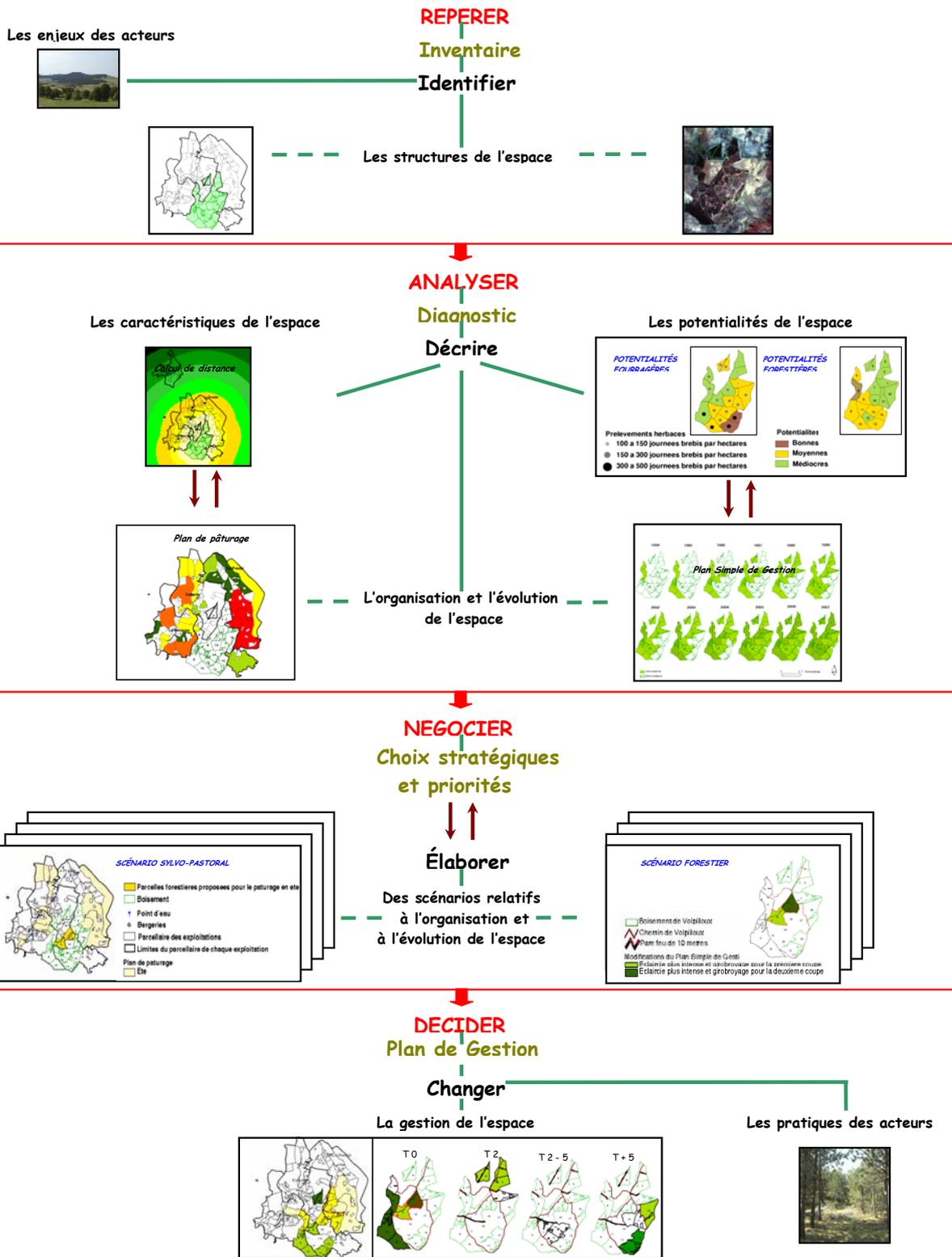
Following Jeantet (1998), such representations of space can be seen as “intermediate objects” in a design process, i.e. as objects whose functions consist of representing, translating and mediating. New spatial criteria are needed to bring together heterogeneous statements about the areas concerned, the first challenge being to create a common basis of understanding. Mapping work is critical as milestone and as a mean for this “cross learning”. The key issue is how to merge individual projects into a shared operation plan. This process however involves steps with repetitions and even deadlocks. Heterogeneous logic’s may conflict, which GIS will help to pinpoint, without rigidifying them. New standpoints and then room for negotiation will depend on the working group’s ability to identify shared objectives.

