Thesis report / Mémoire de fin d'études

Constructing the link between pastoralism and biodiversity:

Role of research on the social representations of biodiversity in the Massif des Bauges, France

Construire le lien entre pastoralisme et biodiversité : rôle des recherches dans les représentations sociales de la biodiversité dans le Massif des Bauges, France

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Summary

This study, carried out in the Massif des Bauges, France, proposes to enlighten the construction of an environmental issue: the effects of pastoralism on biodiversity. The Massif des Bauges is a case where several local actors acknowledge positive impacts of pastoralism towards biological diversity. The Massif is also the "workshop site" of a research network – "Réseau Herbivorie" – that regroups several units of scientists around the questions of interactions between herbivores, habitats and human activities. This study then proposes to explore further the way local actors in the Massif des Bauges perceive the link between pastoralism and biodiversity and to identify whether the presence of researchers has an influence on this perception. Following a constructivist approach, we assume that social representations of pastoralism and biodiversity might influence the way local actors understand this issue and focus our investigations on the construction of representations of biodiversity among different categories of actors (users of natural resources, nature protectors, nature and territory managers) in the Massif des Bauges. The research mobilises different elements of the theory of social representations, (notions of anchoring/objectification, bi-dimensional model of Moliner (1996)), an empirical model of representations of biodiversity developed by Buijs, Fischer et al. (2008), as well as elements of network analysis, in order to enlighten the interactions between three concepts: organisation of the research networks, social representations and attitudes towards biodiversity management. The results are based on 24 semi-structured interviews carried out between March and June 2008 on the territory of the Parc Naturel Régional du Massif des Bauges. We first find out that "Réseau Herbivorie" can hardly be seen as a network but is straddling on two research constellations, respectively focussing on the pastoralism/environment and herbivores/environment relationships. Different relational patterns between actors can be highlighted in these constellations, in particular, hunters' active involvement in the research and farmers' more moderate interest. We also see that the research constellations have an influence on actors' relationships in nature management arenas. The interviewed local actors understand the concept of biodiversity according to its scientific and political definitions, modulated by daily experiences with nature and anchored in pre-existing representations of nature. Although notions of classical and modern sciences of ecology are entangled within these representations, scientific works carried out in the Massif des Bauges do not seem to have a significant influence on the way local actors describe and evaluate biodiversity. The diversity of representations across and within social groups can be noted Social representations of biodiversity and pastoralism are determinant in perceptions of pastoralism/biodiversity relationships. Representations of biodiversity and nature generate positive and negative attitudes towards issues such as the arrival of the wolf in the massif or landscape closure. These attitudes, combined to images of pastoralism, tend to emphasise the positive effects of pastoralism on biodiversity. Biodiversity is also considered as an asset, from which farmers can benefit. Nevertheless, farmers and hunters also see biodiversity protection as an external threat imposed by ecologists and scientists. Our findings echo back other results on social representations of biodiversity, in particular their anchorage in other representations and the strong link between representations and attitudes towards biodiversity management. We also tend to highlight the diversity of representational elements that suggests that the representation remains unstable just like local actors' role in biodiversity conservation. Research might then contribute to constructing this role or identity. The study concludes on the agreement of interviewed actors on the positive effects of pastoralism on biodiversity that seems to be less influenced by scientific knowledge than by social representations of biodiversity and images of pastoralism. It shows the usefulness of the method of interviewing and of network analysis in the description of social representations. Finally, the study suggests the importance of considering different values and beliefs about biodiversity, as well as opening research networks to non-experts in order to build more just nature management policies.

Chapter 1: Introduction

1.1. Problem statement

1.1.1. The end of all-mighty science

Modern societies have to face complex and unstructured problems that technocracies fail to define and master. Scientists, initially considered as legitimate truth-speakers, are nowadays actors involved in political processes, where they still have a form of legitimacy but are also in interaction with other stakeholders. Scientific knowledge cannot be considered as outside society but is the object of a social construction and remains embedded in political discourses. According to Hufty (2006), scientists have an ontological and epistemological role and are intricate in power relations. Scientific knowledge can then be used by stakeholders in order to defend their own interests.

Environmental issues are examples of these complex and unstructured problems that cannot be grasped and solved through simple leverages. The uncertainties surrounding these issues lead to an evolution of environmental concerns towards the notion of risk since the 70's (Granjou 2003). In environmental issues, the evaluation of risks is complex and can only be partially determined by the scientific community. It is also not possible to technically establish thresholds, under which the risk would be insignificant (Granjou 2003), what questions the actual role of experts in decision-making. Social values and interests are then important elements that have to be taken into account to determine the risks acceptability. Therefore, experts do not occupy an established hegemonic position anymore but have to deal with other actors claiming a stake and articulating their discourse on the basis of different values and types of knowledge. More than a fight between simple interests, conflicts over nature management and use of natural resources are an arena in which world views are confronted and contribute to the definition of problems and possible solutions (Aubertin, Boisvert et al. 1998).

1.1.2. Nature images at the heart of environmental management

Environmental conflicts can then be interpreted as debates of different views of what nature is and should be. Kaltenborn, Bjerke et al. (1998) and Daugstad, Svarstad et al. (2006) suggest that different values or beliefs concerning nature, and particularly the place given to human beings in nature, are often central in conflicts over the use of natural resources or in the establishment of protection and management plans. Numerous studies acknowledge nature as a multidimensional notion with which different social groups can associate dissimilar images (De Groot and Van den Born 2002; Buijs, Pedroli et al. 2006; Fischer and van der Wal 2007; Soini and Aakkula 2007). Interestingly, the authors try to relate these images of nature to different views on nature management. Larrère (1999) retraces the history of the conceptions of nature. He shows how different visions of nature influence what we consider as important to emphasize in nature (e.g. its integrity vs. its adaptability), leading to different modes of protection and/or management. More concretely, several studies show the impact of lay people's visions of nature on their preference in terms of nature management options: some studies show that people's landscape preferences are related to their perception of what nature is and should be. De Groot and van den Born (2002) show that people's vision of nature (images of nature and images of the appropriate relationship between nature and humans) is related to the type of landscape they prefer. Landscape management is thus directly influenced by what people call nature and how they see humans in this nature.

Moreover, other studies document the relationship between people's values, beliefs and value orientations towards nature and their attitude in terms of nature and biodiversity management. Harrison, Burgess et al. (1998) show that lay people's understanding of nature

conservation goals and policies is different from scientists' and policy-makers' visions as they base their understanding on their daily experiences with nature, such as the importance of ordinary species encountered around their dwelling or work place for farmers. Michel-Guillou and Moser (2006) also evokes the importance of individuals' values (anthropocentric vs. biocentric values of nature) on their attitude and behaviour towards environment. Similarly, Manfredo, Teel et al. (2003) show that utilitarian value orientations are "associated with more severe responses to wildlife". Buijs, Fischer et al. (2008) also highlight that attitudes concerning biodiversity management are rooted in their social representations of nature and biodiversity.

The debates surrounding the question of compatibility of human activities and nature conservation is thus related to the confrontation of several visions of the relationship between nature and culture, opposing, in particular, the supporters of pristine nature or wilderness in which humans can only generate damaging effects, and the defenders of a vision defining nature and culture as interfering and envisaging a possible beneficial impact of human activities on nature.

1.1.3. Shifts in ecology and adoption of biodiversity as a norm for action

The science of ecology has seen shifts in its fundamental paradigm. Indeed, in the 80's, this science, dominated by Oduman ecology, was based on the climax theory and nature managers tended to seek for the stability of the ecosystems and the preservation of wilderness. In the 90's, a dynamic understanding of natural processes was recognized. Then, nature is perceived as continuously submitted to perturbations, including human disturbances, a shift that leads to the partial acceptance of the interaction between nature and culture. Acknowledging human disturbances as normal perturbations of natural processes also implies the need for developing new indicators to measure the impact of human activities on environmental qualities as well as ecological knowledge that will not simply "describe natural mechanisms but have the ambition to help to manage nature[1]" (Larrère 2004). The shift causes a change in the status of biodiversity in nature conservation. Oduman ecology recognized biological diversity as a means that enabled to maintain the stability of ecosystems. In the modern current of ecology, biodiversity becomes an end to achieve because of its crucial role in the adaptability of ecosystems and therefore can be seen as an indicator of ecological quality. In consequence, biodiversity is introduced as a norm for action (Larrère 2004), as an indicator enabling to measure the impact of human activities on nature (Hull, Richert et al. 2003; Caillon and Degeorges 2007) and to adjust these activities in order to reach a desirable state. Paradoxically, the concept of biodiversity generates two contradictory consequences:

First, since the 1992 Earth Summit in Rio de Janeiro, biodiversity has been acknowledged to be a common patrimony, a common interest (Mougenot 2003). The adoption of this concept as a norm for action invites then to the involvement of scientists and non-experts, to the establishment of participatory decision-making processes and collaborative management in order to guarantee the fulfilment of a plural common interest that a central technocratic State cannot reach anymore (Claeys-Mekdade 2003).

Nevertheless, the term biodiversity is fuzzy and can be subject to multiple interpretations. It is first difficult to measure biodiversity: its evaluation is already embedded in social values and "value scales" (Larrère 1997). Moreover, protecting biodiversity can be synonymous with preserving one single species for its key role on an entire ecosystem, but also with protecting cultural diversity which has shaped current landscapes, fauna and flora (Hufty 2006). Biodiversity, by providing arguments for both supporters and opponents of the domesticated and utilitarian nature, thus, for claims related to different values (Hull, Richert et al. 2003), constrains the opportunities of participative management and provides

[1] Own translation

arguments for new controversies. While, at first, biodiversity seems to represent a common interest for different groups displaying dissimilar values towards nature, the emergence of this concept can also be source of conflicts that emphasize the presence of these different values and relaunch the debates surrounding them.

1.1.4. When biodiversity enables science to strike back

Although scientific knowledge cannot be considered as objective truth and scientists do not tend to be the only experts anymore, they keep a seemingly legitimate role in prevention and are able to study and explore the environment in its complexity. The increasing importance of considering social values and interests in risk management and in constituting democratic political processes to define problems and solutions in a pragmatic and socially acceptable way do preserve a significant role of science: in situations where no objective knowledge can be told, scientists have to enlighten the uncertainties, to enlarge the range of arguments in controversies in order to "open the discussion instead of closing it" (Granjou 2003). Scientists take then more than ever a decisive role in participative decision-making as they might provide for new arguments and counter-arguments, allowing so far silent actors to make their voice heard.

More precisely, the emergence of biodiversity in environmental debates reinforces scientists' position. They indeed still have an important weight in controversial situations. We saw that biodiversity constitutes a common interest which protection can be claimed by several stakeholders and may lead to new conflicts. Scientists take then a role of arbiter and their knowledge remains a precious resource that stakeholders can mobilise to promote their interests in the name of biodiversity.

Moreover, the term biodiversity tends to rationalize nature protection, to erase the affective motives for conservation that were at the basis of the associative preservation of emblematic species (Aubertin, Boisvert et al. 1998). Studying and managing biodiversity requires sophisticated instruments, computerized and automated data collection (Granjou and Mauz 2007; Mauz 2008) which privileges a potentially "confined research[2]" (Callon, Lascoumes et al. 2001) that could exclude non-experts' values and knowledge. Scientists are then still empowered because of their ability to use the language and technologies of biodiversity and are therefore central actors in biodiversity management.

The changes in the science of ecology also necessitate the constitution of new technical knowledge to adapt and evaluate human activities towards the enhancement of biodiversity what justifies the remaining important role of scientists.

1.1.5. Agriculture and biodiversity: an object of controversies

The impact of agriculture on nature is one of these environmental issues that are characterized by its complexity and uncertainties that science cannot solve. It involves several actors from different fields, with dissimilar values and interests, and claiming recognition of their expertise in the debate. Moreover, in Western Europe and particularly in France, agriculture and its relation to nature has been the object of controversies, alternatively emphasizing its responsibility for environmental damages as well as its potential crucial role in managing nature, from the farmer polluter to the "landscape gardener". As a consequence of the shifts in the sciences of ecology and the adoption of the concept of biodiversity as a common objective to environmental policies and a norm for action, nature conservation does not necessarily entail the exclusion of human activities anymore. It is indeed recognized that human activities and in particular agriculture have also contributed to enhance biodiversity through the construction of rich agro-ecosystems and the creation of new varieties and races (Larrère 1997). Nature conservation requires then the redefinition of traditional lifestyles towards the development of practices which preserve and improve

[2] Own translation

biodiversity (Fleury and Larrère 2006; Michel-Guillou and Moser 2006; Caillon and Degeorges 2007). Thus, agriculture is increasingly considered as a possible tool for nature conservation. Indeed, the attribution of European subsidies on a voluntary agreement and the agro-environmental contracts based on an obligation of result, without inspections of means, reflect this new trend towards the devolution of more trust to farmers and the promotion of agriculture as an environmental solution. Nevertheless, considering the scientific uncertainties surrounding the impact of agriculture, in particular the effects of pastoral activities, on biodiversity, the support given to agriculture is subject to controversies. The role of agriculture in the protection of biodiversity is then characterized by its social nature and is constructed by different actors from the scientific, political, environmental and agricultural fields.

1.1.6. Agriculture and the case of Massif des Bauges

The Massif des Bauges is a specific case where we can observe a particularly successful promotion of agriculture as a nature management tool. This area, situated in the "départements" of Savoie and Haute-Savoie (appendix 1) and surrounded by the urban areas of Chambéry, Annecy and Albertville, has been classified as Parc Naturel Régional (Natural Regional Park) since 1995.

In this area, several local institutions such as the Chambre d'Agriculture (local agricultural office) and park managers actively promote the development of pastoral activities in the Massif and thus tend to show and put emphasis on the positive impacts of agriculture on biodiversity with the development of three policy plans: the charter of the Regional Park, the Natura 2000 target documents or the Local Plan for Space Management (Plan Local de Gestion de l'Espace). These plans demonstrate an apparent common willingness to stimulate the development of pastoral activities in some areas of the Massif without major contestations, even though several institutions and individuals have a stake in the management of the area: park managers, hunting reserve managers, mayors, farmers, hunters or associations for nature protection. This seemingly consensus in policy plans can be explained first by the particular case of French mountainous massifs affected by several waves of rural exodus reflected in a constantly decreasing number of professional farmers which arouses a phenomenon of landscape closure on the abandoned pastures. This problem, identified as a possible factor of biodiversity erosion (Steinfeld, Gerber et al. 2006), becomes more meaningful since the Rio summit. Then, agriculture, and particularly the effect of grazing on the vegetation dynamics, emerges as a potential solution, evoked by different actors, from environmentalists to farmers, under the umbrella of biodiversity protection. Moreover, pastoral activities appear as an attractive solution compared to mechanical tools or non-professional use of domestic herds, targeted towards specific environmental objectives, because of the dynamism of agriculture in the Massif des Bauges. Agriculture benefits from the support of the PNR and from the classification of a local cheese under the AOC quality label (Appellation d'Origine Contrôlée – Appellation of origin) which relaunched dairy farming and provoked a trend of pasture-hunting among farmers.

Nevertheless, it seems interesting to study more precisely the extent of the agreement and to identify possible opponents of agriculture promotion through biodiversity conservation policies. Although the policy plans show a tendency to present pastoralism as an environmentally and economically desirable solution, they concern only some parts of the Massif. Actors like natural patrimony conservatoires in charge of other Natura 2000 areas or associations for nature protection might then have developed a more radical conservationist vision that is reinforced by the scientific uncertainties, which surround the interactions between pastoralism and biodiversity. Oppositions towards biodiversity conservation policies that promote pastoral activities might emerge from such groups of actors.

One can notice that the actors who adhered to the promotion of pastoral activities often evoked in previous interviews, carried out in 2007, the presence of researchers in the Massif and referred to their work to legitimate some of their favourable positions towards agriculture. It seems then that the apparent consensus observed in the policy documents

might be linked to the existence of a research network studying, among others, the impact of grazing on the vegetation dynamics and on biodiversity in general and the agronomic validity of the restoration of pastures in the Massif. The development of this network called "Herbivorie", which designated the Massif des Bauges as "workshop site[3]" (Herbivorie Info, June 2007) could be a key element in the adhesion of some actors to a discourse which defines agriculture as compatible with nature conservation. This network can then possibly provide elements that could justify discourses on the positive or negative role of agriculture on nature and contribute to local actors' attitudes towards the use of pastoral activities as tools for biodiversity management. In particular, previous interviews suggest that the presence of the network and the diffusion of research results initiated a process of conviction of farmers towards the agronomic value of abandoned pastures that was considered as a priori poor, considering the classical references (Mestelan, Agreil et al. 2007). The setting up of an on-the-field experimentation was especially perceived as a key element in the network. This experimentation, taking place in the hunting reserve of the Massif, consists in the restoration of the abandoned pasture of Armène through the reintroduction of professional pastoralism. This pasture represents then a laboratory for scientific knowledge production and an arena of exchange between scientific communities, experts and users of natural areas.

The presence of the Herbivorie network might then contribute to structure the controversy surrounding the impact of pastoralism on biodiversity. By bringing technical information, creating networks and inspiring new ways of thinking farming and biodiversity protection, it can possibly question local actors' attitudes, beliefs and values. Indeed, the relationship between agriculture and biodiversity can *a priori* be regarded as a technical issue but also includes social components as it touches people's perception of what biodiversity is and should be, and how to reach that desirable state. For instance, the formulation of landscape closure as a problem does not imply only technical and scientific knowledge about the phenomenon but also values towards nature. In the Pyreneans, Le Floch, Deuffic et al. (2006) show that there is a diversity of perceptions of the vegetation dynamics among public actors and inhabitants They conclude that the several perceptions and formulations of the issue that are observed in their study can be explained by different world views and in particular by dissimilar visions of the relationship between nature and human beings, and the place of humans in nature management. These visions then guide people's preferences in terms of biodiversity management options, i.e. which interventions are necessary and the possibility or not to envisage human activities such as professional agriculture as a solution to enhance biodiversity (and which biodiversity?). Consequently, it is interesting to focus on the interactions between scientists' presence and underlying visions of nature and understandings of biodiversity displayed by local actors. Can we establish a link between scientists' presence and activities and the way local actors understand biodiversity, in particular their familiarity with this concept and their perception of the relationships between agriculture and biodiversity?

1.2. Objectives and research questions

1.2.1. Objectives

This study, carried out in the frame of an internship at the research organisation Cemagref Grenoble and of a master thesis at Wageningen University combines two topics:

- The potential influence of research networks on the way local actors of the Massif des Bauges perceive the effects of pastoralism on biodiversity and the construction of a possible consensus around positive impacts of pastoral activities on nature. This topic is particularly related to Cemagref interests.

[3] Own translation

- A description of local actors' social representations of biodiversity which is more in relation with the thesis work.

The study intends to enlighten the construction of an environmental issue, the controversy concerning the relationship between agriculture and nature conservation and more particularly the effects of pastoral activities on biodiversity management. We aim at exploring the particular case of the Massif des Bauges, where two hypotheses related to the pastoralism/biodiversity controversy can be formulated:

- A consensus about positive effects of pastoralism on biodiversity might exist among the local actors of the territory. The term "local actors" regroups different stakeholders from nature users (farmers and technicians, foresters, hunters) to nature protectors and territory managers (Park agents, nature conservationists, mayors) which activities are settled on the territory of Natural Regional Park of the Massif des Bauges.
- The presence of a network of researchers working on the interactions between herbivores, habitats and humans might be responsible for this consensus.

The objective consists then in exploring these two assumptions by first describing the organisation of the research network and its possible relationships with local actors and then through the analysis of these stakeholders' perceptions of the interactions between pastoralism and biodiversity.

A second more theoretical objective of the research is to get insight into local actors' appropriation of the concept of biodiversity. The goal is to understand how these actors represent biological diversity and how these representations might influence their attitudes towards biodiversity management.

1.2.2. Research questions

General research question:

To what extent might the presence of researchers – working on the interactions between herbivores, habitats and humans – have an impact on local actors' perception of the interactions between pastoralism and biodiversity in the Massif des Bauges?

Specific research questions:

1. To what extent are local actors (nature users, protectors, managers in the Massif des Bauges) in contact with researchers? How are the research networks organised (actors and relationships)?

2. How do local actors understand the role of pastoralism in biodiversity management and the effects of biodiversity on pastoral activities?

2.1. What are local actors' social representations of biodiversity (who knows about it, how do they define and appreciate it)? Are these representations influenced by the contacts with researchers? How do these representations and other forms of knowledge (scientific, technical) inform their attitudes towards biodiversity management?

2.2. What are local actors' social representations of pastoralism? To what extent are these representations perceived as compatible or not to representations of biodiversity? Is this perception influenced by scientific knowledge?

Chapter 2: Theoretical framework

2.1. The Theory of Social Representations

2.1.1. Generalities

The study will mainly rely on the theory of social representations that will be used to deconstruct local actors' understanding of the relationship between pastoralism and biodiversity.

This theory, initiated by Moscovici in 1961, formulates the hypothesis that individuals react to the world through a medium – the social representations – which enables them to give a meaning to this world, to adapt their behaviour and provides for a common basis facilitating communication processes with others. Studying social representations means then apprehending individuals' vision of the world or the common sense they mobilise in their everyday life (Abric 1994) to understand reality and communicate about it.

Social representations are then tools or a set of knowledge that enable individuals to manage – understand and react to – the "complex stimuli of the world" (Moscovici 1961). First, they form a code that individuals can use to conventionalize the elements such as objects, persons and events (Duveen 2000) of the perceived world. Social representations function as a system of pre-existing categories or types, in which each element can be framed and labelled (Moscovici, 1976). They help then to make sense of the world and to acquire new knowledge (Abric 1994). They are also necessary to the communication. They indeed constitute a common code or a consensual "reservoir of meanings" that individuals mobilise to communicate in a language that others can understand (Moscovici, 1984a; Abric, 1994).

In addition, social representations are prescriptive and "impose themselves" upon the individuals. They condition their ways of thinking by constituting classification systems, images, collective memory (Moscovici 1984a) that constraint what people can perceive and imagine. They also frame people's interpretation of a situation and define what is legitimate to do in this situation. Therefore, they have a function of orientation of attitudes, practices and behaviours by defining and anticipating the character of a situation, and identifying what is acceptable according to the present social context (Abric, 1994). According to Abric (1994), they can be considered as "guides for action".

The term social representation covers actually two meanings. First, it refers to the content of the representation: the elements that compose people's common-sense knowledge and the organisation of these elements. Moreover, social representation also means the process of constitution of the representation of an object or of sense-making in face of a new event or idea. Making sense of an unknown object consists in the reconstruction of this object in pre-existing knowledge, categories and systems of values dependent on the subject. The process of representation leads then to erase the boundaries between object and subject. The object, represented, acquires the characteristics of the subject. According to Abric (1994), overtaking the classical opposition between object and subject is the starting point of the Theory of Social Representations. Indeed, representations are not mere reflections of reality. In the process of representation, this reality and the objects that compose it are transformed. In conventionalizing an object, the subject tends to modify it in order to make it fit into a pre-existing category, tries to make it become similar to other objects of this category (Moscovici 1984a). Social representations are then a reconstruction of reality including the features of the object and the experiences and norms of the subject, an image of this object that has a specific meaning according to Abric (1994). He argues that the meaning attributed to a representation depends on:

- The history of the individual and its daily experiences, practices and knowledge.

- The characteristics of the social group to which the individual belongs but also the general social, ideological and cultural context that can be punctuated with what Wagner, Duveen et al. (1999b) call “disruptive events” (e.g. the arrival of scientists in the Massif des Bauges)
- The immediate circumstances in which the meaning emerges: the situation and direct context.

The rejection of the separation object/subject also entails that objective reality does not exist but that only represented objects form the reality of an individual or a group (Abric 1994).

Moreover, the construction of representations is not only a cognitive process by which individuals actively reshape reality. It is also a social process which motor is found in communication. Social representations are created and circulate through social practices of “communication and cooperation” according to Moscovici (1984a). Furthermore, social representations are sets of knowledge that are shared by a group and reproduced in collective actions. More than a simple cognitive image, they constitute then a social reality to this group, what leads Jodelet (1994) to define social representations as a “form of socially elaborated and shared knowledge, having a practical perspective and contributing to the construction of a reality common to a social group”. By constituting a social reality that is embedded in the characteristics of the group that creates and mobilises it, a social representation also define the identity of this group and maintains its specificities (Abric 1994).

Social representations are then characterized by their social and cognitive nature. They are also classically opposed to scientific knowledge and reified universes (Moscovici 1984a). Social representations constitute a set of immediate knowledge that people can use to interpret their environment and adapt their reactions to it. Moliner (1996) evokes social representations as “naïve knowledge” that can be differentiated from scientific knowledge. They are indeed seen as obvious knowledge that is taken for granted and consensually accepted. They are associated with a particular way of thinking that is distinct from scientific reasoning: social representations are related to a way of thinking that gives a large role to “linguistic stereotypes”, to a perception of causality based on the simultaneity of two events and to the preponderance of conclusions over reasoning.

2.1.2. The different currents in the theory of social representations

The theory of social representations has been used in a large range of domains, from health topics (Joffe 2002; Goodwin, Kozlova et al. 2003) to political issues (Moliner and Courtot 2004) or environmental studies (Michel-Guillou 2006; Buijs, Fischer et al. 2008) and is also characterized by the differentiation of several currents within the same theory. It is alternatively qualified of ensemble of values, beliefs, attitudes, images, symbols, knowledge or “schemes of action and apprehension” (Gaffié 2005) that a subject attribute to an object and that are translated into discourses and concrete practices. It is therefore at first difficult to have a clear image of which notions the theory covers considering the fuzziness of definitions given in the literature.

A first distinction between currents is clarified by Wagner (1998), who evokes the distinction of “weak and strong versions of social representation theory”. In weak the version of the theory, the object of representation exists independently of the subject. More precisely, this object gets mentally represented by discursive processes, reproduced in practices and almost becomes a “material object” (Duveen 2000). The representation of the object influences the subject’s behaviours in a causal relationship. The strong version recognizes that social representations are reflected in people’s discourses and actions and, in return,

that these talks and practices construct the representations. These representations include characteristics of the object and the subject.

Quenza (2005) also evokes several trends in the theory of social representations and describes four main analytical perspectives:

- a focus on the attribution of meaning to the world, its objects and events
- the analysis of inter-group relations
- an approach based on social representations as discourses
- the structural approach to representation that deals with cognition

We propose to consider social representations as mental constructs, socially elaborated and therefore shared among social groups, that are separated from attitudes and practices although they influence them and enable to justify them. Social representations will then be considered as constituted of cognitions relative to the object of the representation (Flament 1994), which content is structured according to a specific organisation. These cognitions are combined into stereotypes, categories and scripts (Moliner 1996) that are used by individuals to understand the world, the meaning of a situation, to define what is normal and abnormal and what defines an object. We position then our study in a weak constructivist version of the theory of social representations and in the line of the structural model of social representations referring to the works of Abric, Flament and Moliner, and of the approach dealing with representations as systems enabling to make "the unfamiliar familiar" (Moscovici 1984a) and therefore to give meanings to concepts such as biodiversity.

2.1.3. Relating research questions and theory of social representations

The use of the theory of social representation seems to be relevant considering the research objectives as it may allow us to understand the formulation of the relationship between pastoralism and biodiversity, to enlighten the potential role of scientific knowledge and research networks in the construction of social representations. Figure 1 describes the main concepts used in the study and their relationships.

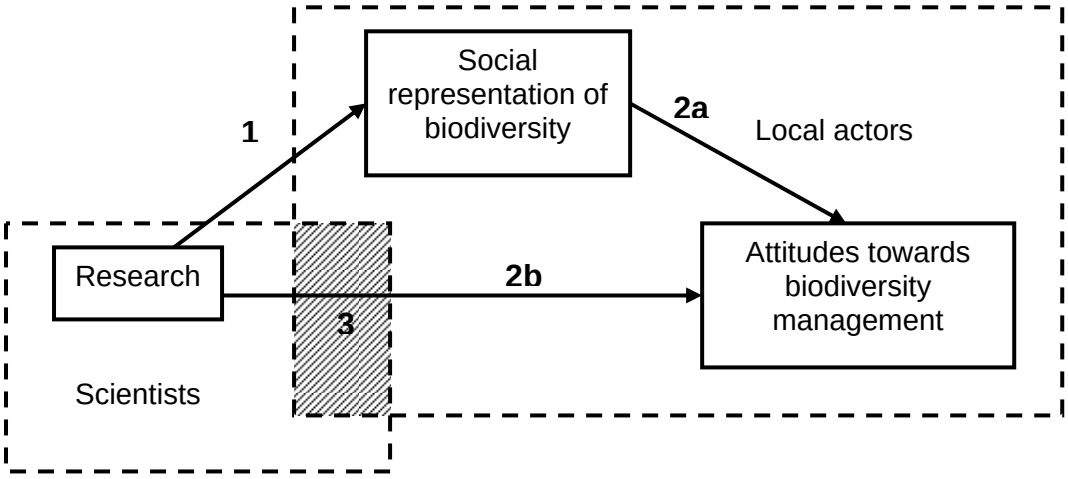

Figure 1: Main conceptual framework

2.1.3.1. Understanding the construction of social representations of biodiversity and the transformation of scientific knowledge: relationship 1 on Figure 1

As we saw, social representation designates the content as well as the process of construction of representations. The action of re-presenting an object consists in transforming it to make it fit the subject's pre-existing system of meanings. A new object will then be modelled in a form that is understandable by the subject (Moscovici, 1976). Moscovici (1984b), quoted by Joffe (2002), affirms that representations are always anchored in other existing representations or in scientific knowledge. Joffe suggests then that the emergence of social representation relies on three main processes:

- The transformation of scientific knowledge into "lay-thinking"
- The use of pre-existing representations (knowledge, values, norms) to understand a new idea
- The "saturation" of the new idea or event through an interpretation based on the "symbolic meanings" existing in a culture.

These processes refer to Moscovici's anchoring and objectification. Moscovici (1984a) indeed evokes two processes by which a social representation emerges or evolves:

- Making the "unfamiliar […] familiar" (Moscovici 1984a) by ***anchoring*** the new object into pre-existing representations (Moscovici 1984a; Wagner, Duveen et al. 1999)
- Crystallising the object into a new image: ***objectification*** (Moscovici 1984a)

Wagner, Duveen et al. (1999a), quoting Bartlett (1928), suggest that innovations always arrive in an existing context of meanings and that cultural groups present a tendency to see reality and new phenomena in a certain way. These processes are particularly important to analyse non-experts' understanding of scientific knowledge. Local actors will then tend to refer to their own knowledge and experiences to understand scientific knowledge and to transform it in order to make it directly usable in their daily life. The active transformation of this knowledge makes Joffe (2002) suggest that lay-people are more than simple receptor of information but can be considered as "lay-thinker".

The use of the theory of social representations may then help us to understand how local actors' knowledge and values about biodiversity are constructed, whether they are anchored in pre-existing representations or are derived from scientific knowledge and particularly knowledge produced by research carried out in Les Bauges. It might also enable us to enlighten how these actors root the information transmitted by scientists in pre-existing representations.

2.1.3.2. Understanding the formulation of the relationships between pastoralism and biodiversity: relationships 2a and 2b

Social representations of biodiversity are a complex network of notions that guides individuals in their behaviour towards it. They indeed highlight what is important in biodiversity, what threatens it, what should be protected and which type of management is acceptable. Thus, they have a latent role in the formulation of the impacts and potential role of agriculture on biodiversity. Therefore, understanding researchers' role in local actors' perception of these impacts requires identifying to what extent scientific knowledge and the research network itself modify their representations of biodiversity.

In this study, the concept of social representations will be used with the notion of attitude. We will regard the relationship between social representations and attitude as causal, social representations influencing local actors' attitudes towards biodiversity management and eventually towards pastoralism in this management. We adopt here the

view of the School of Aix-en-Provence, which is the main developer of the structural approach to representations. Nevertheless, we can note that the link between representations and attitudes is quite contested in the different currents of the theory of social representations.

Some authors define attitudes as individuals' cognitive predispositions, which determine their response to attitudinal objects (Hovland and Rosenberg 1960). Attitude theorists and defenders of the theory of social representations tend then to perceive attitudes and social representations as incompatible: the individual origin and cognitive nature of attitudes is opposed to the social and empirical processes that are central in the elaboration and transformation of social representations.

Nevertheless, we can argue that a change in the definition of attitude could conciliate the two notions. We can define attitudes as judgements towards a specific object that rely on the evaluative components of the social representation of this object (Moliner and Tafani 1997). Social representations of an object like biodiversity, through its normative elements might then inform attitudes towards this object, what is represented by the relationship 2a in Figure 1.

Moreover, we can assume that attitudes might be influenced by other forms of knowledge like technical or scientific information. In order to understand the formulation of attitudes towards pastoralism as a tool for biodiversity management, it is then necessary to consider the potential influence of the presence of research network in the Massif des Bauges (relationship 2b in Figure 1).

2.1.3.3. Describing the structure of social representations

In order to describe social representations and enlighten their possible variety, we will borrow elements of the structural approach to social representations and particularly make use of the bi-dimensional model of social representations described by Moliner (1996).

This approach is first based on the structural dimension of social representations. A representation is indeed characterized by a bipolar structure. Abric (1993) describes a representation as a "hierarchic, coherent system organized around a core". Social representations consist in two complementary systems:

- The core or central system, which is a product of collective values and experiences (Quenza 2005), remains stable, shared by all the members of a group and has two roles: it provides meaning and organizes the elements of a representation. The core elements are absolute or non conditional prescriptions (Flament, 1994).
- The peripheral system, which interfaces between the representation and reality, anchors the representation in reality by associating it with concrete terms (Abric 1994). It is then dependent on the context, modulates, defends and transforms the representations (Quenza 2005). The peripheral elements are generally conditional as they are not absolute prescriptions and are more variable in a same social group. Peripheral elements can present contradictions without threatening the integrity of the representation. They bring flexibility to the social representation and allow its adaptation to a changing reality such as the arrival of scientific knowledge.

We can also quickly evoke the notion of autonomy in representations (Abric 1994). Social representations that are autonomous possess a central system that is centred on the object of the representation. In contrast, non-autonomous representations central system corresponds to the core of another broader representation in which the object is included. This notion can be interesting to study in the light of previous results about social representations of biodiversity. Buijs, Fischer et al. (2008) indeed tend to show that representations of biological diversity are anchored in existing representations of nature and might then depend on these representations.

Secondly, Abric (1994) evokes two dimensions of the core: a functional dimension that orientates action and a normative dimension on which judgements are based. Moliner (1996) shows that this functional and normative dimensions, that he calls descriptive and evaluative dimensions, can be extended to the periphery of the representation. He presents then a bi-dimensional model of social representation, defining four categories of elements as seen on Table 1.

Table 1: Moliner matrix of the bi-dimensional model of social representations (Moliner 1996)

	Descriptive pole	**Evaluative pole**
Core	Definitions	Norms
Periphery	Descriptions	Expectations[4]

The definitions correspond to central cognitions that define the characteristics of the object of the representation: what can be defined as biodiversity?

The norms are cognitions that have a positive or negative value: what is the legitimate form of biodiversity?

The descriptions make the representation operational and diverse and are dependent on individuals' experiences: what does biodiversity encompass?

The expectations designate the desires and perceived threats towards the object: what seems attractive to us in biodiversity?

Nevertheless, this model does not give a clear picture of the representation of biodiversity, especially on the relationships between the way people consider what biodiversity is and their attitudes towards its protection.

Therefore, we will also base our analysis of social representations of biodiversity on the conceptual framework proposed by Buijs, Fischer et al. (2008). This model is founded, on the one hand, on an empirical study about lay-people's representations of biodiversity, general views and specific attitudes towards biodiversity management. On the other hand, it is inspired from previous studies about images of nature which decomposed them into three dimensions: values of nature (what is important and desirable in nature), beliefs concerning the relationship between nature and culture and attributes of nature, value orientations (nature management should be hands-on or off and towards which objective). This framework will indicate us more precisely which points have to be investigated to picture the representation of biodiversity.

Buijs, Fischer et al. conceptual framework of representation of biodiversity, represented in Figure 2 establishes the interrelations between three components:

- Benefits of biodiversity
- Attributes of nature
- Human-nature relationship

Buijs, Fischer et al. show that lay-people refer to these three components to justify their general views on biodiversity management. These general views (hands-on/off management, nature/human-centred goals) correspond to the value orientations in the image of nature framework.

Finally, in a concrete context, these general views lead to attitudes towards specific management measures.

[4] Own translation

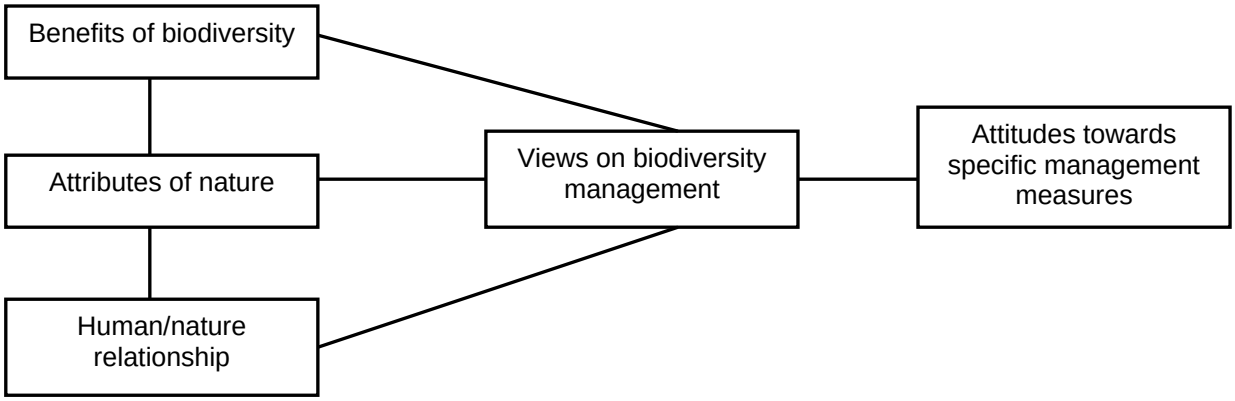

Figure 2: Empirical framework of social representations of biodiversity

This framework will then enable us to establish the connexion between how people see biodiversity (functions, attributes, place of humans in nature) and how they envisage its management, e.g. the possible combination of farming activities and biodiversity conservation. The combination of this model with the Moliner matrix might facilitate the visualisation of variability in the representation and the relative importance of its three components in the representation.

2.2. Network analysis

According to Wagner, Duveen et al. (1999b), social groups never live in isolation and their natural and social worlds are subject to the influence of external events and other social groups. Understanding changes in social representations requires then the identification of these events and of the networks in which a social group is involved. The study of these networks is particularly useful as social groups always define their representations in relation to other groups. Wagner, Duveen et al. (1999b) suggest that social groups' understanding of phenomena, so the way they represent the objects of their world, make them distinct and form their identity. Abric (1994) also states that social representations inform individuals' role in society and their position in social order.

The development of a research network in the Massif des Bauges means more than the production and possible transmission of scientific knowledge to local actors. Indeed, the involvement of these actors in research might imply the appearance of new relationships with other groups or changes in the nature of these relationships. We propose then to use elements of network analysis with two purposes:

- to define who has access to scientific knowledge and contacts with researchers in order to understand a possible absence of interactions between scientific knowledge and social representations
- to understand how the involvement in research network might have changed nature management networks in the Massif des Bauges and therefore triggered shifts in local actors' relationships

The analysis will rely on the study of specific dimensions of networks. We will first consider some of the dimensions evoked by Marsh and Rhodes (1992). These authors use four dimensions that enable to distinguish and define different types of relationships between interest groups and government ("policy community", "issue network"):

- Membership: this dimension includes the number of participants and the main interests of the network

- Integration: the frequency of interactions of the groups that compose the network, the continuity of the presence of these groups in the network and the consensus they share around the same values.
- Resources: this dimension concerns the distribution of resources over the participants of the network and within these organisations.
- The balance of power among members.

Similar dimensions can be found in the Policy Arrangement Approach (Arts, Leroy et al. 2006). This theory is based on the concept of "policy arrangement" that is defined as "the temporary stabilisation of the organisation and content of the policy domain". A policy arrangement contains then two types of elements (Wiering and Arts 2006):

- Its substance or content: the discourses and the rules of the game at work in the arrangement
- Its organisation that will interest us more in this study: the actors composing the arrangement (the constellation of actors, their interactions and the constitution of coalitions/oppositions) and their resources (the constellation of resources, the distribution of these resources and the use the actors make of them).

These four dimensions are linked and stabilised in a policy arrangement as shown in the following Figure 3:

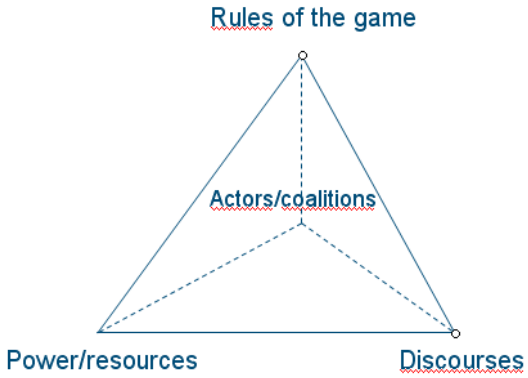

Figure 3: Dimensions of a policy arrangement (from Arts et al., 2006)

We will thus mainly focus on the organisational elements of networks: first we will try to describe actors' constellation by considering the dimensions of "membership" and "integration":

- Who is formally or informally involved in the research network?
- What is the nature of actors' interactions? (frequency, formality, cooperative or conflictive relationships)
- Are there coalitions/oppositions?
- Which part of the network is visible to local actors: with which members of the network do they have contact? Which activities do they know?

Then, we will describe the power relations in the research networks by mapping the available resources and their distribution among members and by identifying whether and how these actors use the resource to reinforce their position of power:

- Who does possess resources (money, authority)?
- Who does access to resources produced by the network (scientific/technical knowledge)?

Chapter 3: Methodology

The research is carried out in the frame of the case study of biodiversity management in the Massif des Bauges. The term “Massif des Bauges” will designate in this study the area delineated by the Natural Regional Park of the Massif des Bauges. This case has been chosen following first investigations that tended to show particularly successful collective actions developed between scientists, policy makers, actors from the agricultural field, Park and reserve agents concerning the implementation of public support to farming activities in the Regional Park. The presence of a research network, perceived as a “workshop site” for different disciplines, was sensed to be important in local actors’ perception of the effects of pastoralism on biodiversity but also in the production of innovative knowledge associating ecology and animal production sciences. The study proposed then to deepen these initial observations. First, it seemed interesting to explore further local actors’ potential agreement on the promotion of pastoralism in the name of biodiversity by interviewing different stakeholders that have not been surveyed during the first interviews. The question was particularly open concerning the opinion of members of associations for nature protection that might have a different point of view concerning human activities and biodiversity conservation. Then, we proposed to enlighten the assumption of a possible relationship between local actors’ involvement in research networks and their perception of the interactions between pastoralism and biodiversity. The case study would then enable us to examine the nature of this participation in networks and, in a second step, to identify the potential consequences on local actors’ familiarity with and understanding of the concept of biodiversity as well as the relationship they could establish between this term and pastoral activities.

This case also fits some more practical requirements. The existence of these preliminary interviews and the general involvement of Cemagref researchers on the site of the Massif des Bauges led to the constitution of contacts with decisive actors of the territory like Park agents. These pre-existing contacts were important to enter into the local networks, be identified as an intern of this particular research institute and then have a sort of legitimacy to carry out this investigation. Concerning pragmatic issues, the Massif des Bauges is also situated close to the Cemagref office.

Background information about the Massif des Bauges are presented in appendix 1.

3.1. Data collection

- *Choice of interviewing*

We decided to use a qualitative method to this research. The main data on which the study is developed were collected on the basis of interviews. According to Abric (1994), the use of interviews in data collection is essential in the analysis of social representations. Nevertheless, he also shows the limits of this method that leads to the production of discourses that can be influenced by different contextual factors such as the situation of enunciation or the respondent’s perception towards the interviewer. It is then difficult to distinguish what depends on the context and what is more stable in the respondent’s narrative production. Nevertheless, it seems interesting to use this data collection technique to get an in-depth understanding of local actors’ representations that quantitative methods cannot grasp and to enlighten the complexity of the relationships woven between pastoralism and biodiversity.

- *Constitution of the sample*

The purpose of the research was to get a large diversity of opinions concerning the issues of pastoralism and biodiversity therefore the sample did not aim to reach statistical

representativeness. We decided to cover a broad range of stakeholders in the Massif des Bauges by focusing on four main groups of actors:

- Important users of natural areas and resources, namely farmers (agriculture being the first economic activity of the Massif), hunters and foresters. Even though tourism is the second main economic activity of the territory, we did not interview visitors as we wanted to include groups of actors that were directly politically involved in nature management at the scale of the Regional Park.
- Managers of the territory such as Park agents and mayors.
- Conservationists represented by members of associations for nature protection.
- Members of research networks (with a focus on members who are/were particularly in contact with actors on the field).

The sampling followed a snow ball method. First, on the basis of previous interviews, we started the investigation on actors who have been identified as important in the research network and particularly by the link they draw between researchers and local actors. This first list encompassed agriculture technicians, territory managers, scientists and nature managers already identified as deeply involved in research. From the contacts provided by these first actors, mainly by technicians, we established a list of potential respondents. In a second stage, at the end of each interview, we also asked the respondent whether he could indicate persons that could have a different opinion and that could be interviewed.