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Fig. 6. Design of a silvopastoral management project: main steps (reproduced from Lardon & Barthès, 1998).

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Perspectives

At a time when a great diversity of groups and institutions are expressing concern over changes in rural landscapes and the valuable habitats within them, we argue that the formalising of the time-space dimensions of farmer practices gives new insights into both the production efficiency and the environmental sustainability of the farming systems. Sheep farming in southern Massif Central seemingly evolves as in the Scottish borderlands where, according to J. Gray (1996), hill sheep farmers “create a distinctive form of production, social world and identity at the same time as they are drawn into, and forge external relations with the European community, whose policies determine the viability of their farms”. Our aim is to identify and assess leeways for farming systems from the study of real-life situations. Based on farm surveys, our methodological tools firstly characterise the livestock rearing modes and the spatial patterns (“*chorèmes*”) of farmlands. These qualitative models are independent of farm dimensions and other conventional structural factors. They shed light on renewed specific skills in handling herds and managing grazing lands. For instance, they pinpoint situations where high feeding standards do not preclude high grazing pressure on rough grazings. A key issue for farmers and development agents is indeed how to plan a convenient layout and to design an adjustable management of the grazing areas. New time-space references are required there, given the need to control vegetation dynamics. This issue furthermore involves local co-ordination, since farmers’ initiatives always interact with other land uses and other users. In this respect, we have gained a promising experience with the use of GIS for a concerted local project of multiple land use. Beyond the needed mapping formalisms and instruments, what is targeted is co-operation support tool. In the process of designing management projects, the stakeholders should be enabled to react, adjust, propose...

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Résumé : Prendre en compte les dimensions spatio-temporelles des pratiques des agriculteurs : propositions méthodologiques issues d'enquêtes et de modélisations d'élevages ovins (Sud Massif Central, France)

Là où l'usage de l'espace prend de nouvelles valeurs pour de nouveaux acteurs, les activités agricoles sont confrontées à des difficultés d'adaptation, en particulier dans les zones défavorisées. Nos propositions méthodologiques concernent la diversité et les adaptations des exploitations au delà du court terme, notamment vis à vis de l'espace. Nous nous basons sur des enquêtes répétées et des recherches participatives en zone d'élevage ovin extensif dans le sud du Massif Central français.

En nous focalisant sur les dimensions spatio-temporelles des pratiques courantes des éleveurs, nous identifions d'abord des modes d'élevage. Ces modes d'élevage synthétisent les façons dont les éleveurs gèrent les calendriers saisonniers de la vie du troupeau et du pâturage. Ils répondent à des cohérences fonctionnelles qui structurent les systèmes techniques en longue période. Ils aident aussi à comprendre l'organisation spatiale de l'élevage.

Nous proposons ensuite une représentation de cette organisation au moyen de "chorèmes", qui sont des modèles graphiques élémentaires. Ces modèles combinent des modalités de convergence autour d'un pôle et des modalités de contrastes entre parcelles. En effet, la circulation des troupeaux est fonction en particulier de la position des bergeries et du gardiennage, et elle s'ajuste à l'agencement des espaces de l'exploitation et aux contrastes entre les parcelles qui ont, ou non, proches, clôturées, abritées etc. Ces aperçus de la gestion du pâturage au cours du temps visent à contribuer à un thème peu référencé, celui de la configuration du territoire par les pratiques des agriculteurs.

Les changements dans l'usage de l'espace, de même que dans les productions pratiquées, les activités de diversification, les genres de vie etc., impliquent une cohérence stratégique, c'est-à-dire la gestion des relations du système avec son environnement spécifique. Dans cette perspective, nous avons conçu un dispositif utilisant un Système d'information géographique (SIG) pour aider un projet local de gestion concertée, à propos d'un domaine planté à l'intérieur du Parc National des Cévennes. De fait, l'émergence de projets d'usages multiples de l'espace révèle le manque d'outils de représentation à même de favoriser le dialogue entre les agriculteurs et les autres parties prenantes.

Mots-clés : utilisation de l'espace, pratiques des agriculteurs, zone défavorisée, typologie, modèle graphique, élevage ovin

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