As the fieldwork period had to be limited to 3 months, it was also important to orientate the snow ball sampling in order to include actors corresponding to different criteria:

- Actors with different degrees of involvement in research in order to make comparison and identify a possible relationship between participation and representations. The purpose was nonetheless to interview in priority actors that were involved in research in order to get information about the structure of the networks and the potential impact of their participation.
- Geographical area: we decided to focus on farmers located in the Hautes-Bauges. Indeed, the discourses about pastoralism and biodiversity that were identified in previous interviews mainly concern practices on mountain pastures and these specific practices are mostly carried out in the Hautes-Bauges. This area also concerns most of the research about pastoral practices that are developed in the Massif. In contrast, we included hunters from different areas of the Regional Park because of the variety of practices on the territory in particular between the administrative departments of Savoie and Haute-Savoie which hunters are submitted to different federations. The involvement of hunters from the whole territory of the Park in research also implied to enlarge the scale of the sample.

The size of the interviewed groups could not be planned in advance. We decided to do more interviews among farmers and hunters because these actors were the most concerned by the research we studied.

We carried out 24 semi-structured interviews from the different categories of actors evoked in the research objectives and summarized in Table 2:

Table 2: List of interviewees

Category	Area	Number	Code[5].
Farmers	Coeur des Bauges	6	F
Hunters	Coeur des Bauges	2	H
	Combe de Savoie	1	
	Albanais	1	
	Pays-du-Laudon	2	
Park agents		3	PA
Mayors	Plateau de la Leysse	1	M
	Coeur des Bauges	1	
Foresters	Haute-Savoie	1	FO
	Plateau de la Leysse	1	
Herbivorie: PhD student, intern, technician		3	R (Researcher)
Members of association for nature conservation		3	C (Conservationist)
Agriculture technicians		2	AT

NB: some interviewees belonged to 2 categories:
- 1 forester/mayor
- 1 hunter/mayor
- 1 farmer/hunter

The respondents were contacted by email or telephone.

- *Interview guideline*

The interviews were carried out on the basis of a semi-structured interview guideline founded on an inductive approach. The aim was to provide for broad topics and open questions that the respondent would answer in his/her own words. The goal was then also to avoid bias from the researcher that might impose his representations and vocabulary to the respondent. The interviews followed these main lines:

- Presentation of the topic and the interviewer
- Introduction: responsibilities of the interviewee, partners
- Involvement in research networks: knowledge about the presence of researchers and topics of research, participation, perception of the researchers, expectations, learning aspects
- Involvement in and opinion about agro-environmental policies (mostly Natura 2000)
- Perception of specific environmental issues in the Massif des Bauges
- Knowledge and definition of the term biodiversity
- Perceived effects of pastoralism on biodiversity / role of biodiversity in pastoral activities

Considering the variety of actors who were interviewed, these broad lines were nevertheless adapted according to the respondent. The profession and the estimated age of the respondent were also noted as potential factors that could influence social representations of biodiversity and pastoralism.

Several studies suggested that the term biodiversity was not commonly used in groups such as farmers (Mauz and Rémy 2004; Fleury and Larrère 2006), in consequence, we decided to use the term biodiversity only at the beginning of the interview, in the

[5] To respect respondents' anonymity, codes will be used to identify the interview extracts. The letter(s) designates the social group (i.e. F: Farmers), the number is the respondent's reference

presentation of the topic, and leave the respondent free to reuse or ignore the word during the interview. The interviewee was also free to evoke the biodiversity topics that he thought were the most important sometimes related to the context of Les Bauges or to their own activity. Topics such as the arrival of the wolf in the Massif were then massively evoked although it was not initially an object of question in the guideline.

The interviews lasted from 1 to 3 hours. This large variation was mostly due to the different degrees of formality of the talk as some respondents were interviewed at their personal place and others at work what invited us to develop more or less formal discussions. All the interviews have been recorded and transcribed into a textual form.
We completed the data with transcribed interviews carried out by Céline Granjou at Cemagref Grenoble in 2007, especially to get more information about Herbivorie network.

Other written documents were also included in the data: general information about the Park and the Reserve, Natura 2000 target document, scientific papers about research carried out in Les Bauges. I also attended meetings concerning agriculture issues in Les Bauges what brought additional background information about farmers' situations in this region.

3.2. Data analysis

We analysed the content of the transcribed interviews by defining the main themes of the interviews and coding extracts according to these themes. The information was separated in three categories:

- Information about research networks
- Information about the respondent (responsibilities and professional networks, education…).
- Information about practices, relationships with other social groups, pastoralism and biodiversity

Another category concerning the characteristics of the farm was added in the analysis of farmers' interviews.
We built matrices inspired from the conceptual groups matrixes described by Miles and Huberman (2003). These matrices order information by groups of "items that belong together" according to themes conceptually or empirically determined. In this study, the matrixes were built on the basis of these two approaches.

- *Coding information about research networks*

The codes used to classify information about the research networks were based on the theoretical framework:

- Information about the research: topic, protocol, main results
- Actors and roles
- Relationships between actors: frequency and formality of the links
- Shared resources
- Strong and weak points
- Consequences on practices, knowledge and relationships between actors

The detailed codes are presented in appendix 2.

- *Coding information about representations of biodiversity and pastoralism*

The codes were empirically and conceptually determined. The main themes of the interviews were first identified:

- Practices in relation to nature management and agriculture and factors of evolution of these practices

- Perceived effects of pastoralism on biodiversity and role of biodiversity in pastoral activities
- Threats towards pastoralism and possible ways of supporting it
- Relationships with other social groups concerning nature management and conservation
- Definition and use of the term biodiversity
- Natural elements, nature management measures and threats towards biodiversity

Then, we described concepts of the theoretical framework. In order to distinguish the descriptive and evaluative elements of the representations of pastoralism and biodiversity, practices related to pastoralism and biodiversity and statements towards natural elements and management measures were separated according to their neutral, negative or positive value affected by respondents in their responses.

A second system of code was applied to the interview extracts. The statements were indeed coded according to Buijs, Fischer et al. conceptual framework of representations of biodiversity. Moreover, the organising principles of the representations of pastoralism were also identified and used to code the statements concerning pastoral practices.
The double coding led then to the construction of matrices that classified respondents' statements, and consequently elements of representations to which they refer, according to the organising principles to which they belong and their descriptive or evaluative feature. An example is shown in appendix 2.

Finally, a synthesis, summarizing the information of the matrixes, was written for each respondent. An example of synthesis is presented in appendix 3.

21 out of the 24 interviews were coded in the conceptual matrices. The three other interviews, more focused on the organisation of the research networks and on the relationships between local actors and scientists, were directly coded on the text according to the categories inspired from the network theories. The written documents were broadly analysed without following a particular coding strategy.

Chapter 4: Results

4.1. Organisation and objectives of the research networks

The first remark that can be done about the organisation of the research networks concerns the term “research” itself. This word that seemed quite univocal, designating groups of scientists tending to answer to fundamental or applied questions through a scientific process, is differently understood among the respondents. A first distinction is made between research that is usually carried out by confirmed scientists and studies which are often related to internship or PhD works. The length of the period of fieldwork and therefore of contact with local actors seems to influence the category the latter ascribe to different types of scientific works. Moreover, the term “scientists” is also the object of different definitions, some respondents tending to differentiate scientists from technicians of, for instance, public offices in charge of nature management in the area, while other interviewees call scientists every person that carries out works with a scientific character. The stereotypes of scientists are then important in identifying who can be included in research network and who cannot. The development of numerous internal studies within organisations of nature managers also tend to put up a smokescreen. The existence of different understandings of the term “research” but also “study” and “scientist” entails difficulties in the reconstruction of the networks as people might have been involved in what we consider as research without being aware of it.

4.1.1. Research in Les Bauges: historical outline

This study will focus more precisely on research dealing with the interrelationships between humans, wildlife and habitats. We will see in this part that these topics aroused the emergence of different research programmes and the organisation of the Herbivorie network. We will first give an overview of the development of scientific programmes in the Massif des Bauges in order to understand how research objectives evolved through time towards these issues and to enlighten the foundation of the research organisation that will be more extensively described in the third part of this section.

4.1.1.1. The National Wildlife and Hunting Reserve and the beginning of the research programmes in Les Bauges

The existence of scientific programmes is deeply rooted in the history of the massif. The first programmes indeed came with the creation of the Réserve Nationale de Chasse et de Faune Sauvage (RNCFS - National Wildlife and Hunting Reserve) in 1953. The reserve, situated in the east and highest area of the Massif, is one of the 8 National Wildlife and Hunting Reserves in France. Forested areas of the current reserve, exploited by Benedictine monks since the 11th century, have been controlled by the State since monks’ flight during the French Revolution. In 1913, parts of these forests were forbidden to hunters in order to preserve game populations. Nevertheless, during World War 2, the food shortage triggered the multiplication of poaching acts by French Resistance fighters and villagers, a trend that almost led to the complete extermination of game and in particular mountain goats. The State started to purchase the mountain pastures that were massively abandoned during the rural exodus and created the reserve for the purpose of reconstituting the population of mountain goats and reintroducing the species in other massifs. The shift in ministerial statutes of national reserves in the 70’s imposed the development of a scientific programme coming with the management of the reserve. Since 1985, a large programme of monitoring and studies about mountain goats has been developed in the reserve, what makes the site be nowadays the “international reference” of research about this species. As mountain goats are not considered as endangered anymore and do not require more reintroductions, the

reserve is now mainly dedicated to the development of research about mountain wildlife and habitats. The initial focus on mountain goats has been extended to other large herbivores like mountain sheep that have been introduced in the reserve in the 50's and roe deer, but also grouses. ONCFS (Office National de la Chasse et de la Faune Sauvage – National Hunting and Wildlife Agency) is in charge of research carried out in the reserve and collaborates with ONF (Office National des Forêts – Forest National Office), which manages forests and game, and the Natural Regional Park of the Massif des Bauges that is concerned with the transmission of information about research to the public and professionals, and the touristic valorisation of the reserve.

4.1.1.2. Creation of the Natural Regional Park and shifts in research orientations

The creation of the Natural Regional Park of the Massif des Bauges in 1995 induced a shift in research objects and questions. While, before its creation, most of the studies were carried out in the reserve area and on hunting management issues, the arrival of the Park as a new actor in territory management stimulated the introduction of socio-economic issues in research focus. The questions related to the abandon of pastoral areas became central in the Park concerns because of its important economic and ecological consequences. Issues of agricultural development such as the initiative of creation of the quality label AOC Tome des Bauges stimulated new links with researchers and an orientation of research towards a focus on local problems, whereas initial research about game populations was more designed to provide for wildlife management solutions at the national level. In consequence, the entrance of the Park in the nature management arena induced a "territorial anchorage" to research that aimed to identify the patrimony of Les Bauges in a perspective of preservation and valorisation. Research follows then the line of the objectives of the Park: promoting territorial development on the basis of the valorisation of its patrimony.

The charter of the Park, renewed in 2006, gives a large importance to the development of applied research in the Massif in its "vocation" to develop "a territory of appropriate patrimonies" (Parc Naturel Régional du Massif des Bauges 2006). The charter plans to enhance research in the domains of agro-environment and ecology in order to develop indicators enabling to follow the state of natural patrimonies of the area, to develop a "dynamic approach of ecosystems functioning" and enlighten the links between local practices, know-how and products identity. Another orientation consists in identifying and preserving the "immaterial" patrimony" (know-how, traditional social practices or even local tales).

These shifts from wildlife studies on the Reserve scale to the enlargement to socio-economic issues on the level of the territory can also be observed in the development of the particular "Herbivorie" network.

4.1.1.3. Development of the "Herbivorie" network

The organism in charge of research and studies in the reserve has established a longstanding collaboration with CNRS (Centre National de la Recherche Scientifique - National Centre for Scientific Research) of Lyon and Grenoble that provide them with scientific support on the herbivores monitoring campaigns. From 1995 to 2000, the first discussions about the creation of a research network aiming at collecting knowledge about herbivores populations and their impact on the habitats were initiated. CNRS, ONCFS and ONF were at the initiative of the project.

The project of such network was stimulated by the context of exponential increase and spread of wild herbivores populations. As explained by one of the researchers coordinating the network, the development of population arouses new issues of coexistence between species of herbivores, as well as shifts in the use of natural resources in their habitats. The interactions between humans and herbivores are also subjected to changes due to evolutions in hunting, pastoral or touristic practices. The network proposed then to

regroup researchers working on these three components (herbivores, habitats, humans) by, first, establishing a common study site where all the researchers could work together on several species. The second goal was to coordinate the actions developed on one particular species on different study sites.
Even if, initially, the network was mostly dedicated to research about wild herbivores, it quickly got extended to the study of domestic animals consequently to the rehabilitation of a mountain pasture in 2003 that opened new opportunities of studies to zootechnicians and ecologists. The programme Herbivorie is currently referred as a multidisciplinary network that regroups research institutes such as CNRS, INRA (Institut National de la Recherche Agronomique – French National Institute for Agricultural Research) and Cemagref (Institut de recherche pour l'ingénierie de l'agriculture et de l'environnement – Agricultural and Environmental Engineering Research) but also Grenoble, Chambéry and Lyon Universities. The three institutions in charge of territory and nature management in the massif are also associated in partnership with researchers. The interest of the network consisted then in coordinating different disciplines in particular in innovatively coming together approaches of ecology and animal production science.

Why has the Massif des Bauges been chosen as a common study site? Several reasons were given by researchers and members of the network to justify this choice:

- First, ONCFS has already carried out research on the mountain goats since 1985, what allowed the constitution of a large database directly usable by researchers. The presence of the Natural Regional Park also implied a better structuration of existing data such as maps of the territory.
- Then, the diversity of the site and in particular its biological diversity was a decisive aspect: the presence of several species of ungulates would permit to study phenomena of coexistence between populations; the interminglement of both forests (58% of the surface of the territory (Chevrier, Michallet et al. 2007)) and pastures, thus both opened and closed areas, represents the opportunity to study interactions between animals and habitats in different settings. The rehabilitation of the Armène mountain pasture in the Reserve and the dynamics in wild herbivores populations (introductions of mountain sheep and red deer that is in a process of extension in the whole massif) also represented occasions of different observations in natural and semi-experimental conditions.
- The possible partnership with several management organisations and pre-existing collaborations between the institutional actors of the territory (ONCFS, ONF and Natural Regional Park) also justified the choice of Les Bauges as a study field.
- The lack of studies in rural sociology and anthropology carried out on the area compared to other massifs like Le Vercors made Les Bauges more attractive to researchers who were looking for novelty. We can note in particular the anthropologic work carried out by Marianne Palisse in 2006.

As already said, the network is articulated around 3 axes involving relatively new research objects:

- Axis 1: wild animals, domestic herds and their interactions

This axis, focussing on the interactions between herbivores species such as mountain goats, mountain sheep, roe deer and cows, is the main component of the network. Indeed, the network was based on the project of extending studies about one species alone to the observation of populations and interactions between several species of ungulates. The goal of this axis is to establish predictions about the evolution of the populations in time and space. This axis has aroused the development of several PhDs on topics such as the transmission of abortive diseases between wild and domestic animals, processes of coexistence between mountain goats and mountain sheep in the reserve or the genetic structuration of populations of roe deer and mountain goats at the scale of the massif landscape.

- Axis 2: plants and interactions between herbivores and their habitat

This axis remains to be developed but is already the object of specific research concerning herbivores feeding behaviours. The questions of resources selection of different ungulates, of overlapping feeding behaviours and individuals reaction to shifts in resource availability are dealt with. Such studies are initiated on wild herbivores but are already more developed in the field of domestic herds, as several studies have been carried out on the impact of cow grazing on meadows plant composition and on green alder growth in the rehabilitated pasture. The purpose was to monitor the effects of grazing in the perspective of restoring grouse habitat. This ecological approach was combined to the work of animal production scientists, who studied cow abilities to exploit steep and heterogeneous habitats and the nutritive value of these habitats.

- Axis 3: Humans, predators and interactions with herbivores

This axis, dealing with the interactions between human activities and populations of herbivores is mainly developed on the aspects treated by animal production scientists. The topic of humans as predators and therefore the inclusion of hunters' practices as a factor in the evolution of herbivores populations remain to be dealt with. The involvement of sociologists could then be envisaged in order to deal with the human component of the scheme on which the network is based and to contribute to its multidisciplinary ambitions. The arrival of the wolf in the French Alps has also been the object of study. Les Bauges have been used as a control site so far. Nowadays, consequently to the arrival of the wolf on the territory, the Massif des Bauges could become a privileged site to examine changes in herbivores behaviours, enabling to establish comparisons before and after the arrival of the wolf. An existing programme called Programme Prédateur Proie (Predator Prey Programme[6]) could therefore merge with Herbivorie in order to focus more precisely on the consequences of wolf presence on the way herbivores use their habitats.

We can see that the programme evolved in its objectives and research objects. It was initially meant to organise the production of knowledge on wild animals and habitats, then integrated domestic animals and tended to introduce more socio-economic issues in the research framework. The study field got also extended, from the limited area of the reserve to the whole territory of the Regional Park. Moreover, the network initially meant to produce knowledge at a national level started to integrate local issues concerning relationships between agriculture development and biodiversity.

4.1.2. Organisation of the research

Our first questioning concerns the organisation of the Herbivorie network in terms of actors and relationships. In this part, we will try to describe the internal organisation of the network by first identifying the actors who contribute to the three axes of the programme and then characterizing the relationships between the participants. This analysis will enable us to question the actual existence of a network and see the relationships between Herbivorie and other related research structures. We will first present a general analysis at the level of the whole network in order to demonstrate the actual relevance of focussing on two particular branches.

4.1.2.1. Herbivorie: a network?

We will first broadly describe the actors' constellation of Herbivorie and the transversal relationships in the network.

[6] Own translation

- ***Main actors of the structure and general organisation***

The network is composed of several representatives of laboratories, belonging to research institutes and universities, mainly focussed on the herbivores and habitats components, while the "humans" pole is essentially covered by INRA Avignon.

These research structures are associated with management public organisations that financially support part of the studies:

- ONCFS represented by two teams: CNERA (Centre National d'Études Appliquées - National Centre for Applied Studies[7]) "Faune de montagne" (Mountain fauna) and CNERA "Cervidés et Sangliers" (Deer and Wild Boars) that are mostly in partnership with CNRS
- ONF and Cemagref that are concerned with forest issues
- The Park, which works in partnership with INRA Avignon.

We can observe a dissymmetry in the relationships between the research structures and the management organisations. Long term partnerships are mostly established between CNRS and ONCFS on the one hand, and the Regional Park and INRA Avignon on the other hand. Other partnerships are described as more occasional and related to particular missions. Moreover, the implication of the teams on the field is relatively variable with some groups permanently present such as ONCFS teams that have specific means dedicated to the site of the Massif des Bauges and other teams that less frequently work in the area and on shorter periods. Therefore, the network does not seem to function in a homogenised way and appears more articulated around two closed partnerships that are working in large autonomy. In these partnerships, the management structures take a role of mediator between researchers and actors on the field such as farmers and hunters.

- ***Informality of the relationships***

A first remark concerns the absence of an official status of the network that informally regroups several research teams from different research centres.

The coordination of the network is realized by two researchers of CNRS who carried on with the animation of the network in 2000 and redefined the orientation of the programme towards the development of the three herbivores-plants-humans components. Concretely, they are in charge of finding financial support for common actions, developing communication tools and organising meetings and other logistic matters like accommodation for researchers and students on the field.

From the very beginning, the enrolment of different institutions and researchers has been based on personal relationships and by word of mouth. This informal way of managing the network is also displayed by the absence of an official list of participants.

The informal status of the network does not seem to have impacts on its composition as affirmed by one of the coordinators, who suggests that the programme regroups researchers who already worked on the topics covered and therefore are interested in bringing contribution without financial support. Nevertheless, the informality of the network status has consequences on its general coordination as it leads to a lack of means to be dedicated to communication and meetings organisation, enhanced by the problems of availability of the coordinators. Therefore, the relationships between the different teams are quite infrequent and exchanges of information depend on limited communication channels:

- A mailing list informs participants of meetings and workshops and diffuses general information about the objectives of the network. This list only includes management organisations, research institutes and universities.
- A short information bulletin, called Herbivorie Info, is published three times a year and presents the works in progress. This bulletin is sent to the persons included in the mailing list but is also distributed by the Park to interested members of the general

[7] Own translation

public. We could not verify whether this channel was actually used to transmit information to the general public as no respondent, except the ones included in the mailing list, seemed to know about the bulletin.

We can see that the general communication means in the network are not entirely settled, what was reflected in interviewee's responses. First, the existence of the network is barely known by farmers, hunters, foresters or mayors even though they participated in some particular studies. Generally, people related to wildlife issues such as hunters and foresters do not know about the research carried out on the domestic animals topic. Similarly, farmers do not establish a relationship between studies about game populations and research developed on pastoralism issues. Respondents who know about the network also evoke the fuzziness of the structure and can hardly identify who belongs to the organisation and what its main orientation is. An agriculture technician talks about a "nebulous" structure that is also confusing to farmers. According to one of the Park agents, the Herbivorie network is mainly considered as carrying out works about wildlife because the network is rooted in historical links between ONCFS and CNRS and their collaboration in research about large herbivores. Therefore, the Herbivorie structure can barely be identified as a real network and people tend to separate research on wildlife and investigations around the question of pastoralism and biodiversity management.

- ***Compartmentalization of the structure***

Concerning the collaboration and more generally the relationships between the researchers' teams involved in the network, we can distinguish a compartmentalization of the three axes and in particular a separation of the teams specialized on domestic and wild animals. Even though the network is meant to study the interactions between humans, herbivores and habitats, the relationships between the three components remain very rare. The interviewed researchers acknowledge the lack of contacts between the three units on the field and the rare exchanges that only occur during the annual meeting of the network. A respondent explains that each team works in relative autonomy and that the missions are rarely overlapping:

"On the field, each one has his specialty, each one his operations…And on territories, on different fields […] I work in forests, well INRA or others work on pastures so…we have very few things that intertwine" (R 1)

Moreover, no common database exists at the level of the network but only at the scale of privileged partnerships. In particular, ONCFS and CNRS constituted a common structure, mostly meant to facilitate the work of interns and PhD students.

According to an interviewee, the lack of coordination is due to the fact that this network remains too recent to be able to create an actual collaboration between the axes. Each unit would have first to develop its own activities and produce enough knowledge before being in capacity to share it.

Even though formal contacts and collaboration between the units have not been established yet, more isolated and informal relationships occur, in particular between the plants and herbivores poles that remain quite complementary. A PhD student, working on processes of coexistence of herbivores populations, evokes for instance her contribution to a fieldwork carried out in the frame of the plants/habitat unit but also the exchange of advices she could benefit from the researchers of the habitat component.

We can then conclude that Herbivorie cannot be considered as an actual network as the horizontal relationships between the different axes of the programme still remain to be established and concretized by the development of communication means and common actions such as the development of a database platform.

It seems then necessary not to focus on the Herbivorie programme as such but on research constellations organised around a common theme. We call research constellation an assembly of actors, which includes research institutes, managers or users of natural areas, who are directly or indirectly involved in research focussed on similar issues but

without obligatorily clearly being in relationships with each other. The term constellation is then seen as an alternative to the word network that does not seem appropriate considering the very informal structure of Herbivorie.

We decided to describe two particular research constellationswhich are focussed on wildlife populations and domestic herbivores (essentially cows).

4.1.2.2. Focus on two research constellations

We will then deal with two specific research constellations. They include research organisations involved in Herbivorie but are also extended to structures that do not belong to Herbivorie but are frequently evoked in local actors' responses and seen as important sources of knowledge. We can identify two main branches in the general research constellations established in the Massif des Bauges. The first constellation we will deal with concerns the production of technical knowledge about pastoralism and biodiversity management. The second structure will focus on the interactions between large herbivores (domestic animals and game) and their impact on habitats.

- ***Pastoralism and environment***

Partnerships between the Regional Park and researchers' teams

The actor in charge of the development and implementation of agro-environmental policies on the territory of Les Bauges is the Natural Regional Park, which is in particular the operator of two Natura 2000 sites (the target objectives of a third site is currently in preparation), one of them located in the "Hautes-Bauges" and including the hunting reserve and most of the mountain pastures of the massif. Natura 2000 has been interpreted as a tool for "ecological, economic and social valorisation of biodiversity of the Massif" (Parc Naturel Régional du Massif des Bauges 2005) financed by the funds of the Common Agricultural Policy. Therefore, Natura 2000 has been directed towards agricultural development and particularly the rehabilitations of abandoned pastures subjected to ligneous plant dynamics on the basis of its supposed responsibility in the decrease in patrimonial species populations such as grouses (this assumption was at the origin of a PhD work concerning grouses habitats carried out at Cemagref Grenoble (Decout 2007)). The arrival of Natura 2000 in the Massif des Bauges, and its actual operational stage in 2001, aroused then new concrete questions about the relationships between pastoralism and biodiversity and the need for producing technical knowledge to combine pastoral activities and biodiversity conservation. According to an agricultural technician, the complexity of combining both animal production and ecological purposes requires the use of scientists' expertise in order to produce case-by-case solutions:

"We have to associate a good habitat management while guaranteeing animals in good shape, a good farming income and also maintaining this biodiversity. And there researchers are interesting, to help, through diagnosis, protocols, to better understand what can be done with animals. […] even if we, technicians, are able to analyse the pastoral value of a habitat, so many animals we can put in for so many days, but taking into account all the elements of diagnosis and establishing the protocol, we need at first scientists because they are more able and competent to analyse what has to be done and formulate propositions. And then, as we focus on small scales, [they may help] to see what works and what does not before saying this is the solution and I use it everywhere" (AT 1)

The rehabilitation of the Armène pasture especially triggered the necessity for developing new forms of pastoral management plans. Indeed, on the one hand very little knowledge existed on the agronomic value of such type of abandoned pastoral habitats and, on the other hand, the Park agents and technicians in charge of the rehabilitation were confronted to a lack of methodological tools that could allow them to carry out the rehabilitation of a heterogeneous habitat. The shortage of innovations in terms of diagnosis

methods on pastoral surfaces was then problematic in this operation of re-conquest of an abandoned pasture and initiated changes in the research networks.

The Natural Regional Park uses to work in partnership with GIS Alpes du Nord (Groupement d'Interêt Scientifique des Alpes du Nord), a collective referent in research and development in terms of pastoral practices. GIS Alpes du Nord has been involved in a partnership with the Park since the establishment of this structure and worked on different projects of development such as the creation of the AOC Tome des Bauges. Nevertheless, in the context of these operations of rehabilitation, according to a Park agent, this research structure did not propose a technical assistance what led the Park to establish contacts with a team of INRA Avignon that already worked on the exploitation of heterogeneous pastures by goats and sheep in the south of France and was interested in developing knowledge about cows abilities to feed in shrubby habitats and steep pastures. The contact was taken in the frame of the Herbivorie programme, to which INRA Avignon had been invited to participate under the initiative of CNRS. Nonetheless, as we already said, the partnership was barely related to other branches of the programme and worked in relative independency with a convention established between the Park and the laboratory that was assigned to developing a management plan for the rehabilitation. In this association, the Park agent in charge of the implementation of Natura 2000 and more generally of the development of agro-environmental measures was particularly considered as the motor of the partnership and as an important contact for researchers on the field by providing them with information about the area and introducing them directly to local actors.

We can also note that the Park finances studies developed by professional groups such as SITOB (Syndicat Interprofessionnel de la Tome des Bauges – Interprofessional Syndicate of the Tome des Bauges). Several actors recognize then the decisive role of the PNRMB creation in the development of innovation:

"I think that the GVA[8] had the chance to benefit from it [the Park] because the relationship we have with the Park is that it finances all of our projects. We do not have our own financial means. All of our projects are subsidized at 80% by the Park" (F 6)

This partnership between the Park and this particular laboratory of INRA Avignon led to the involvement of another unit of the same research institute that worked on the economy of biodiversity and quickly developed a convention with the Park on the organisation of dairy products sector and the relevance of the implementation of policies such as Natura 2000 in the development of local agriculture.

The rehabilitation of the Armène pasture also aroused the development of research about the impact of cows grazing on plant dynamics. A team studied the shifts in meadow plants while another unit focused on the impact of grazing on the green alder dynamics. These two laboratories, also adhering to the Herbivorie programme, have less frequent relationships with the Park.

Farmers' moderate knowledge of and involvement in research

The main comment concerning the relationships between local actors and researchers is the dissymmetry of the links between on the one hand researchers, Park agents and technicians, and on the other hand farmers and researchers. Farmers are indeed very moderately involved in the research while the Park and technicians have a more active role and Park agents are particularly influent on the research development.

We saw that the partnership established between INRA Avignon and the Park made the latter put its own technical questions as a priority in the investigation carried out by researchers. Scientists' interests also influence these questions and the orientation of the research. Nonetheless, it seems that farmers are less invited to contribute to this first stage of orientation. Indeed, only members of professional groups can possibly give their opinion towards research questions and protocols during meetings organised by the Park. The base of farmers' community remains then silent in this phase of research. More generally, the Park

[8] GVA : Groupement de Vulgarisation Agricole – Groupement for agricultural vulgarisation (own translation)

is also identified as an important actor in the transmission of results and general information about the scientific works carried out in Les Bauges, in particular because of its official role in the vulgarisation, at the level of the Reserve, to lay-people and professionals such as farmers. Nevertheless most of the respondents who are not directly involved in the research do not know a lot about the studies carried out in the massif about pastoralism and environment:

"The surveyed farmers know the research but not the others" (F 6)

Several farmers regret that the Park does not communicate more about research:

"There is no diffusion as such, to a large public […] the one who does not go on purpose to the Park […] cannot be aware [of the research]" (F 6)

Other actors like conservationists also blame the Park for keeping information:

"We do not have access to knowledge at all…well they say that we can go visit them but…there is a sort of exclusive preserve, they do not really share it" (C 3)

Few actors and in particular few farmers have then access to information about research and are empowered to contribute to the definition of the studies but are they more involved in the development of the research themselves?

Similarly, very few farmers are identified as actually participating to the studies, as it is affirmed that researchers' informants, such as the technicians, often designate the same potential respondents, who are considered as more open and therefore might be more inclined to answer positively to researchers' requests. In consequence, representatives of professional groups and associations are frequently surveyed to the detriment of the grass roots. A respondent who was an important member of one of these professional groups affirmed that he was surveyed 5 or 6 times a year but that the researchers only see 5 to 10% of the farmers' population of the Massif. The orientation of the contacts provided by the technicians but also the Park agents implies then that most of the farmers get excluded from the research structures and consequently constrained in their opportunities to intervene and make their voice heard. Nevertheless, when evoking the relationship they had with the researchers during the studies, the farmers involved as respondents all displayed a positive opinion towards them and appreciated the fact that their own empirical knowledge was taken into account and analysed by the scientists. They all talk about a form of "exchange" between researchers and farmers by highlighting scientists' particular concerns with their practices and their abilities to listen to them. In return, they value scientists' explanations concerning these practices that allow them to understand the logic of their empirical actions. However, researchers' questioning about these practices, considered as banal by farmers, is also the origin of confusion and unease. Some farmers explain that they do not always understand why they are the focus of such attention:

"It seems that it is a little bit like a chance for them to meet us, you see. As if we were some kind of dinosaurs […]. It seems that they come to see us to say in 15 years 'I have seen this person'. [His wife] I do not know if they do it for that but it might be to show it on TV" (F 1)

"I do not say it is negative but it must not be disproportionate" (F 1)

Concerning the transmission of the research results, the information seems to transit through two main actors. First, we saw that the Park was a significant actor in the transmission of results. Indeed, it coordinates the organisation of researchers' interventions during general meetings of agriculture professional groups that are meant to allow the communication of information to farmers and to enable them to meet scientists. Nevertheless, as in the phase of research definition, only representatives actually attend these meetings and the grass roots is not directly concerned. We can also note that the Park also produces booklets designed for the public.

Nonetheless, it seems that information between researchers and farmers is channelled through other ways. First, the rehabilitation of the mountain pasture in the reserve is considered by Park agents as a "pedagogical" site that allows them to show farmers proofs of the financial and technical feasibility of the restoration of this type of agricultural lands. Moreover, this rehabilitation stimulates the exchange of information and knowledge among the farmer community by word of mouth. The respondents generally learnt about some results or studies because they knew other persons who were surveyed or had contacts with

researchers. Nevertheless, it is admitted that farmers in Les Bauges have a very individualistic way of working (characteristic that seems to be commonly found in other massifs in the Alps) and that this characteristic tends to hinder the transmission of information in the community. Therefore a third actor seems to have an important role in the communication of knowledge produced in the research.

Indeed, the professional organisations like the Association des Agriculteurs du Parc (Park Farmers Association) and agricultural technicians from the Chambre d'Agriculture or syndicates appear to be important actors in the networks. First, besides the transmission of information, they have a role in researchers' protocols and particularly intervene in interns' works by providing them with advices and critical views on methodological aspects or potential respondents' contacts. Technicians also have an important role in the transcription of scientific knowledge into practical advices to farmers and the transmission of this new information on the field.

Actors on the field are then barely involved in early stages of research about pastoralism and biodiversity and very few of them can actually participate in research. Nevertheless, farmers in particular have a potential access to the results but several of them acknowledge that they never went to results presentation or other types of communication. They tend to adopt a more passive behaviour towards information and therefore to exclude themselves from the research constellation. Another situation of auto-exclusion can be described as it is also said that the professional groups located in Haute-Savoie are less involved in the research coordinated by the Regional Park because of their distrust of this structure:

"All the Valley of Laudon and places like this have the same group as us but they never go to the Park or only to finance a small part of a study but nothing, nothing. They fear the Park, they see it as an overly complicated system, far away" (F 6)

This quote shows the lack of unity observed on the territory of the Park with a strong gap between the regions of Savoie and Haute-Savoie, difference that was also perceived concerning specific practices such as hunting or forestry. This quote also suggests that people's perception of other actors is an important factor that determines their willingness to participate in the research constellation. Farmers tend to display a negative image of researchers based on the stereotype of scientists who "search to search" and do not answer to daily technical concerns:

"What researchers do is light years away from reality and what we live every day […] sometimes we have the feeling they are totally out of it" (F 5)

Several farmers regretted then that too many research never lead to a concretisation on the field.

Moreover, scientists are often associated with policy-makers and territory managers. Some farmers indeed relate their problematic experiences with agro-environmental policy-makers to researchers and therefore are immediately reluctant with the idea of participating in scientific studies:

"The farmer will have this vision of the researcher: it is a guy who is not with it, who will ask us to mow the 15th of December" (F 6)

The Regional Park is at the origin of the partnership established with INRA Avignon, a partnership that was meant to answer to specific expectations of agriculture technicians and the Park itself in terms of methodology to follow to manage the rehabilitation of the pasture. Nonetheless, it seemed that the interviewed farmers did not share the same concerns. They mainly expected researchers to produce pieces of evidence of the positive impact of their practices on environment and biodiversity in particular or to provide technical knowledge that follow the line of classical references they are used to employ. They tended to perceive research works as sometimes far from their daily concerns and the production of proofs of the environmental benefits of pastoralism insufficient in front of the dramatic decrease in farmers' number in the area and the economic difficulties they encounter:

"I think that if we cumulate all that has been written [on the pastoral practices on mountain pastures] well I do not know but it would make cubic metres and cubic metres of paper […]

we need more than that [to maintain pastoralism] […]. We do need to work on that to find the right arguments, to show the value of this activity but well afterwards what is important today if we still want to talk about it in the future is that there is still people doing that tomorrow" (F 1)

This perception of research might be responsible for the lack of involvement of farmers into the research constellations, seen for instance in the small number of respondents who went to results presentation and other communications.

The research constellation focused on studying the relationships between pastoralism and biodiversity is summarized in Figure 4.

- ***Herbivores and environment***

ONCFS: a key organisation in the research constellation

As we already said, the initial orientation of Herbivorie was structured around the study of communities of herbivores instead of monospecific research classically developed. This axis of Herbivorie is mainly supported by the collaboration between CNRS and ONCFS. It is indeed important to highlight that the choice of the Massif des Bauges as a common "workshop site" has been influenced by the historical presence of ONCFS, a public research and administrative structure that has been carried out monitoring and studies on mountain goats in the Reserve since 1985. The research developed in the frame of Herbivorie are then based on existing work undertaken by ONCFS:

"Herbivorie is the expression of this partnership in mountains but the ideas have been formed already a long time ago" (R 1)

Nowadays, this organisation remains a significant actor in the production of knowledge about wildlife populations, aiming at developing sustainable management of populations and habitats (Chevrier, Michallet et al. 2007). The main purpose is to inform the establishment of hunting plans that would allow several activities (hunting, forestry and farming) to coexist. ONCFS works together with scientific centres like CNRS but also with nature management organisations and users' groups such as ONF, CRPF (Centre Régional de la Propriété Forestière – Regional Centre for Forest Property), the Park or the Park Hunters' Association. It is then important to extend the Herbivorie network to taking into consideration other collaborations like the Observatoire de la Grande Faune et de ses Habitats (Observatory for Large Fauna and its Habitats[9]) which regroups the organisations evoked above. The main theme developed by this Observatory concerns the interactions between herbivores and forested habitats and the elaboration of tools enabling to evaluate the state of habitats and populations, more generally the state of biodiversity in a habitat:

"What we are asked for is to provide with tools to possibly expertise, evaluate biodiversity" (R 1)

In particular, the Observatory works on the establishment of Indicators for Ecological Change that combine grazing indicators and animals monitoring (traditional counting and more recently biometrical measures such as weight, length of the legs and horns). ONCFS also includes departmental networks, dedicated to monitoring game populations, that are organised in collaboration with the FDC (Fédérations Départementales des Chasseurs - Departmental Hunters' Federation) and more generally individual hunters and naturalists (ONCFS 2003).

ONCFS works then in partnership with numerous nature management organisations with which it produces technical knowledge and methods to pilot management of large herbivores populations in order to answer to expectations of different natural resources users. Research goals are then defined in common with several stakeholders on the field. It is also argued that the elaboration of technical knowledge requires the involvement of research institutes. Indeed, specific knowledge about coexistence phenomena within communities and impacts of herbivores on the habitat are necessary to establish indicators

[9] Own translation

for managers. The involvement of CNRS in particular aims to answer to this need for scientific knowledge:
"Indicators are not enough, we also need to have some knowledge about species and habitats. Setting up monitoring is not enough to improve things. It necessitates also some additional knowledge about some topics, that we did not have and that we actually still do not have in mountains. Hence Herbivorie, that is of first importance" (R 1)

The production of technical knowledge usable by managers necessitates subsequently the development of scientific knowledge. Therefore researchers and organisations in charge of nature management work in collaboration. This partnership is mainly articulated around ONCFS that establishes the link between scientific and technical knowledge. Technicians of ONCFS are the relay between researchers and field actors such as hunters. The latter affirm that they barely see researchers but that they have frequent contacts with members of ONCFS. A researcher, who carried out her PhD study in Les Bauges on the topic of the mechanisms of coexistence of different species of ungulates, highlights the importance of these relationships during her fieldwork by evoking the numerous collaborations she benefited from, encompassing hunters' groups, Park agents or technicians of ONCFS, who transmitted their competencies and knowledge of the area. Research is then the occasion of actively involving actors on the field.

Active involvement of hunters

While research objectives are defined in collaboration with managers in order to respond to their needs, the practical part of the studies, as well, cannot be carried out without the participation of these managers and the actors they represent. Indeed, ONCFS also works in tight partnership with groups of hunters who have an important role in data collection. Indeed, the studies carried out on wildlife populations require the collection of a large number of samples that cannot be organised by researchers alone. Even though some data are directly collected by ONCFS agents, especially in the hunting reserve on captured mountain goats, and these agents provide PhD students and interns working in research institutes with technical support for instance in their protocols, the participation of hunters in data collection remains necessary in order to be able to monitor animals on large scales and in a continuous way. Hunters are then in charge of taking biometrical measures on hunted animals, of collecting samples for DNA analysis or taking rumens. This collection of material has been the occasion of several adjustments of the methods employed, thanks to very close relationships between a particular technician of ONCFS and hunters' representatives. The construction of a standardized tool to measure animal legs (the so-called "Guyapon") is an example of coproduction developed between ONCFS and groups of hunters. This coproduction, focused on the elaboration of a measurement tool, also shows hunters' willingness to improve the methods of data collection and an appropriation of these techniques that become routinized.

The partnership established with hunters' organisations is then important to actually be able to carry out research but also to guarantee an appropriation of these studies by people on the field what is highly valued by this technician of ONCFS:
"I would say that what is a little bit particular in Les Bauges and to my mind innovating is that we really work with people of the country. Well it has inconveniences but it also has a lot of advantages […] it gives a huge weight to our work" (R 1)

According to the ONCFS technician, hunters' collaboration and trust are mainly due to the efforts carried out by this Office to participate in operations on the field like hunting dogs packs contests and to establish frequent formal and informal contacts with local hunters:
"We are recognised because we have a local impregnation and we also participate to a lot of other operations in relation to local actors. In plain language, coming here one or twice a year and telling them 'so, we work on your territory' is not enough, it will not work" (R 1)

This technician also evokes different factors that could explain the success of this partnership. He assumes that the historical presence of ONCFS in Les Bauges may have founded the legitimacy of this organisation on the territory. Two interviewed hunters also talk

about the authority devolved to ONCFS as an official hunting institution and imply that hunters accept to collect data only under the pressure of this administratively legitimate organisation:

"Why does it work well? Because it is [organised by] someone who still represents a structure, isn't it, the 'Office National de Chasse et de la Faune Sauvage' […]. They have authority" (H 3)

"Well, we explain [the reasons for taking samples on culled animals] them [the hunters] but when it comes from someone of ONCFS, when it comes from a guy who takes care of that, it has more impact than when it comes from someone like me" (H 5)

In the last quote appears a nuance concerning the involvement of hunters in research and particularly in data collection. This hunter, a representative of a hunting group, suggests that the whole population of hunters is not totally willing to actively be involved in research. Indeed, most of the respondents explain that mainly representatives of hunting groups and associations (GIC[10], ACCA[11]) and a limited number of hunters without particular responsibilities have an active role in the collection of samples and counting. A majority of hunters remain interested in the research though but prefer not to take responsibilities in them.

This interest of local actors in research dealing with herbivores and their environment and in particular hunters' motivation to participate in research, even though mostly stimulated among representatives of the group, can be explained by the so-called typical "Baujus[12]" willingness to know about the cutting-edge of technologies but also their pride of their territory that pushes them to contribute to research that are perceived as enhancing its value:

"To our great surprise, we saw people be very supportive. They came from everywhere, from Haute-Savoie, from other departments, in a quite spontaneous way. Because they thought 'this is our territory, this is our roe deer'" (R 1)

"Les Bauges is really particular […] there is a real identity and people are often mistrustful at first but as soon as you managed to establish the contact […] they invest a lot into it" (R 1)

Therefore, hunters but also people from different kinds of public such as non professional naturalists often offer their help in campaigns of captures, which are also perceived as occasions to learn more about animals and the research carried out in Les Bauges. The contribution to these campaigns seems to be another way to enter the research constellation without taking the responsibilities most of hunters are reluctant to accept within hunting groups and associations. Moreover, information about research and results are then not only transmitted in meetings and through written communication devices but also on the field.

According to the technician of ONCFS, in charge of the coordination of the research on the field, the tight partnership can only be maintained because of the transmission of the results to the field and the establishment of bilateral relationships between actors in charge of analysing the data and collectors of data. This diffusion, through the elaboration of posters, meetings and technical documents, is one of the priorities of his activities. It is said that most of the hunters are interested in getting the results of the research to enrich their "personal culture" but mainly people, who are directly involved in the data collection, go to meetings and ask for documents such as technical and pedagogical booklets. These persons affirm that getting the results is important to maintain hunters' motivation by showing them the usefulness and importance of their work. The transmission of the results is also appreciated because perceived as a way of recognizing hunters as real actors in nature management, what was not the case before the arrival of this particular ONCFS technician to Les Bauges, who initiated the diffusion of information to hunters' representatives, in charge of informing the community of hunters:

[10] GIC: Groupement d'Intérêt Cynégétique (Hunting Interests Group)
[11] ACCA: Association Communale de Chasse Agréée – Authorized Hunting Association of the Rural District
[12] Name given to the inhabitants of Les Bauges, initially attributed to the inhabitants of the Canton du Châtelard

"I fought for and I managed to make the term 'laboratory' erase [from the new Park charter]. I do not want Les Bauges to be a laboratory. Because in a laboratory you slip on the laboratory coat, you enter, you shut the door and then nobody knows what happens there. It is not a lab. So they tried to link that to an open-air lab. No, I prefer an experimentation field […] before the reserve of Les Bauges was a lab. We did not know what was happening […] for a long time it was closed, the hunters did not have any right" (H 1)

The transmission of information is also seen as positive as it enables the expression of criticisms and the emergence of bottom-up adjustments of protocols, just like the creation of the measurement tool previously evoked. Representatives of hunters' groups and more largely hunters involved in the research constellation can then also *a posteriori* intervene, express their needs and questions concerning the studies carried out. The communication of research results made then hunters be more responsible for their tasks in research and appropriate a role in the constellation, at least concerning hunters' representatives:

"[Before the arrival of R 1] the holders of hunting rights or the representatives of hunting teams weighted the animals but some of them were weighted full, others were weighted empty, others were weighted emptied but not eviscerated […] now it is true that there must still be approximate measures but it has evolved. [Interviewer: Why?] I think people got more responsible and they have a feedback of the information now and they got more responsible. And as we already said, mentalities also evolved" (H 2)

As evoked in this quote, the transmission of research results is not the only factor that motivates hunters to participate in scientific works. The so-called "change of mentality" in the hunting world towards more environmental concerns, in particular the preponderance of fauna regulation and conservation in the hunting activity, is perceived as determining in hunters' interest towards research about herbivores and their environment. This role of hunting is recurrent in interviewed hunters' responses and justifies the importance of scientific works. The respondents, who all had responsibilities at different levels in hunters' groups, generally display a keen interest in these studies by enhancing the importance of research in wildlife management and especially in adjusting hunting practices towards an ever more precise regulation of populations. According to them, the adoption of qualitative culling (culling based on age and gender instead of a fixed number of individuals) requires more monitoring and knowledge about animals' behaviour. Then, most of the interviewed hunters are directly interested in the results of the research because of their potential consequences on their practices. In relation to that point, they are particularly curious about high technology methods. Although hunters were at first disconcerted when confronted to sampling pieces of tissues for DNA analysis, and in particular to the lab material that was introduced, several respondents explain how these techniques of sampling are now as a routine as regular animals monitoring. They also regard high technology methods as interesting to communicate towards the whole community of hunters, by proving that scientific studies and techniques can show elements that are not possible to monitor through traditional visual counting.

They also value scientific knowledge that enables them to communicate with other users of natural resources such as foresters and farmers. Knowledge about large herbivores alimentation allows them to argue against protests towards some species that are considered as particularly devastating for forests regeneration or meadow productivity.

Finally, some hunters evoke a personal interest towards the production of knowledge about fauna. The participation in research is then motivated by a personal taste for naturalist activities such as animal watching and the willingness to know more about the ecology and biology of game species.

Figure 5 summarizes the organisation of the constellation dedicated to herbivores and interactions with their environment.

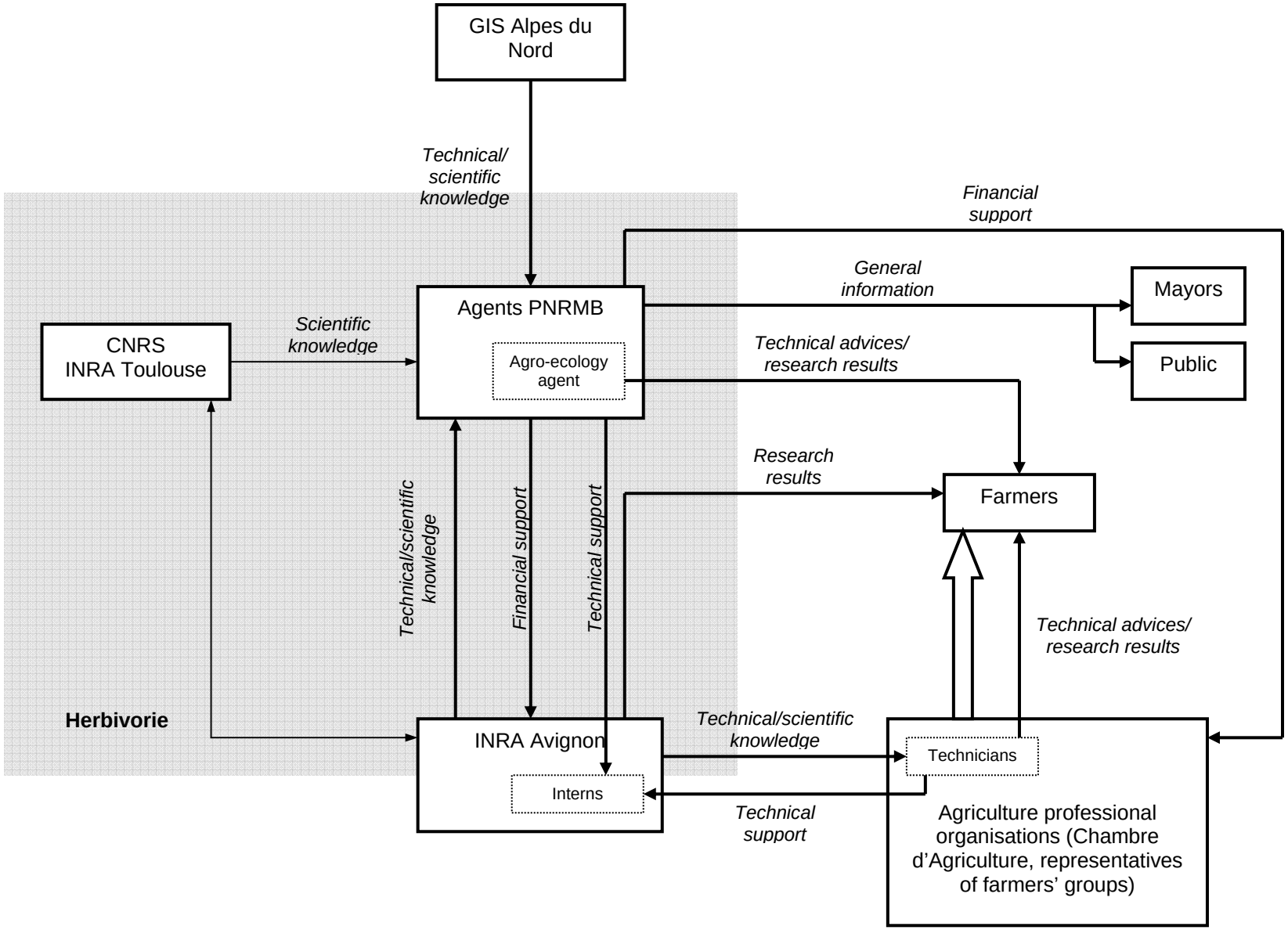

Figure 4: Research constellation pastoralism/environment

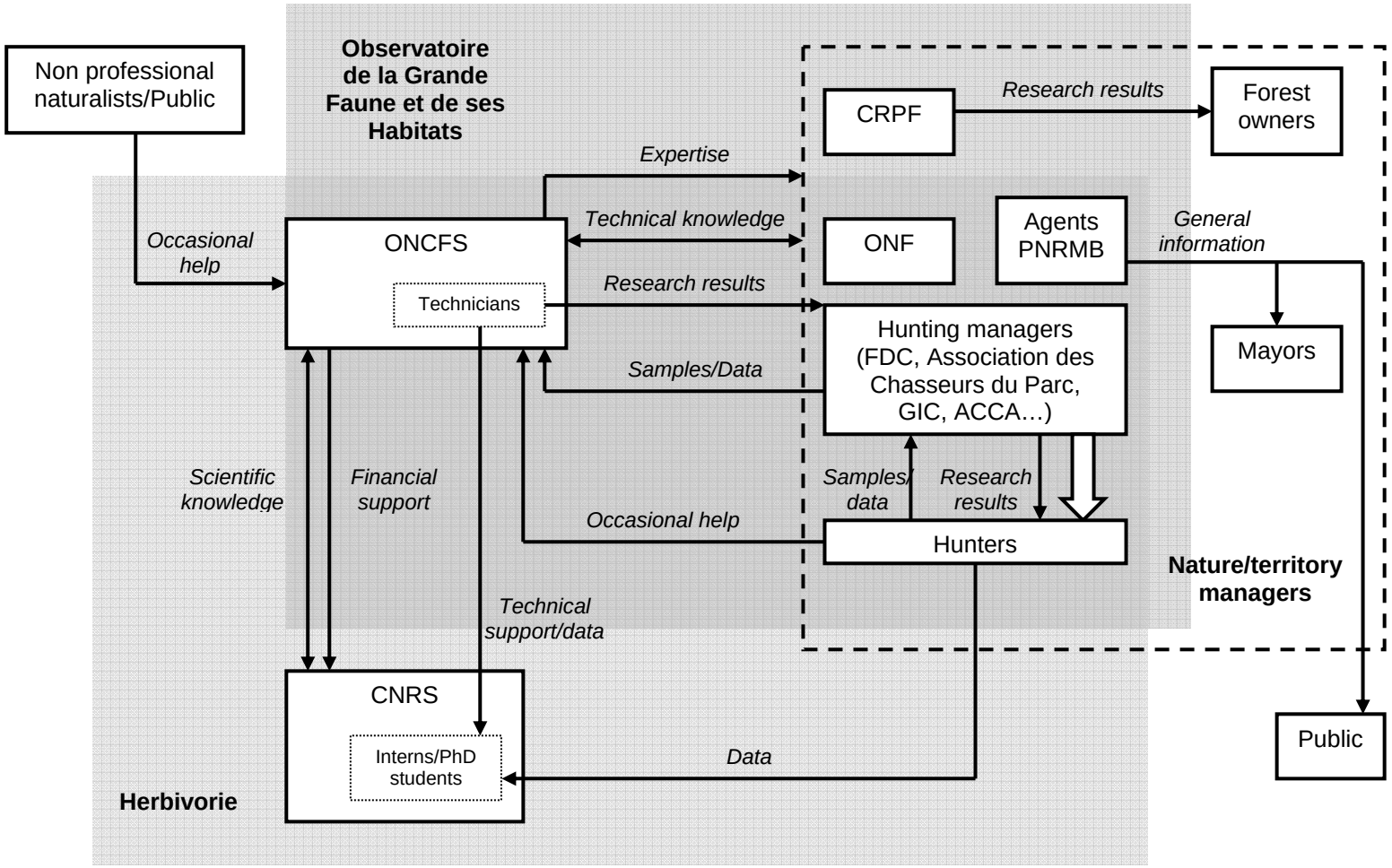

Figure 5: Research constellation herbivores/environment

4.1.3. Shifts in nature management networks

We saw that the research constellations regroup different actors who have a stake in issues of nature conservation and natural resources management. We will now try to see whether the involvement of these actors in research has an influence on the current nature management networks in the Massif des Bauges. As social representations are influenced by discourses of other social groups and new knowledge or ideas, we will focus more precisely on the changes of actors present in this network and the resources (knowledge, money, authority) they can access to, that might influence them or make them more influential towards other groups.

We can first note that these research constellations are formed in a context in which hunters and farmers particularly feel a lack of representativeness of their groups in local political arenas. Changes in the demography of rural areas are seen as responsible for the decrease of power. While most of the respondents talk about the importance of participatory approaches to nature management, farmers do not perceive that their involvement in such management is encouraged and denounce the lack of dynamism of professional groups:
"We are so much in minority compared to […] these naturalists, who are very active" (F 1)
Farmers frequently evoke the story of the reserve and the exclusion of pastoralism in the 50's and regret the long process of recognition of their role in ecology that is still not achieved according to them.

Hunters evoke the lack of communication of their group towards the public in the past and the bad image that is associated with their activities.

We can then wonder whether changes of this situation of exclusion are aroused by the presence of researchers in the massif.

4.1.3.1. Shifts in actors constellations

The involvement of local actors in research constellations triggers the development of new relationships between the groups. The participation of different social groups in ONCFS research allows lay-people, nature protectors and users of natural resources to meet on the field, during campaigns of animal captures for instance. These exchanges on the field are described as particularly important for some hunters, who see there the occasion to improve communication, to defend their activity and show the respect for nature and commitment to its protection of the hunting community. A forester particularly emphasises the role of these exchanges in understanding hunters' practices and giving more transparency to wildlife management. He also highlights the role of the ONCFS technician already evoked as a mediator between natural areas users and his importance in facilitating contacts between these groups. These contacts have eventually led to the establishment of a convention, aiming at assuring the coordination of agriculture, forestry and hunting activities on the basis of a common programme of actions in the particular area of the Massif du Semnoz, comprised in the perimeter of the Natural Regional Park of the Massif des Bauges.

The involvement of hunters in data collection and the recognition of their role in research constellation, through the diffusion of results or the organisation of meetings with researchers, seem to have improved the relationships between the hunting reserve managers, particularly ONCFS and hunters' community. The prohibition of hunting activities and the exclusion of hunters' participation in wildlife management in the area aroused deep conflicts between nature managers and hunters. Recognizing hunters as crucial actors in scientific works and attributing them a label of researchers in the constellation are then ways to reintegrate the role of this human activity in the constitution of the ecosystems of the reserve:
"Ask all of the hunters, nowadays, the reserve is fine whereas 30 years ago, the reserve [managers] were only bastards" (H 1)
Relationships between ONCFS and hunters' representatives have then increased in frequency and in intensity.

Concerning the relationships between farmers and the administrative structure of the Natural Regional Park, research has mitigated consequences. While it is acknowledged that this structure supports innovative projects on emerging agricultural issues, the lack of transparency concerning the research results and organisation is sometimes generalised to other issues that reinforces the perception of problems of communication of the Park about its actions:

"Since I am at the farmers' association board of directors, I learn things but if you are not at the board of directors, well you do not know what they are doing" (F 5)

In the same way, the differences perceived in research topics and concerns displayed by farmers in their daily activities echo back other criticisms formulated towards the action orientations of the Park. It is argued that this organisation does not answer to actual local issues but considers Les Bauges more as a natural and rural area that should be preserved for recreational purposes of urban people living in the gate-cities of the park. Moreover, research does not seem to increase contacts between farmers and Park agents or agricultural technicians.

4.1.3.2. Shifts in actors resources

- ***Production of new knowledge***

New technical and scientific knowledge emerges from research carried out in the Massif des Bauges. Some examples can be presented:

First, pieces of evidence of the agronomic validity of mountain pastures rehabilitation by professional farming have been produced. The re-conquest of abandoned pastures stimulated the production of innovative knowledge about the agronomical value of heterogeneous habitats, a value considered as weak according to classical references established on monoculture meadows (Mestelan, Agreil et al. 2007). Researchers showed that the alimentation of heifers bred on the rehabilitated pasture of Armène contains 10 to 30% of brambles, which nutritive value is equivalent to or better than meadow grass (Meuret and Agreil 2006).

Second, research has led to the identification of specific competencies of farmers and animals to exploit these heterogeneous pastures. Débit (2005) shows that some farmers "intentionally" or not develop practices of education of calves meant to improve their abilities to move on steep pastures. She suggests that certain practices help animals to acquire competencies enhancing their abilities to exploit pastures in re-conquest. Moreover, other practices such as the strategic setting up of systems of enclosure or location of water spots are seen as important "to exploit a pastoral resource devaluated or neglected so far[13]" (Mestelan, Agreil et al. 2007).

Then, observations have been produced regarding the ecological impact of cow grazing, in particular the influence of this pressure on the dynamics of green alders. It has been shown that a whole class of age of young green alders is missing on the Armène pasture, a class that corresponds to the beginning of the reimplantation of heifers on the pasture. Although other factors can be responsible for this phenomenon, this result suggests cow grazing but also shuffling about might have an impact on the ligneous dynamics.

Concerning wildlife populations, a large range of knowledge concerning interactions between large herbivore species has been produced:

Research has enlightened the phenomena of pathogens transmission between wild and domestic herds. In particular, it has been shown that abortive diseases of cattle and small domestic herbivores are transmitted to mountain goats populations that are in contact with these animals on mountain pastures and affect their reproductive success (Pioz, Loison et al. 2004)

[13] Own translation

Knowledge about wild herbivores "feeding profiles" has been improved through collects of faeces and stomachs which content is analysed on the basis of different techniques: DNA analysis, Infrared Spectrophotometry and visual observations. Differences of profiles between species have been enlightened such as the fact that mountain goats and red deer essentially feed on grass resources, while roe deer are more selective and these profiles are influenced by seasonal variations (Herbivorie Info n°3, November 2007). The consequences of species interactions on feeding behaviours are also under study.
Populations monitoring through the use of standardised biometric indicators and methods enable to follow quantitative and qualitative evolutions. Indicators of the impact of herbivores on plant communities and particularly on commercial tree species are also developed for nature managers.

Other studies remain to be transmitted like information about spatial interactions between different species of large herbivores, both domestic and wild ungulates.

- ***Devolution of scientific legitimacy***

The assistance of scientists working in collaboration with nature and territory managers produces new available scientific and technical resources but also confer legitimacy to specific actors who are able to mobilise this knowledge. Park agents particularly value the credit they get from their contacts with researchers:
"They bring us the scientific backing […] the researcher still has a particular status, because of his objectivity" (PA 2)
The collaboration with scientists is then perceived as necessary to justify the Park actions in front of governmental institutions in order to obtain means to finance agro-environmental actions. Similarly, the support of researchers is perceived as facilitating the transmission of pro-environmental discourses from agricultural technicians:
"We have to talk about it [biodiversity], to be helped by these competent persons in order to make some farmers start to think about it. The one who mows at the end of August and therefore it is straw or the one who mows too early. To make them understand that they do not obligatory behave in favour of biodiversity […] we can use our general meetings or our information bulletins to transmit these messages but… [it has to come from] accounts of external persons because it has to be persons who are acknowledged in this domain" (AT 2)
For representatives of farmers and hunters, scientific knowledge is an important resource to defend their group that they consider as contested. Their loss of weight in political arenas due to their decreasing proportion in rural societies and the contested character of their activities necessitate acquiring a new legitimacy that scientists could give. Some farmers recognize that the operations of rehabilitation of the mountain pasture of Armène would not have been possible without researchers who had a role of mediator between agriculture and nature management worlds. Similarly, representatives of hunters perceive research results as useful to open the debates with other nature users such as foresters and give them more weight in nature management arenas.

- ***Unequal distribution and use of the resources***

But these resources are unequally distributed. First, social groups such as mayors or associations for nature protection do not know a lot about this research and then can hardly mobilise these resources. Then, Park agents and ONCFS technicians are more empowered as directly in contact with researchers and in charge of information diffusion. We can also see a disparity in the distribution of the resources, which are firstly directed towards representatives of groups of natural resources users rather than largely spread to the base, which barely have access to information.

Moreover, hunters seem to appropriate more actively the research results than farmers. They indeed make use of the results and technical to initiate changes in their own practices, shifts that are of course first stimulated by a restricted group of representatives. The adoption of biometrical indicators, in substitution of mere visual counting and the interest

towards other techniques like genetic analysis seem to be a result of hunters' involvement in research constellation. In contrast, the use of research results is less obvious in farmers' practices. They indeed tend to affirm that the presence of scientists on their territory hardly aroused changes in their concrete activities.

4.1.4. Conclusion on research networks

The Herbivorie network results from the needs for producing new knowledge in front of a situation of change. The dynamics of large herbivores population imply the emergence of new interactions between species and the appearance of different forms of exploitation of their environment in particular potential new feeding behaviours. The networks answer then to the need for taking into account the complexity of environmental issues, by enlarging its focus from the study of one particular species to the observation of multi-levelled ecosystems, comprising several communities, both preys and predators, in interactions with their habitat, its plants but also the characteristics of its landscape that influence the structure of the population. Herbivorie also lies within the current of new ecology by including humans as a normal factor of perturbation of this complex ecosystem. The network is thus meant to produce scientific knowledge that would allow the adjustment of another form of knowledge, more technical, in the perspective of developing practices that would maintain a desirable state of nature. Nevertheless, this network, which structure is actually quite informal, is not the only organisation at work on the territory of the Natural Regional Park of the Massif des Bauges.

Research constellations are actually structured around two main axes: the first dealing with pastoralism and environment, the second focusing on herbivores and environment. The links between the two axes are still slender despite the ambitions of the Herbivorie network to connect the three components herbivores, habitats and humans. In these two constellations, the relationships between actors turn out to be different.

On the one hand, research about pastoralism and environment is centred on a partnership between the Regional Park and a specific research unit of INRA Avignon. The links between researchers and most of the actors on the field are centralised around the Park and particularly its agent in charge of agro-environment. The empowerment of this actor in the research constellation provides it with the opportunity to use research as instrument to communicate its discourses and persuade other stakeholders such as farmers and technicians. Its important role in the transmission of information allows it to filter the results that are actually communicated and sometimes to present them in a simplified manner that eludes parts of the conclusions of the research. The agricultural technicians also relay the information that is then transmitted to farmers towards channels, which are sometimes difficult to identify. They use this role of transmitter to communicate their own discourses that they cannot propagate in regular ways. Researchers are directly in contact with farmers but with a very limited number of individuals of the community. Farmers hardly seem empowered in the research constellation as poorly informed and limited in the opportunities to influence the orientation of the studies. But the question of voluntarily exclusion from research can be addressed. Indeed, they sometimes perceive research and scientists too far from their concerns what feeds the stereotype they formulate about researchers and policy-makers, two groups with which they tend to be in opposition. Very few farmers seem to make use of knowledge that is produced by researchers and some representatives claim the importance of giving room to farmers in research constellations in order to orientate the production of knowledge towards their actual concerns and immediate needs.

On the other hand, research about herbivores and environment are characterized by the tight relationships between hunters and ONCFS, relationships more particularly organised around the work of a technician of the Office. While researchers are actually perceived as far from the field and barely have direct contacts with actors on the field, ONCFS and hunters' organisations work in partnership for pragmatic reasons but also because of the relation of trust the technician of ONCFS managed to establish by continuously involving hunters' representatives in fieldwork and developing ways of

communicating the results. The success of the partnership can also be explained by hunters' particular interests in these research that enable them to improve their practices, enrich their naturalist knowledge and to have more weight in nature management arenas that, just as ecosystems, tend to gain in complexity. Hunters' representatives see their participation in research as a new way of being involved in nature management and making their voice heard. Research represents new occasions of gathering different actors, in particular natural resources users. The participation in research and the development of a dialogue based on knowledge that is perceived as neutral facilitate exchanges and account of different needs and expectations of natural resource management. Research, by gathering stakeholders, contributes then to the construction of win-win solutions that permit the combination of different land uses. One can now question the place of biodiversity in these arenas. Is biodiversity a concern for the different actors evoked in the research constellations? What does this concern imply for pastoralism, in other terms, is pastoralism seen as an activity that can preserve biodiversity?

4.2. Social representations of biodiversity

This second section will focus on local actors' social representations of biodiversity. As social representations inform attitudes that people adopt towards an object, we will try to identify respondents' social representations and see whether they are affected by contacts with scientists. In order to understand local actors' argumentation for and against the promotion of pastoral activities in the name of biodiversity management, it is first necessary to enlighten how they understand the term biodiversity and which attitude they display towards its management.

In this section we will try to enlighten the constitutive elements and structure of local actors' social representations of biodiversity by focussing on four groups in particular: farmers, hunters, Park agents and members of associations for nature protection. The results for foresters, mayors and agricultural technicians will be presented in appendix 4. These groups have been chosen for their implication in research constellations as shown in the first section of the results and to check the assumption of a possible opposition of nature protectors towards the use of pastoralism in biodiversity management. First, we will describe social groups' definitions of the term biodiversity and the relationships they established with extended concepts. We will try to see whether participation in research had an impact on local actors' familiarity with the term and on the meaning they attributed to it. Then, we will describe the evaluative elements of social representations of biodiversity and similarly try to show whether these evaluative elements are influenced by scientists' presence.

In this part, we will try to identify the elements belonging to the four fields of social representations defined by Moliner (1996): definitions, descriptions, norms and expectations. First, we will focus on enlightening how the different consulted social groups understand biodiversity. We will address the questions of knowledge and familiarity with the term, the meaning attributed to it without dealing with appreciations of the concept itself. Therefore, this first approach is meant to grasp non evaluative elements of social representations of biodiversity that is the components of the fields of the definitions and descriptions. The second approach that will be dealt with in the next section will focus on identifying evaluative elements (norms and expectations) that inform general attitudes towards biodiversity management.

4.2.1. How do local actors understand biodiversity? Descriptive elements of representations of biodiversity

4.2.1.1. The farmers group

All of the interviewed farmers already heard about the term biodiversity. Nevertheless, most of them recognize farmers' general lack of understanding of the concept and they displayed difficulties to explain the term:
"I went to a geography university so biodiversity, yes, I master but I think the boys even do not know what it means" (F 6)

According to one of the respondents, this poor understanding of the concept of biodiversity justifies a rare evocation of this term in conversations with colleagues:
[Interviewer: Do you use the term biodiversity with other farmers?] *"Oh no because most of them do not know what it means" (F 2)*

Biodiversity is first associated with wild emblematic and endangered species but domestic nature also starts to be included in the description of the concept. We can see that farmers' understanding of the concept is deeply rooted in their experiences of agro-environmental measures. Indeed, although biodiversity is only barely defined as a topic of conversation among farmers, they use to hear and talk about it in meetings with representatives of the Natural Regional Park about Natura 2000 or other agro-environmental measures. Biodiversity is therefore first related to the protection of emblematic species mentioned in the directives but considering the development by the Park of agro-ecological

measures dedicated to spaces that farmers use to not consider as natural, some of them recognize that their view over what biodiversity is has changed and got extended to ordinary nature they used to not value:

"The image that people [farmers] had of a biodiverse meadow it is something…a meadow on the top of a pass that one mows very late, one arrives and sees only flowers, you see? […] we did not have the feeling that the meadows that we mowed at the bottom could be biodiverse meadows. Because maybe we expected even too much compared to what biodiversity actually is" (F 3)

Farmers argue that the implementation of a particular agro-ecological measure, the so-called "Prairies Fleuries", which aims at establishing remunerated contracts with farmers, who guarantee maintaining a certain diversity of flowers in mowed meadows, had an influence on their understanding of biodiversity. Biodiversity is not only considered as limited to wild nature but can also be found in the diversity of flowers in exploited meadows as evoked by most of the interviewed farmers:

"Biodiversity [is] the maximum of plants on a territory and all of these things" (F 4)

"it is like plants in a meadow, several tree species" (F 2)

"[in biodiversity] it is true that we talk about flowers but there are also races" (F 6)

One of the farmers particularly stresses this point by claiming that diversity of cow races is as important as plant diversity. Nonetheless, other respondents still root biodiversity in the domain of wild nature, which is considered as the only real nature. Biodiversity is then directly associated with emblematic species figuring in biodiversity protection policies such as the Habitats and Birds Directives. The perceived degree of naturalness of spaces and species conditions the legitimacy of their protection in the name of biodiversity:

"[The Prairies Fleuries measure] should not be done on the mowed meadows. It should be done on the natural meadows that are not mowed or grazed. In the mountain, yes, that it is worth. There, there are not 4 flowers, there are 40. But here, with the fertilizers, the manure, it is not natural" (F 2)

All of the farmers define biological diversity as the variety of species on a territory. Even if plant diversity is the most common example of biodiversity suggested, they also acknowledge that biodiversity concerns all the forms of fauna and flora in a habitat. More than the mere variety of living beings, the notion of interrelationships between species is also important in farmers' understanding of biodiversity:

"It is, how to say…well it is like plants, several plants in a meadow, several tree species, several…everything that it is, how to say…well every flowers and trees and all of these mixed" (F 2)

Besides specific diversity, they also evoke landscape variety as important but not directly covered by the term biodiversity itself that is more particularly associated with the diversity of living beings species.

Biodiversity is also associated with its use in politics. Besides describing it as a material object, two farmers acknowledge the discursive existence of the concept:

"Biodiversity, it is a word in fashion" (F 6)

We will see in the section dedicated to the evaluative components of the representations of biodiversity that this descriptive element can also be normative and lead to negative judgements towards it. Because he acknowledges the fuzziness of the concept, one of the farmers tends to attribute more legitimacy to scientists when dealing with the topics related to biodiversity, arguing that only scientists can master the concept:

"[Researchers] have a clear image [of biodiversity]. There is the average citizen's image of biodiversity and then there is the real image of biodiversity […] it is two different things" (F 3)

Besides this evocation, the work of scientists in the Massif is not frequently linked to the term biodiversity. When talking about the topics of the studies or the results of the research, farmers indeed barely establish a relationship with the concept of biological diversity.

4.2.1.2. The hunters group

The group of hunters shows certain heterogeneity in their understanding of biodiversity. First, the term is not known by all of the interviewed hunters. More precisely two of them never heard about the word. The appropriation of the concept in the hunting community is different between the oldest and youngest generations:
"I rethink about the young hunters, all of the ones that graduate from P., who prepare a BTS[14] or a Master […] well the term is often taken in their discourses. Therefore […] it also helps the ancients, the other generations to evolve but it is true that they have not been used to use these terms" (H 3)

Generally, biodiversity is then not considered as a familiar concept in the whole hunting community. Nevertheless, it seems that the notion was introduced in this community by the hunting federations.
"We can feel it through their publications, their discourses. Our hunters' federations understood that. Today, they are very present at the environmental level […] hunters are not only there to cull but they are interested in biodiversity in general" (H 3)
Biodiversity is then a term essentially used by hunters' leaders and representatives and the youngest generation that seems to be more familiar with ecological concepts because of its scientific higher education.

The term biodiversity is mainly associated with specific diversity of animals and plants. Biodiversity understanding is particularly anchored in the elements composing the hunting world:
"Biodiversity yes [can be used] to talk about the species that are hunted but otherwise…I do not think that people look at…use this expression in another context" (H 2)

Similarly to farmers' understanding of biodiversity, the notion is related to the process of erosion and particularly to the loss of hunting species:
"For me biodiversity would be to see species that existed because my uncle and my grand-father hunted the hazel grouse […]. I have been a hunter for a long time and I have only seen hazel grouses in picture" (H 2)

One hunter also evokes the socially constructed character of biodiversity. According to him, this new notion is more a social creation than a material reality:
"It is a new word. I speak fluently patois. As a joke I say that now I only accept words that I can translate in patois […]. Biodiversity does not exist [in patois]. So it means that it is something that has been created" (H 1)

All of the interviewed hunters have a tight relationship with the research constellation working on herbivores and environment. Nevertheless, we cannot establish a link between these contacts and their knowledge of the term biodiversity. This group indeed shows a large heterogeneity of understandings of the concept although they are relatively deeply involved in research.

4.2.1.3. The conservationists group

The interviewed members of associations for nature protection consider biodiversity as the variety of animal and plant species, both wild and domestic living beings. One of the interviewees is particularly critical towards the definition that nature managers, representatives of agriculture organisations, lay-people and even the majority of naturalists use to attribute to biodiversity. According to him, people confuse the notion of landscape and the concept of biodiversity, tending to affirm that biodiversity is necessarily associated with a specific type of landscape what was considered as ecological non-sense:
"To affirm that biodiversity is associated with this particular landscape is a huge mistake. It has absolutely nothing to do with it" (C 2)
He argues that while it is possible to display a preference toward a particular landscape, attributing an evaluative judgement to different forms of biodiversity does not make sense:

[14] Brevet de Technicien Supérieur: Technical higher educational diploma

"Is there a biodiversity that is better than another? Well we are not able to answer" (C 2)
He also claims that biodiversity, as such, only includes the notion of variety and not of species biomass. Biodiversity corresponds to the amount of species in a habitat, not the amount of individuals of one species.

According to the same respondent, the dynamic features of biodiversity are essential to understand its functioning. Biodiversity is argued to vary in time and space. In contrast, the two other interviewees stress the importance of biodiversity in providing balance to ecosystems and therefore in stabilising nature – which is defined as equilibrium or a series of balanced states – or in pushing it towards a positive evolution.
"Biodiversity means to stop disturbing the equilibriums according to our supposed needs and how we feel" (C 1)
"Biodiversity is the fact that on a same territory, on the same field, there are various species, plants as well as animals, that can create equilibrium. Well…we know that this equilibrium can evolve but well…" (C 3)
"A lot of things are triggered, isn't it, that are…let's say richness leads to bigger richness while impoverishment leads to impoverishment" (C 3)

4.2.1.4. The Park agents group

Park agents mostly talk about biodiversity in terms of species and habitat variety. Even if the term is not always directly used during the interviews, biodiversity is suggested through the evocation of particular species considered as symbols of biological diversity such as grouses or *Potentilla delphinensis*. Indeed, biodiversity is often defined according to the way it is understood in official biodiversity conservation policies such as Natura 2000 programme and its two directives. Therefore, biodiversity tends to be understood on the basis of the concept of erosion: disappearing habitats and rare species are more readily included in biodiversity.

Erosion is generally considered as a complex process that is caused by several and sometimes undefined factors from natural and human origins. Therefore, it is argued that the concept of biodiversity is difficult to grasp as a whole. Moreover, they also recognize that the definition is not very clear and they tend to include or exclude landscape from the concept during a same interview. The fuzziness of the definition is also linked to the political reality of the notion:
"Biodiversity is like sustainable development. Even if one talks a lot about sustainable development, you stop anyone in the street or even students, you ask what sustainable development is, none is able to say…or we stammer three words. But it is in fashion, one talk a lot about it" (PA 1)
"The Rio conferences happened, a lot of things happened. We used to talk a lot about biodiversity, biodiversity. So everyone had the head full of that and sustainable management" (PA 1)

Similarly to farmers' evocation of the research, Park agents rarely relate the studies carried out by scientists to biodiversity. It is not possible to determine a link between their definition of biodiversity and their contacts with researchers.

4.2.1.5. Conclusion on the understandings of biodiversity

To conclude, even if most of the respondents hesitate on the definition of the term biodiversity and acknowledge that they do not know what they call the "right" meaning of it, they can formulate quite elaborated understandings of it. Among the groups, several definitions are given to the word, categorising what belongs to biodiversity and what is excluded from it.

First, they almost all heard about the term. As all of them have directly or indirectly a stake in nature management due to their profession (farmers, Park agents) or hobby (hunters, conservationists), most of the respondents explain that they regularly hear about this concept in their networks or in media what explains their relative familiarity with the term.

They apparently learnt about its scientific definition. Indeed all of the respondents who know the term explain it as an ecological concept but generally focus on the specific diversity level rather than on habitats or genetic variety. Biodiversity is indeed understood as the variety of species in a habitat.

Habitats and genetic diversities are barely included in biodiversity *sensus stricto*, nonetheless, when enlarging the debate on more general views about nature, respondents tend to identify and value other forms of diversity: landscape variety for example is rarely understood as a form of biodiversity but is nevertheless valued and therefore has an influence on people's preferences towards nature management measures. Similarly, they understand the concept of biological diversity in terms of the maximal variety of species but tend to value the abundance of individuals in a same population as well. It is then necessary to enlarge the use of the concept of biodiversity to notions that are not strictly evoked in the scientific definition but that are implicitly related to biodiversity by the respondents. We should indeed consider these notions that respondents do not call biodiversity, as such, but still value and use to construct their attitude towards biodiversity management.

Generally, the meaning of the term biodiversity covers the specific diversity of wild plants and animals with nonetheless an enlargement towards the inclusion of ordinary and domestic elements in it like meadow flowers. Moreover, biodiversity is very often related to the notion of erosion as respondents tend to understand the concept of biological diversity in relation to the loss of variety. This also has consequences on the way they evaluate species and decide which ones could be considered as contributing to biodiversity. Indeed, rare species have a particular place in biological variety because of their decisive position in biodiversity erosion.

More generally, while local actors' understandings of biodiversity are indeed modelled by the scientific definition and political use of the term, they are also shaped by their experiences, for example their involvement in agro-environmental measures and their daily activities in relation to nature. Biodiversity is then seen through every-day nature like in meadows near villages.

Nevertheless, the majority of respondents displays clear difficulties to explain the concept of biodiversity and can hardly give a precise definition of it. The term biodiversity seems more familiar to three specific groups of actors who spontaneously tend to take it up during the interviews. Indeed, park agents, members of associations for nature protection and representatives for farmers' professional groups more often use the word. In contrast, other groups and in particular hunters develop less knowledge about biodiversity while they are frequently in contact with members of research networks. Most of the actors do not relate their experience with researchers to exchanges about the topic of biodiversity. Therefore, we are not able to establish a relationship between local actors' contacts with researchers and their knowledge of the term biodiversity. While this relationship cannot be demonstrated, it seems likely that the respondents' familiarity with the term is more related to their professional activities and responsibilities in associative or professional networks rather than to their involvement in research programmes. Besides the ecological definitions of biodiversity, numerous respondents doubt the reality of the concept and regard it as a political buzzword. This anchorage of biodiversity in political spheres echoes back the fact that representatives of groups seem more familiar with the term and then suggests the possible use of biodiversity in communication with non-professionals.

4.2.2. Evaluative elements of social representations

This part will present respondents' appreciations of biodiversity and their value orientations towards biodiversity management in general. We will try to address several questions:

- Do they think that biodiversity is important to protect?
- Why do they believe biodiversity should be managed (human vs. nature-related goals)?

- Which type of management do they suggest as necessary (human interventions or hands-off management)?

We will particularly try to enlighten which type of knowledge (cultural, technical, scientific) influences local actors' general attitudes towards biodiversity management. As attitudes and judgements towards an object are motivated by the evaluative elements of social representations, addressing these questions will mainly help us to identify the fields of norms and expectations in Moliner's bidimensional model (Moliner 1996). We saw in the previous section that the social groups were barely homogenous in term of understandings of biodiversity, particularly among hunters and conservationists. We propose then to transversely describe the evaluative elements of representations, presenting types of representations instead of focusing on each group. This presentation of results will help us to highlight similarities between the groups but also dissonances within a same group.

4.2.2.1. Biodiversity: a value for humans or nature?

All of the respondents recognize different values to biodiversity that can be ranged on an axis situated between two poles figuring anthropocentric and ecocentric functions. The majority of the persons who were interviewed evoke both of the values but groups of actors can be discriminated through the degree of importance they give to the first or second pole. Interestingly, these groups did not reflect the social groups that were *a priori* established according to respondents' profession or activity in relation to nature management. As we already saw when studying the understandings of biodiversity, the social groups are actually heterogeneous and some similarities can be observed across them, showing links between individuals from different groups. Four main tendencies, although overlapping, can be identified:

- ***Position 1: Biodiversity mostly valued for anthropocentric purposes***

The first position, and the most commonly taken by our respondents, is based on the vision of nature centred on human beings. Biodiversity is then valued for its functions that bring a benefit to humans. Within this position, two nuances can be distinguished: a willingness to transform nature according to human needs, and a tendency to preserve nature functions because of its role of human life support.

Most of the interviewed users of natural resources support the first view. Nevertheless we can first notice that farmers tend to display a dual judgement towards biodiversity, expressing evaluations situated in between a positive and a negative pole. First, it is clearly subjected to negative evaluations as being associated with scientists and ecologists, towards whom they sometimes formulated poor judgements:

"[Farmers] have hard time with associating themselves with the term "écolo[15]" […] that is why biodiversity which is related to this kind of terms […] according to who used them before, it is more difficult to re-use them" (F 3)

The appreciation of biodiversity is thus anchored in pre-existing social relationships with and stereotypes of other groups and is contingent to conflicts such as the expulsion of farmers from the hunting reserve in the 50's. The deliberate use or reluctance to use the particular term of biodiversity has then a social significance. It is a way of recognizing common interests with other groups or, like in the case of interviewed farmers, also showing its difference with ecologists by refusing to employ the same vocabulary and concepts.

As biodiversity is often related to the context of agro-environmental policies that have not been particularly well perceived, such as initial stages of Natura 2000, it was then related to notions of constraints and threats of which farmers should wary. Nevertheless, they also tend to attribute positive values to biodiversity.

The majority of hunters and farmers justify the need for maintaining biodiversity because of its contribution to benefits such as scenic beauty or recreational opportunities.

[15] Ecologists

This vision focused on humans' needs and representing them as legitimate users of natural resources leads to the emergence of a categorisation of natural elements in "good" and "bad" biodiversity. Species and habitats that are not beneficial to humans are indeed generally seen as an illegitimate form of biodiversity:
"If we do not put animals then it will become woody and then…and then it will be over, there will be nothing. Precisely, there will be no biodiversity because there will be no plants, there will only be shrubs or damn nuisance. Well, it actually is biodiversity as well but it is not in the right way, isn't it? […] all the shrubs, brambles and stuff, I do not really see the point" (F 2)
"When I have a mole, I leave it but when I have a grey rat in my garden I eliminate it. It is not biodiversity. If my wife finds a spider in the bathroom, it is not biodiversity either […]. I agree on biodiversity but at the condition that it is positive" (H 1)

Most of the interviewed farmers and hunters tend to value approaches of active management more meant to enhance nature qualities than diversity in particular. Indeed, they are in favour of management measures meant to protect some species, such as game for hunters, or types of landscapes more than others. These species and landscapes are positively judged on their contribution to the three main functions attributed to nature: economic production, aesthetic and recreational profits and therefore are considered as belonging to "good" biodiversity.

This approach of biodiversity management that defends active interventions for anthropocentric purposes is also shared by an actor of the nature protection associative world. This interviewee affirms that, on numerous points concerning nature management, he displays a marginal position in this world and can therefore not be considered as representative of this group. He argues that the main debate about biodiversity management should be focused on human activities and that nature protection should first answer to social and economic needs:
"We change the environment according to our societal needs but strong needs not the fact of wanting or not to have a little flower somewhere or other. That does not change the core of our society. What changes it is whether in the future we will need firewood […] we will certainly set up new forms of forest management to go towards firewood, it is very probable, there is nowadays a high demand. And so, in 50 years, when we will start to see the results of this work, the French forest might be different from the one we know today. Is it good, is it bad? No! It is just a demand, but a very strong demand, it is not three flowers somewhere or other" (C 2)

Considering human needs before purely ecocentric concerns is also supported by the fact that, for him, it is not possible to target a desirable state of nature.
While this respondent shares similar general concern towards satisfying human needs through nature and biodiversity management, he does not perceive aesthetical matters or affective attachment to specific landscapes and species as crucial to consider in the development of management orientations. Therefore, nature should not be considered as static pictures that have to be maintained by continuous interventions.

The other tendency supports an egocentric vision of nature conservation. Conservationists tend to see human survival as dependent on nature, what justifies the need for protecting its essential functions. The role of biodiversity as a source of subsistence for humans and as having an option value is evoked by the three respondents:
"As we do not know for sure which [plants] bring benefits, we might as well keep a large range of them" (C 3)
"We are a creature among others in nature. Without nature, we are nothing at all, we cannot eat, we cannot live, we have nothing […] we have to leave things setting…even from a strict selfish point of view, it would be favourable to us" (C 1)

A farmer also joins this vision by perceiving the importance of diversity in nature for all forms of living beings including humans:
"It is important, yes, that the landscape is composed of several plants, several…even if it is not especially beautiful to the eye but…anyway, everybody finds something, insects […] well nature is…we live in it […] it is important for humans and for farmers as well" (F 4)

While all of the respondents evoke anthropocentric functions to biodiversity, they tend to emphasise different specific values:

The main human-related value given to biodiversity by interviewed farmers and Park agents is the contribution of diversity in habitats and species to improving the scenic beauty of a landscape. A conservationist also shares this point of view:

"In plantations around houses, between a hedge of thuja, thuja does not make me angry but it is a pity if it is the only species, when you compare an alley of thuja and a hedge composed of plants, shrubs that we find in our area, we know that it will attract different birds and that in consequence there will be another microfauna" (C 3)

"If there was less species, it would be sad, isn't it? [laughs]" (C 3)

"If there is either forest alone or flat lands alone, I think that is a pity" (C 3)

Nevertheless, farmers and Park agents tend to particularly highlight the importance of biodiversity as a common richness for the territory of Les Bauges. The economic profit that can be generated from the exploitation of this natural richness is said to be one of the strongest point of the Massif des Bauges, allowing the development of touristic activities.

"People tell that they come to Les Bauges [because] it is a lung, a green lung" (F 1)

Biodiversity is then at the basis of a nice living environment that might be a source of income for a territory that moderately invested in winter sports infrastructures. The "authenticity" and preserved feature of the area are then highlighted and related to its biological diversity, such as the variety of flowers in a meadow and the diversity of large herbivores species such as mountain goats or roe deer, which populations are considered as particularly exceptional in Les Bauges:

"All the people who come here to our massif, well people are filled with wonder by coming across a herd of 30 mountain goats" (F 1)

"[The Massif des Bauges] is a inhabited rural area that is remarkable because of its landscape, its biodiversity, it cultural patrimony" (PA 1)

Nonetheless, only few interviewed farmers consider tourism as an important activity on the territory, the other ones arguing that people from the cities close by barely contribute to the economy of the area. It is indeed said that the existence of the Natural Regional Park is hardly known by people, even though they inhabit in villages belonging to this structure. The relatively recent creation of the Park and the association of the term Bauges with the area limited to the Canton du Châtelard hinder thus the development of a flourishing touristic sector.

Biodiversity is then considered as a common good for Park agents and some farmers but is also evoked as a private richness for other actors. First, some farmers acknowledge the benefits of biodiversity in their own activities. In particular, they evoked the importance of plant diversity for the appetency of fodder and believed in the influence of this diversity on milk quality and cheese taste.

"The more flowers you have better the milk will be" (F 2)

"The real cheese maker clearly sees that the more diversity he has in his meadows easier cheese making is" (F 6)

"[in flowery meadows] the fodder is also not the same. It is less quickly ripe, it is more…well it remains fresh longer, it is also crunchier. It is completely different" (F 4)

The contact with researchers working on biodiversity economics, and even more the implementation of an agro-environmental measure aiming at rewarding the management of flowery meadows, seem to have changed the way farmers perceive the benefits of biodiversity. While they tend to see biodiversity more as a common good than being beneficial to individuals – even though they consider the positive effects of plants diversity on dairy production as obvious, albeit not proved – the financial compensation brought by the measure to maintain biodiversity makes some farmers see biodiversity as actually profitable for their activity. The individual values of biodiversity are also evoked by farmers, albeit less frequently, in the positive impact of herbivores diversity and scenic beauty on their personal recreational activities such as hunting and hiking. This argument is nonetheless and non

surprisingly mostly defend by hunters who tend to praise the success of the introductions of mountain sheep and roe deer in the Massif, carried out by hunters since the 50's. Several respondents therefore associate biodiversity to the pleasure of practicing hunting and watching animals:
"I adore watching them [grouses] when I can. I could stay for hours with a spyglass watching grouses. Because they are magnificent, aren't they. In May, when they fan their tail, the courtship and all that, for me it is magnificent. Ah yes, for me if grouses would completely disappear it is true that it would make me...especially as we already lost all the hazel grouses" (H 4)
"For me biodiversity would be to see species that existed because my uncle and my grand-father hunted the hazel grouse […]. I have been a hunter for a long time and I have only seen hazel grouses in picture" (H 2)
This pleasure and other benefits related to mental health restoration are also suggested by conservationists, who, like hunters, keep up a personal and affective relationship with natural elements:
"Nature is an incredible resource. Resource of mind rest" (C 2)

- ***Position 2: Protecting biodiversity for nature own sake***

More rarely and disparately among the groups, biodiversity is valued beyond human-related objectives but for its role in maintaining nature for its own sake. A conservationist argues that nature should first be preserved for its intrinsic functions beyond the benefits that humans can take from it. Although he also recognizes that human beings would also enjoy the good functioning of ecosystems, he mainly expresses statements that refer to the need for protecting nature for its own sake.
Moreover, although farmers have the tendency to enhance perceived anthropocentric values to biodiversity, two of them also argue that biodiversity has to be protected as a whole because of its role in maintaining a desirable balanced state of nature. While this role cannot be clearly explained by one of the respondents, the other farmer stresses the importance of keeping every species because of their particular role in nature:
"If nature is composed of a multitude of things it necessarily means that each thing has […] its place and its utility" (F 4)
According to him, maintaining biodiversity assures the preservation of nature harmony and systems of regulation:
"If a species disappear, we do not know for sure […] the consequences"
"It is a sort of malfunctioning. When you erase a species compared to another […] more or less everybody regulated each other […] it is negative" (F 4)
Although this respondent has particularly been in contact with researchers, we do not think that this knowledge about ecosystems functioning is due to these relationships but more to knowledge that the respondent already had. This individual is indeed particularly interested in activities of observations such as animal-watching and knew a lot about plants and herbivores behaviour.
Even if some interviewed hunters are not familiar with the concept of biodiversity, most of them can formulate and explain the need for protecting species variety but only one respondent tends to attribute ecocentric functions to biodiversity. Just like the farmer evoked above, this interviewee argues that diversity of species should be preserved because of the role of each one in the food chains and their importance in ecosystems functioning:
"Even foxes are useful somehow, even stone martens…they do their predator work on rats, a lot of things like that" (H 4)
He also argued that every species has right to live even if it has negative consequences on human activities such as hunting:
"Kites do harm. But well, it is nature, so the saying goes. It is…the right to live. But well, it is true that it is quite annoying" (H 4)

This difference with other interviewed hunters responses can be explained by the fact that the interviewee describes himself as in margin compared to most of the hunters. He particularly disagrees on the meaning most of them attribute to hunting:
"Hunting is nowadays more a competition. The one who kills the most, it makes me…Well fortunately all of them are not like this but we can really see that it is now a competition. When you see what happens sometimes… […] As long as they have not killed, it is not alright. No, I do not adhere to this behaviour" (H 4)

- ***Position 3: Duality of vision: from ecocentric to anthropocentric functions***

Park agents tend to adopt a dual position concerning the values given to biodiversity. On the one hand, they suggest the existence of an intrinsic value of biodiversity and develop a view based on the necessity to protect nature for its own sake:
"My discourse will consist in saying that landscape should be maintained for landscape or for biodiversity" (PA 2)
Intervening to maintain habitat diversity is deemed necessary to preserve variety of species:
"When there is a mosaic of open/closed habitats, there is a lot of things…ring ouzels, there are hazel grouses, there are grouses, so there are lots, lots of animals that are dependent on these semi-open habitats" (PA 1)
"Are we playing at being God or not, I do not know, but we are particularly aiming to maintain a certain equilibrium between open habitats and closed habitats because…forest species are always there but open and semi-open, semi-shade habitats species disappear. Either plants or animals" (PA 1)

The notion of equilibrium between different habitats as enabling to maximize variety of species is used as an argument to justify interventions on nature. So, at first, park agents adopt an attitude in favour of hands-on management for purely ecological purposes. Nevertheless, it is argued that all kind of species and habitats cannot be preserved and that a choice had to be done:
"[Interviewer: Why did you decide to protect these species in particular?] Why [protecting] these species? Because there are existing programmes so we follow that way, because these species are emblematic too, because we have knowledge about them. It is much easier to take to climb onto the bandwagon than to go back to square one. Because it requires money and time"
This choice is then influenced by the certain path-dependency of policy and scientific programmes. The Natura 2000 habitats and birds directives largely frame the orientations of biodiversity management in the Massif. Moreover the existence of monitoring networks, such as the Observatoire des Galliformes de Montagne (Observatory for Mountainous Galliformes[16]) that carries out campaigns of grouses counting in the whole Alps, enabled the constitution of scientific knowledge about this animal which population can therefore be controlled.

Even if at first, Park agents' view is articulated on the protection of biodiversity for ecological purposes, we can observe a series of shifts appearing in this view. First, one of the interviewees recognizes that hands-off strategies would not necessarily be problematic for biodiversity and that it could actually be beneficial to it.
"If we leave natural areas evolve in a natural way, well it is very good, we will gain biodiversity. It is almost sure" (PA 2)
Nevertheless, he argues that human presence would obligatorily bias the natural evolution of the area and that humans' needs for natural resources could not be achieved in a nature released from human management:
"[Management could be] not necessary at all but then humans should not be on Earth" (PA 2)
Humans were then seen as legitimate users of nature that they should transform according to their needs.

[16] Own translation

This view justifies the use of intensive interventions to maintain the anthropocentric values of biodiversity, in particular aesthetic functions related to the development of touristic activities.
Park agents develop then a dual view towards biodiversity management in general. While they argue that biodiversity should be maximised for nature-related purposes, they acknowledge that a particular combination of habitats and species was desirable in the Massif for human-related objectives.

4.2.2.2. Balance and dynamics of nature

The notions of balance and dynamics are recurrent in all of the respondents' representations and largely influence the perceived necessity to intervene or not on nature. Three visions are nevertheless observed:

- ***Balance: an important ecological quality***

Balance is first seen as a sign of nature healthiness and perceived as necessary to the good functioning of the ecosystems. Hunters and farmers perceive for instance the overabundance of large herbivores population as the factor that triggers the emergence of diseases and the quick propagation of epidemics.

Biodiversity is therefore seen as important to maintain the stability of ecosystems and therefore their ecological quality. This static vision of nature explains the fear for biodiversity erosion as a factor of instability of the natural equilibriums:
"Red tuna in the Mediterranean Sea for example is very close to extinction […] this will have consequences on the equilibriums in the Mediterranean Sea on the other species […] for sure we influence in a very, very precise way an equilibrium that will be disturbed" (C 1)
The notion of fragility of nature is also evoked by this respondent, who clearly sees humans as a source of perturbation of the desirable state of balance:
"Shall we go back to our place in nature that is an animal among others, even if we are a little bit invasive, or shall we still consider ourselves as the king of Creation?" (C 1)
Other actors like a hunter and a Park agent support a relatively similar view. The Park agent argues that reaching the state of climax would enhance biodiversity on the scale of the Alps. We can see here that while all of the interviewed actors see balance as a positive attribute of nature, they do not perceive the same equilibrium as positive. While these conservationist and Park agent argue that nature should be left untouched because in a way it "knows best", farmers and hunters advocate an active management to maintain the state of equilibrium.

- ***Another vision of balance: intervening to protect nature anthropocentric functions***

The notion of balance is thus massively seen as a positive feature of nature by respondents from every group, for ecocentric matters as well as anthropocentric functions. Disequilibrium and the dynamic character of nature are thus negatively perceived because of their impacts on nature benefits to human beings. Farmers and some hunters consider interventions on nature as necessary because they believe that wild nature cannot benefit to humans and therefore has to be tamed and transformed:
"Nature left to itself does not really have the priorities that we expect from it" (F 1)
"Managed, it has to be managed that's it. If it is not managed it is a complete mess" (F 2)
"In areas that have been abandoned for 40 years, it is obvious that there is another equilibrium that has been created. But meanwhile, it is not an equilibrium that is really stabilised. Because we pile mountain goats one above the other but it is not getting us very far" (F 1)

Humans should therefore intervene to manage nature dynamics and constitute an equilibrium that would be beneficial to them. The regulation of this equilibrium has to allow the combination of different uses and economic expectations from nature such as forestry,

hunting and agriculture. Hunters are particularly sensitive to the topic because of the complaints formulated by farmers and foresters towards problems of overabundance of game that disturbs tree regeneration and damages pastures. The development of different structures gathering the actors of the three sectors, like the Observatoire de la Grande Faune et de ses Habitats or the convention for the equilibrium between agriculture, hunting and forestry in the Massif du Semnoz, allows the participative and coordinated management of large herbivores populations that takes into account the different interests of actors having a stake on meadows or forested habitats. Hunters particularly show their awareness of the difficulties to combine every expectation of users and the need for developing new ways of monitoring populations and their impacts on their resources:

"Nature belongs to everyone anyway so we have to share it" (H 2)

The implication in research seems to stimulate hunters' interests for developing more accurate knowledge about game feeding behaviour or structure of populations and techniques of monitoring such as the use of biometric indicators to trace the qualitative evolution of populations. Nevertheless, only some representatives who are in contact with research constellations display this willingness to improve hunting practices.

Park agents also evoke the state of balance as a goal to reach, in an anthropocentric perspective, in nature management in Les Bauges because of the attractiveness of harmonious landscapes in a perspective of touristic development:

"We try to develop tourism, green tourism of course and to conserve a certain landscape harmony" (PA 1)

"The charter [of the regional park] says that we have to maintain a balanced, bucolic, rural landscape" (PA 2)

Developing touristic activities and attracting neo-rurals necessitates then the creation and artificial stabilisation of a particular "rural idyll" (Halfacree 1995) type of landscape. The interviewed agents recognize that this static view of nature is in contradiction with actual natural processes that they describe as a series of temporarily stabilised equilibriums:

"Hikers think that…see nature as frozen. They have hiked here for a long time and they do not see that it evolves, that it gets woody. They believe that there have always been cows here […] we explain them all that is happening and how it moves, that it is an equilibrium in disequilibrium, that mountain is a big disequilibrium" (PA 1)

In consequence, biodiversity management is defined as the stabilisation of a specific state of nature that would satisfy human social and economic expectations (recreational, economic use of natural resources) as well as ensuring nature functions of adaptation. Stabilisation then requires active interventions that could counteract shifts such as plant dynamics or climate change. The association of the objectives of development and nature protection implies in Park agents' views the separation of different types of areas that should not be managed in a same way. While small, lonely and particularly rich and remarkable areas, that do not present any stake in terms of natural resources use should be managed through conservationist strategies (*"gardening" (PA 2)*), most of nature should be managed on the basis of human activities, like forestry or agriculture, that should be adapted in order to maintain the desired equilibrium of species and habitats, in other terms, the desired biodiversity at a particular moment.

"I think that none knows how to solve environmental problems, we are not God on Earth, it is not that important, the important thing is to make people aware of common issues and to make them accept to work together […] in issues of natural reserves, all the protected areas that are always very conflicting between naturalist competencies on one side, agronomic competencies on the other who do not manage to talk to each other, to meet, each one in its own legitimacy" (PA 3)

One of the Park agents states that this pragmatic view of biodiversity management is relatively new among nature managers and that the implementation of Natura 2000 contributed to a shift from exclusionist conservation to the inclusion of human activities in nature management.

We can see that the notions of balance and dynamics are often related to the interactions between humans and nature, humans being described as potential disturbers of balanced states or creators of a nature that keeps its ecological qualities and is favourable to human beings. We will then now focus on the relationships between nature and culture, and the notion of naturalness.

4.2.2.3. Relationships between nature and culture

The interactions between human activities and nature are seen differently among and within the groups. Three main views of the relationships between nature and culture are identified:

- ***Humans as dominant exploiters of nature***

Several respondents describe the tension between the use of natural resources and the preservation of these goods. Some hunters and conservationists particularly evoke the problems related to urbanism and touristic activities that damage landscape scenery and disturb wildlife. Actors encountering problems on the field with tourists or with mayors and building contractors tend to emphasize the image of humans as enemies of nature:
"They wanted to do a cross-country skiing track that was 34 kilometres long I think, that was going around the Semnoz so mountain goats protection, grouses protection […]. The Semnoz is really a magnificent mountain, it would be a pity to damage it […] the Earth does not belong to humans but humans belong to the Earth" (H 5)
"There is a lot of off-piste skiing too […] it is also not good especially because we know that a grouse that have been disturbed two or three times in winter, it…for recovery…it is very hard […] it might be a big factor of grouses decrease" (H 4)

Farmers all recognize their own negative impact on nature and most of the respondents are quite sceptical about the ecological willingness of farmers in the Massif des Bauges or at least in the Canton du Châtelard, arguing that they are more interested in financial advantages of and the weak constraints imposed by agro-environmental measures than by preserving endangered species such as the globe thistle. General notions of pollution and climate change are also suggested:
"Can you […] destroy everything just because of…your well-being or in order to produce more […] all these things that have been used, they found it back in water here and there, all these pesticides, all these things" (F 4)
The damaging practices are particularly acknowledged when dealing with the meadows of the valley that are intensively exploited.

- ***Humans as participants in nature***

Although the potential harmful consequences of the exploitation of natural resources are frequently evoked, hands-off management is barely suggested by local actors. The rejection of exclusionist strategies is rooted in the past of the Massif des Bauges and in particular of the reserve. The progressive interdiction of human activities in the reserve with first the restriction of hunting and eventually its total prohibition followed by the expropriation of farmers in the 50's remains a hot topic in local actors' minds. According to most of the respondents, this hands-off strategy failed as it is perceived it has led to the appearance of epidemics of kerato-conjunctivitis among the mountain goat population in 1977 and more recently to the local decrease in grouses population, following a same trend on the whole Alps. Moreover, the active exploitation of forests since the 11th century makes some respondents and especially conservationists aware of the human interventions contribution to the current landscape of Les Bauges:
"Human activities […] have generated, how to say…were very important for natural areas as well. There was an interaction between the two of them, so this awareness [of humans' role in nature] progressively arrived with experience" (C 3)

"The monks in Chartreuse deforested and, with foresters, also changed the structure of the forest of Chartreuse because they had needs. We changed the forest structure; we went from a beech grove to a beech grove/fir forest then a fir forest etc. Well in function of our needs, we change the environment" (C 2)
The stance for a view of humans as participant in nature is also adopted by a hunter:
"A national park, like in Vanoise, forbids hunting. It almost forbids every human activities, what to my mind is in contradiction to all that environment is" (H 1)
"All kinds of presence have a beneficial effect on biodiversity. All kinds of presence. Of course, it is even better if it is human presence" (H 1)
More generally, farmers claim their role in the construction of this biodiversity that managers try to preserve today. They also affirm that the Regional Park exists because of this rural heritage and the natural patrimony it has created. Nevertheless, all of the farmers do not agree on this point as the whole group did not value the same type of nature.

- ***Humans as stewards of nature***

A third view can be enlightened. While human activities can potentially be damaging, people also have the capacity to adapt their practices in order to enhance biodiversity. This vision of steward regroups the notions of engineers of a nature from which they try to create a profit but also the view of humans as responsible for nature own health.
Users of natural resources tend to emphasise this view. It is argued that farmers tend more and more to behave get responsible of nature by empirically adapting their practices towards environmental friendly practices. This view is based on the argument that local people have a better knowledge of the natural processes on their territory than experts from outside and would be able to adapt their traditional practices to maintain natural resources:
"The locals should at least be listened to a little bit more than what they have been. Because, I am willing that people who often have a string of academic titles or something come from outside but…we have seen so many stupidities in our territory…" (F 1)
"By force of circumstance, they [ancient farmers] realized what [practices] had mileage and what should be left alone" (F 1)
"I think that to implement things like that [agro-environmental measures] you really have to be on the field. And…what I told you before, we have the feeling that sometimes, people who do research they are a little bit on the margin of all of that" (F 5)
A hunter also displays this need for adopting reasoned ways of dealing with ecology and that lay-people know pretty well how to adjust their practices:
"Everyone is ecologist anyway. Well, we have to have a reasoned ecology anyway. We cannot say no hunting anymore or yes everything has to be hunted" (H 2)

4.2.2.4. Conclusion on evaluative elements of social representations of biodiversity

- ***Good and bad biodiversity***

The four social groups are in favour of biodiversity protection as everyone agrees on the importance of maintaining a rich environment for both nature health and the benefits humans can enjoy from it such as a nice living setting, the increase in incomes or the practice of recreational activities. Most of the respondents evoke human-related goals in biodiversity management, goals that are justified by the view that humans have the right to exploit nature and to change it according to their needs. Nevertheless, this view is not interpreted in the same way by all the groups. Nature users like hunters and farmers tend to differentiate "good" and "bad" biodiversity. To their mind, conservation of biodiversity does not mean protecting all forms of variety in nature but only the elements that are considered as favourable to humans like game for hunters or plants with high nutritive value for farmers. We saw that biodiversity is a term that could not clearly be explained by farmers and hunters.

Therefore they tend to establish a relationship between the concept of biodiversity and their understandings of nature. Indeed, biodiversity is mostly valued because of the desirable functions and characteristics it allows nature to reach. For instance, biodiversity enables nature to be more aesthetical and productive or to maintain its healthy state of equilibrium. Consequently, diversity as such is not seen as the most important aim but the conservation of useful or appreciated species and habitats seems the correct goal of nature management. We can note that research results have an impact on the way farmers see economic functions of biodiversity. This point will be further detailed in the part dedicated to representations of pastoralism.

- ***From biodiversity to the protection of specific elements of nature***

This distinction between good and bad biodiversity is not clearly displayed by conservationists and Park agents who tend to express the need for protecting all kinds of species and habitats because of the ecological function of biodiversity. At first, human-related goals seem then less important. But, the protection of all species and habitats cannot be envisaged in a realistic way: first, it is pragmatically not possible to protect all forms of biodiversity but easier to focus on species that are already concerned with existing programmes and about which knowledge has been produced. Second, natural dynamics leads to the irreversible loss of species that humans cannot counteract. Therefore, a choice has to be done. This choice depends on past and current global environmental policies and studies that have already been carried out but also on human-related goals. Conservationists and Park agents recognize that human needs require interventions on nature through the protection of particular desirable species and landscapes. Thus, we can see that, while hunters and farmers see the protection of biodiversity as less important than the preservation of specific elements belonging to the "good" biodiversity, actors of nature protection and management, because of pragmatic reasons, tend to the same general objective: biodiversity management should prevent the loss of at the time socially and economically desirable species and habitats and avoid the development of less favourable nature. In that way, the four groups evoke similar species and habitats to be in priority protected such as grouses, hazel grouses or agro-pastoral landscapes. Nevertheless, the groups diverge concerning the conservation of other species like *Potentilla delphinensis*, classified by Park agents and conservationists as "emblematic" but less valorised by farmers and hunters, who both tend to see the management of large game as an important measure in the preservation of the natural patrimony of the Massif. The question of the arrival of wolves in the Massif des Bauges is another source of oppositions that we will describe later on in the third part of the results.

- ***Oduman ecology and new paradigm in science of ecology***

The notions of balance and nature dynamics are evoked by all of the respondents. While equilibrium is generally seen as both favourable for nature and humans, dynamics is differently considered among the groups. The two paradigms of ecology are indeed entangled in interviewees' views. For numerous actors, the notion of natural equilibrium is synonym with assuring well functioning ecosystems and the sign of a healthy state of nature. The Oduman vision of ecology based on ecosystems equilibriums is then present in most of local actors' knowledge of biodiversity and nature. The modern view of nature as the product of natural but also human perturbations can be traced as well, with the majority of the respondents acknowledging the role of human activities such as pastoralism in shaping the current landscape of the territory. Nevertheless, the notion of balance remains recurrent in the anthropocentric perspective. The view that humans participate in natural processes is combined to the belief that balance of nature is also beneficial to them. Balance indeed allows different uses and satisfies several expectations of natural areas. From an ecocentric point of view, ancient and modern trends of ecology are also present: following Oduman principles of ecology, biological diversity is considered as a factor of stability, maintaining the

balance of ecosystems but is also a source of adaptability, allowing the resilience of ecosystems to perturbations.

Consequently, hands-on management and human exploitation of nature are not excluded from possible biodiversity management solutions. It is acknowledged that humans contribute to shape landscapes and should transform nature to benefit from it. Therefore, according to most of the respondents, pastoralism is not seen as incompatible with their representations of biodiversity.

- ***Incorporation of scientific knowledge?***

The importance of the notions of balance and dynamics, concepts at the heart of the different paradigms of the science of ecology, in local actors' social representations of biodiversity may suggest that scientific knowledge about in particular ecological principles such as the climax theory have propagated and have been integrated into lay-knowledge although it remains difficult to identify the origin of the ideas of equilibrium and the positive evaluation of static states of nature on which our respondents refer to understand the functioning of natural processes. Moreover, besides the impact of research and of the implementation of agro-environmental measures developed on these studies on some farmers' perception of economic values to biodiversity, scientific knowledge from the research networks rarely seems to inform local actors' evaluations of biological diversity. They tend to refer more to values such as beauty and affective preferences in terms of species and landscapes. They also found their views on general knowledge about ecosystems functioning rather than on precise scientific arguments. This approach was criticized by one of the conservationists who argue that people tend to behave according to irrational desires that they tried to cover by very broad scientific statements such as the fact that all species should be maintained to ensure the integrity of ecosystems. He believes that this enables people to use the concept of biodiversity in order to legitimate management measures that do not ecologically make sense.

4.2.3. Conclusions on social representations of biodiversity

4.2.3.1. Conclusions on Moliner Matrices

- ***Difficulties encountered in the construction of the matrices***

The use of the structural approach to social representations with a qualitative method of data collection and analysis was a point of uncertainties at the beginning of the research. Is it indeed possible to use the bi-dimensional model of social representations, developed by Moliner (1996), without using a quantitative approach such as the "hierarchical evocation" (Abric 2003) – free association exercise from a word and ranking of the items associated to this word according to their importance – which is frequently employed in socio-psychological studies to differentiate the core and periphery of a social representation. Moreover, besides an important literature dedicated to images and representations of nature, few studies deal more specifically with representations of biodiversity and, furthermore, try to define the structure of these representations. Therefore, little material was available to orientate the construction of the matrices.

We adopted then an empirical procedure to analyse the data, by classifying the elements of representations according to the positive, negative or neutral value that was attributed to them by respondents as explained in chapter 3. The first problem relies in the difficulty to establish the distinction between descriptive and evaluative statements. Some elements can indeed have both characteristics for a same respondent, alternatively designating what can be considered as biodiversity or nature and what can be seen as healthy states of nature or legitimate biodiversity. For instance, the statements referring to the dynamic aspects of nature could be interpreted as neutral descriptions of what nature is

(the observation of the increase in large herbivores populations) but also as a negative process that should be fought (the threat of epidemics due to this increase). Attributes such as wildness or statements related to human/nature relationships could hardly be classified in a specific manner.

The identification of the core and periphery also raised problems considering the small size and the heterogeneity of the social groups that were included in the sample. The determination of the periphery is especially complicated because it is not possible to verify their variability in the whole population. We nevertheless tried to distinguish the core and peripheral systems at the scale of our sample by segregating the elements that were expressed by every member of the group and were categorized in the core from elements less frequently evoked, which were by default attributed to the periphery.

We established the matrices only for the social groups that were composed of at least 3 interviewees in order to apply the criteria distinguishing core and periphery. The matrices do not present in an exhaustive manner all of the representational elements evoked during the interviews but the most important elements we found.

- ***Social groups' matrices and diversity of representations***

Table 3, Table 4, Table 5 and Table 6 represent the Moliner matrices of the four studied social groups.

Within each group, elements can be qualified of particularly stable and make the link between its members but also with other groups as we saw in this section with a tendency to define biodiversity on a common scientific and political base and to appreciate it according to codes that differentiate users of natural resources from protectors and managers. Nevertheless, the most striking point in our findings is the diversity of representational elements identified within a same social group. The periphery of the representations indeed shows alternative ways to describe and evaluate biodiversity that partly depend on individuals' characteristics.

The group of conservationists is particularly divided and displays three different views:

- Humans are enemies of nature. The latter should not be managed in order to return in a balanced state that is both profitable to nature itself and humans. This vision is typically in line with the Oduman principles of ecology, centred on the protection of pristine nature from humans, who can only disturb its equilibriums.
- Humans are both users and responsible for nature and therefore should manage it to enhance its ecocentric and anthropocentric benefits.
- Humans should be participant in nature rather than dominant exploiters. Nature evolves through its own dynamics but also under human influences. Humans should intervene to enhance nature anthropocentric benefits, and adapt their practices to preserve ecocentric functions.

Similarly, differences in biodiversity descriptions and evaluations are observable among farmers and hunters. It seems nevertheless difficult to enlighten the causes of such variety. The proximity with urban areas also seems to enhance the sensitivity to problems related to touristic activities and urbanisation of rural areas. Respondents who live near the agglomerations of Annecy or Chambéry indeed tend to evoke more frequently such issues, a tendency that is also suggested by a Park agent, who thinks that mayors located in periphery of these "gate-cities" are more concerned with nature and biodiversity protection than in the most rural parts of the massif.

We can also note that Park agents, and one respondent in particular, recognize a distinction between their own understandings and evaluations of biodiversity and the institutional discourse they have to display when taking the role of representatives of this structure.

4.2.3.2. Conclusions on value orientations

The diversity of social representations can be translated in the formulation of different value orientations: which general type of management (hands on/off) is desirable and towards which objectives (human or nature-related objectives).

Farmers and hunters are mainly in favour of active interventions of humans that aim at preserving the anthropocentric functions of biodiversity and nature, as they generally consider that wild nature cannot benefit to humans and therefore has to be tamed and transformed. Biodiversity is rarely valued as such but particular species and habitats that enhance landscape scenery, economic incomes or recreational opportunities (abundance and variety of game species) are privileged. They recognize that human activities like forestry and agriculture have largely contributed to the creation of the landscape of the Massif des Bauges and influenced the diversity of species present in this territory. Nevertheless, farmers and hunters also acknowledge the need for adapting human activities, for reasoning the exploitation of natural resources in order to maintain the qualities that are perceived as important in ensuring healthy state of nature: controlling the abundance of species is particularly seen as necessary to maintain the balance of ecosystems. Moreover, some hunters also think that regulations of access to particularly fragile areas are necessary. Examples of nuisances due to touristic activities are frequently evoked during the interviews and justify the need for excluding these specific activities from remarkable zones, for instance grouses habitats.

The three different representations held by conservationists entail dissimilar value orientations. While one of the respondents is particularly in favour of hands off management according to the principle that nature knows best and that humans can only behave in disfavour of natural equilibriums, the two other interviewees recognize the need for intervening in order to preserve both anthropocentric and ecocentric functions of biodiversity and nature. They also evoke the anthopic nature of the Massif des Bauges landscapes and, consequently, the need for maintaining the human activities that created this environment.

Park agents tend to distinguish large areas of ordinary nature, on which conservationist management would be too expensive and time consuming. Therefore, they believe that human interventions on these areas should be based on resource exploitation activities such as agriculture and orientated towards the valorisation of human-related functions. On the other hand, very small areas that are particularly rich or that contain rare habitats and species should also be managed in a conservationist perspective and to enhance ecocentric values.

We can conclude that most of the respondents acknowledge the need for actively intervening on nature to preserve its functions. The notion of balance is particularly important, as perceived as an indicator of nature healthiness and as positive to humans. The majority of the interviewees also recognize the role of activities such as agriculture in the construction of natural areas of Les Bauges. Subsequently, their social representations of biodiversity and nature *a priori* allow the consideration of pastoralism as a possible element that could be integrated in biodiversity management plans.

Table 3: Farmers' social representations of biodiversity

Farmers	**Descriptive elements**	**Normative elements**	
		Positive	**Negative**
Core	- Species diversity - Endangered species - Scientific word - Humans as exploiters of nature	- Aesthetic function - Economic function - Balance of nature	- Dynamics of nature - Scientific word
Periphery	- Political word - Wild species - Cow species - Meadow flowers	- Enhances tourism - Facilitates farming production - Recreational function - Stability of ecosystems - Support for human life - Humans as stewards of nature - Humans as participants in nature	- Political word - Fuzziness - Humans as enemies of nature

Table 4: Hunters' social representations of biodiversity

Hunters	**Descriptive elements**	**Normative elements**	
		Positive	**Negative**
Core	- Specific diversity - Endangered species - Humans as exploiters of nature	- Recreational function - Balance of nature	- Dynamics of nature
Periphery	- Socially constructed word - Game species	- Economic function - Stability of ecosystems - Humans as stewards of nature	- Humans as enemies of nature

Table 5: Conservationists' social representations of biodiversity

Conservationists	**Descriptive elements**	**Normative elements**	
		Positive	**Negative**
Core	- Species diversity - Endangered species - Humans as included in nature	- Ecocentric functions - Anthropocentric functions	- Humans as dominant
Periphery	- Dynamics of nature - Resilience - Domestic species and habitats (meadows)	- Stability of ecosystems - Adaptability of ecosystems - Aesthetic function - Recreational/well-being function - Support for human life - Balance of nature	

Table 6: Park agents' social representations of biodiversity

Park agents	**Descriptive elements**	**Normative elements**	
		Positive	**Negative**
Core	- Species and habitats diversity - Endangered/emblematic species - Humans as exploiters of nature	- Aesthetic function - Enhances tourism - Facilitates farming activities - Balance of nature	
Periphery	- Dynamics of nature - Domestic species and habitats (meadows)	- Intrinsic value - Balance of nature	- Political word

4.3. Social representations of biodiversity confronted to social representations of pastoralism

In the previous section, we identified the social representations of biodiversity that respondents expressed during the interviews. As they saw human activities as contributing to shape nature, we could conclude that their social representation of biodiversity did not prescribe an incompatibility between agriculture and nature conservation. In this section, we will describe how the interviewed local actors perceive the relationships between pastoralism and biodiversity. To study these perceptions, it seems necessary to consider both social representations of biodiversity and pastoralism. Indeed, social representations of biodiversity might inform attitudes towards its management and, in this case, the way local actors regard particular biodiversity issues that are related to farming activities, such as the phenomenon of landscape closure or the arrival of wolves in the massif. Moreover, social representations of pastoralism might influence whether local actors consider or not pastoralism as compatible with biodiversity and its conservation so whether pastoral activities can be seen as a factor of enhancement or destruction of biodiversity.

Thus, the elements of social representations of pastoralism that were identified in the interviews will first be quickly presented. Then, we will tend to establish the relationships between local actors' understanding of biodiversity and attitudes towards specific issues of management, and their perception of the activity of pastoralism. Do local actors see positive or negative effects of pastoralism on biodiversity and why? Do they attribute a role to biodiversity in pastoral activities?

4.3.1. Social representations of pastoralism

The definition given to pastoralism by local actors mainly concerns the extensive management of domestic herds grazing in mountain pastures, from the end of spring to the beginning of autumn, in the frame of a professional activity. Nevertheless, different views and practices are related to this term:

According to some actors, only mountain summering of milking animals can be considered as pastoralism. Pastoralism is indeed directly related to dairy production and not breeding activities. The management of heifers in mountain pastures for instance is not categorised as pastoralism to their mind. Similarly, the transformation of milk on the site is also considered by these specific respondents as a requirement in the definition of legitimate pastoral activities:

"For me, a mountain pasture is…a meadow where one brings up the herds in spring to make cheese. They bring up herds, they bring up people, who go there to work, to make cheese, and in autumn everybody come back" (H 1)

"You stay at the mountain and you have everything, you make your cheese at the mountain, well that is a mountain pasture" (F 5)

"False alpagistes so to say do not stay long […] first they never go up, they only milk, they do not stay at the chalet" (F 6)

These three respondents particularly criticize farmers who bring down the milk to transform it in the valley and only spend time at the mountain for the milking. Nonetheless, these practices are totally accepted by other actors who consider them as modern pastoralism that enable to gain free time or allow a better time management for other farming activities.

While pastoralism itself is related to the exploitation of mountain meadows, most of the interviewed actors also associate pastoralism with activities that are carried out in the valley and that are part of the production system in which pastoral activities are included. The exploitation of mowed meadows on the flattest plots near the farms and the villages are perceived by numerous actors as interacting with mountain grazing activities as part of a same production system. They have therefore to be taken into account in the analysis of

social representations of pastoralism. The notion of races is not evoked in the definition of pastoralism that can then encompass ovine, caprine or bovine production.

Deconstructing local actors' perception of the interactions between pastoralism and biodiversity, two main categories of elements seem to structure the social representations of pastoralism.
First, the statements concerning pastoral practices are often structured around the notion of function of this activity. Two functions are distinguished:

- Pastoralism: an activity of production
- Pastoralism: an activity of landscape management

Second, two characteristics of pastoralism are evoked in the interviews:

- A stance focusing on pastoralism as a traditional activity
- A stance describing pastoralism as a modern activity

These two categories lead to the construction of different attitudes towards pastoralism that are situated along an axis bordered by two extreme images of pastoralism: on the one hand an activity of economic production that requires modern and technical means and on the other hand a traditional activity, part of the cultural patrimony of Les Bauges, that preserves nature and landscapes thanks to farmers' ancestral knowledge and experience of the field. In between these two extremes, we could identify different practices that tend to limit the damaging effects of farming activities on nature, but also the development of quality products (AOC label).

We will now show how the confrontation of social representations of biodiversity and pastoralism triggers the expression of different opinions concerning their interactions. We will also focus on the role of scientific knowledge produced in the research in the formulation of these links.

4.3.2. Local actors' perceptions of the interactions between pastoralism and biodiversity

In this part, we will develop the positive and negative effects of pastoralism on biodiversity that are perceived by the interviewed actors. But we will first see whether these actors define a specific role of biodiversity in pastoral activities and if we can identify influences from the presence of researchers in the Massif des Bauges.

4.3.2.1. The role of biodiversity in pastoralism

Both positive and negative attitudes are displayed by local actors towards the role of biodiversity in pastoral activities.

- ***The construction of biodiversity agronomic and commercial value***

Pastoralism is mainly described as an economic activity meant to generate food products. As all of the respondents see biodiversity as a source of anthropocentric benefits, they generally argue that it has a positive role in farmers' activities. Nonetheless, mostly farmers themselves can only clearly explain the benefits of biodiversity. As we already see in the part dedicated to the evaluative elements of social representations of biodiversity, farmers indeed recognize positive consequences of diversity on their economic activities.

First, they argue that diversity of plants in meadows enhances the quality of milk and in particular contributes to the taste of cheese. This statement is supported by scientific results transmitted in particular by technicians, and by farmers' own experiences and common-sense knowledge. The diversity of flowers in a meadow could then be used as a

commercial argument to distinguish their dairy products in particular from cheese made in plains:
"[Biodiversity is important for] the milk quality […] the plants quality […]. I mean, we are in mountains, you cannot do like the farmers from the bottom […] somehow you are obliged to distinguish yourself" (F 4)
"We will say that we do have flowers in our meadows, the farmers have contracts, they guarantee to have flowers in their meadows, it is fine, you can come over to see the flowers in the meadows and the 'tome' smells good the flowers that are in the meadows" (F 3)

We can then identify a form of appropriation of biodiversity by farmers, who consider it as part of the "terroir". Biodiversity becomes a specific quality, an added value characterising the product and enabling farmers to counteract the lack of productivity due to difficult conditions of production in mountainous areas. In consequence, several farmers regard the development of the Tome des Bauges AOC label as a potential solution to enhance the value of the milk and increase their incomes in a harsh economic context.

Moreover, farmers tend to perceive diversity of plants as good for cows alimentation. The variety of plants, including species that were not considered as valuable according to classical references, seems to have more value to farmers' mind. The development of technical knowledge about the cultivation of these species and their diffusion, in particular by Park agents, convinced some farmers of the adoption of the agro-environmental "Prairies Fleuries" measure. It is difficult to clearly conclude on farmers' motives for adhering to this measure, in particular the balance between environmental and financial interests or the only few constraints that the measure entails, but at least, numerous farmers thought that their productivity would not be sacrificed and therefore subscribed a contract:
"When he [a Park agent] brought me the list of flowers the first time, I thought that it was only weeds…it was a little bit the impression, you looked at the list of flowers and you thought that is was only damned nuisance. But actually we have them in our meadows and we are not aware of that, and it is true that when it is done at the right date, at the right stage, it is appetent for the cows" (F 3)

The interviewed farmers mainly agree that the variety of flowers in meadows improves the appetency of the fodder and contributes to a diverse alimentation of animals. The notion of equilibrium in meadows composition was then seen as positive because of its role in ensuring balance in animal nutrition. We cannot clearly establish whether this particular knowledge originates from research but it is likely that the Park agents communicated about it at the implementation of the agro-environmental "Prairies Fleuries" measure in order to convince farmers of the benefits of adopting practices that enhance plant diversity. The role of a particular Park agent in the diffusion of knowledge is highlighted in farmers' responses:
"We talked with [the Park agent] about the fact that you can have a flowered meadow that is productive"
"He [the Park agent] notes that, yes, as long as there is a load of liquid manure, a load of fertilizer and then two or three good harrowing, the meadows can subscribe [to the "Prairies Fleuries" measure]" (F 6)
"[The Park agent] saw the ones which harrow more and, apparently, it does not facilitate biodiversity" (F 6)

According to Park agents, the experiment carried out on the mountain pasture of Armène also produced proofs that ligneous plants can be included in cows alimentation and bring an extra value. For them, farmers have been convinced of this new idea in the summer 2003, in consequence of the extreme climate of scorching heat and drought. They indeed observed that heifers bred on Armène seemed to suffer less from the drought than cows that were bred outside the reserve, in open pastures.

- ***Biodiversity: a constraint for modern pastoralism***

New technical knowledge vs. classical references

For some farmers, the success of the "Prairies Fleuries" measure is due to the lack of constraints implied by the contract, as the flowers mentioned in the measure list are generally already present, even in meadows that are relatively intensively exploited. Consequently, the "Prairies Fleuries" measure is considered as a successful experience that managed to regroup researchers, managers and farmers around the common interest of biodiversity:
"Concerning the choice of flowers […] the compromise was to try to find plants that were not too complicated […] that represented their biodiversity. They still did not want to put [plants] like the white clover or the ryegrass, what is understandable but they have not looked for plants that none had […] they stayed on logical things […] that is what gets the researcher and the farmer closer, they got aware that their two worlds were far from being opposed" (F 6)

Nevertheless, when studying this quote more accurately, we can see that this farmer associates the term biodiversity with the pronoun "their", which suggests that biodiversity might not be the common interest that seems to profit to humans in general and farmers in particular. Biodiversity is replaced into a social context and attributed to the group of "ecologists", regrouping around a same stereotype, members of associations for nature protection, natural areas and territory managers and scientists working in the domains of ecology and agro-environment. It suggests that the type of biodiversity that is supported by Park agents is not a matter of concern for farmers and that a compromise has to be established to make farmers produce this biodiversity without losing productivity. Scientific and technical knowledge concerning the benefits of cow diverse alimentation is not uncontested though. Indeed, several respondents explain their initial reluctance to consider the plants included in the "Prairies Fleuries" measure as agronomically valuable. Some of the interviewed farmers even strongly contest the list of flowers that is used, blaming it for containing only poor nutritive plants such as dandelions and buttercups. Similarly, very few farmers are actually convinced of the benefits of ligneous plants in cows alimentation. Most of the respondents are quite sceptical concerning the results of the experimentation of the Armène mountain pasture. While they recognize that cows can actually eat green alders, a behaviour they particularly observed in pictures largely diffused by researchers, they do not consider the good shape of the herd of heifers bred on this pasture during the 2003 drought as related to this behaviour. According to them, their healthy appearance is more a consequence of the presence of "good grass" next to green alders on the same pasture, good grass designating a resource that is evaluated according to classical technical references. The farmer responsible for this herd seems then to be the only one actually convinced by the importance of proposing diverse plants to cows in order to compose balanced meals. The classical technical references, in use in cattle rearing, it then responsible for rejecting or, at least, questioning scientific results:
"According to me, a cow eats fodder and aftermath, and then cereals to balance" (F 5)

The conflicts over natural patrimonies: biodiversity conservation as a brake on pastoralism development and modernity

Biodiversity is consequently also seen as an external threat imposed by nature managers, ecologists and researchers. In order to conceal both positive and negative perceived effects of biodiversity on pastoral production, farmers tend to distinguish what we called "good" and "bad" biodiversity. The protection of "bad" biodiversity is associated to efforts of ecologists and more generally urban people to preserve wild species and natural landscapes that are not valued by farmers for their usefulness, their beauty or their naturalness. What is natural patrimony? The evocation of "their biodiversity", designating the species that the agents of the Regional Park see as important to preserve, suggests that

there is not only one natural patrimony and that the protection of a specific one can potentially enter in contradiction with the main function attributed to pastoralism that is the economic production. The mountain pasture is a space of confrontation of two visions of nature: it is considered as a production tool by farmers and some hunters, while these actors criticize some mayors, the Regional Park and nature managers in general of regarding them as spaces that should be somehow protected from human activities. Farmers regret the existing conflicts around the construction of tracks and other infrastructures necessary to carry out dairy production on the basis of ecological and aesthetical concerns:
"[Talking about a mayor] she wanted the Park to vote against [the construction of a track] because…oh mountain pastures are still a sacred place…they should not be denatured by building tracks. But well we go to mountain pastures, we go working there. We are not in the same world anymore because for her, mountain pastures are still sacred, they are looked after but we do not know how, that is why they are sacred […] they are pure" (F 3)
"There are areas that are closed today […] that nowadays we could make accessible again and on which we could work properly. And we have some ONF areas that we do not have right to go through or anything else. We even do not know why but it is like that. We are not in periods where villages laden with farmers. I mean that when there are people who want to go working up there, they should be allowed to do it" (F 1)

Besides a lack of interest of some farmers towards the species protected under the programme Natura 2000 (some of them explained for instance that they did not know how *Potentilla delphinensis* looks like even though the species is present in their pastures) implemented at the initiative of the Park, the latter is particularly blamed for privileging forms of nature and cultural patrimony that are not valued by farmers and rural people in general:
"They do not defend the aesthetics of Les Bauges, the mountain pasture, the typical Bauju house. They do not give a damn. It is a little bit the park of Chambéry, of Annecy" (a hunter assisting to the interview at a farmers' place)
"[Chalets] are the patrimony, they do not stop going on and on about three little barns but [chalet] are still part of the patrimony. There are ruins all over the mountains, it is a pity […] they are attached to folklore, to packs of stupidities […] and then nobody is there to maintain settled systems" (F 5)

The Park is then blamed for being attached and highlighting in its policies a folkloric vision of agriculture in Les Bauges, a view that hinders the modernisation of production means. These conflicts particularly recall other problems crystallised around the topic of the Tome des Bauges AOC. Even though the AOC is not directly related to the issue of biodiversity, as the specifications of the label do not prescribe environmental measures, the problems linked with farmers' involvement in this label are often evoked when dealing with agro-environment. While numerous interviewed farmers acknowledge the creation of this quality label as a possible opportunity to improve the sales of local dairy products, the AOC network remains fragile and the specifications of production contested. The conflict originates from the choice of cow races. In the 60's, the industrialisation of agriculture tended to replace the local cow races by more productive animals. Consequently, nowadays in Les Bauges, a lot of farms breed herds composed at 100% of Montbéliarde cows that have substituted the Tarine local race (Palisse 2006). Nevertheless, the AOC decree, based on the INAO (Institut National de l'Origine et de la Qualité – National Institute for Origin and Quality[17]) trend privileging local races, obliges farmers to have 50% of "local" races (Tarine or Abondance) by 2012 (INAO 2002). For numerous farmers, this obligation is a problem, firstly because of the extension of pasture surface the adoption of local races that are less productive would require, but it is also perceived as a way to go back in time and artificially attribute a traditional character to the fabrication of this local cheese by adding elements like races that figure local colours. The "folklorisation" of mountain agriculture is denounced and seen as a brake on the development of the sector:

[17] Own translation

"Saving a product and a way of doing it, yes, but the folklore […] there are things that are a little bit ridiculous […]. They are attached to packs of stupidities. We have to use a copper cauldron, even if a stainless steel cauldron is quickly cleaned and does not change the taste of the tome" (F 5)

This farmer and a hunter also criticize the Park of privileging remarkable nature to the detriment of ordinary spaces and functional areas:

"I think that there are mountain pastures where a cheese production could be settled and that also need [money]. I would not like that all of the money of the Territory Pastoral Plan goes to these areas where Offices call for it […] there are other mountain pastures that also are in need and that we would rehabilitate without that much mediatisation. But this is a little bit [the problem of] the Park" (H 1)

"Environment is not only in mountain pastures, isn't it? It is also in the bottom of valleys and as I said before it is worse and worse […] it is forgotten because it is not spectacular" (H 1)

The agriculture development proposed by the Park through the rehabilitations of mountain pastures is not always seen as positive by the local population. It is often perceived as a new way for the national offices in charge of nature management to take possession of the area. Some respondents indeed think that rehabilitations do not have an actual objective of agricultural development but are only meant to respond to biodiversity conservation purposes in which farming activities are simply reduced to a tool. These operations are criticized because they are conducted in the objective of reopening pastures of heifers and not spaces of dairy production, which is the function of a "real" mountain pasture according to some respondents. The rehabilitated pasture is therefore qualified of "cattle enclosure in mountain". Finally, the restoration of abandoned pastures is also seen as a means to enlighten the actions of the Park in the media.

When pastoralism encounters wild nature: the wolf issue and the relationships between domestic and wild herbivores

Rehabilitating mountain pastures in the hunting reserve also means that domestic herds will get directly confronted to wild fauna. What does professional pastoralism become when its production means are in interaction with less predictable elements?

The topic of the arrival of wolves cannot be ignored in the debate surrounding the interactions between wild and domestic fauna. This issue was initially not meant to be dealt with in the interviews but most of the respondents spontaneously talked about it at the evocation of the study topic concerning the relationships between pastoralism and biodiversity. They seized the occasion of the interview to express their point of view about this topic that remains very hot among agricultural and nature conservation spheres in Les Bauges. The evocation of the wolf raises different remarks. First, this animal arouses very different reactions among the respondents that clearly separate two groups: the users (farmers, hunters) who display a very negative attitude towards it and suggest management measures such as the eradication or the confinement of the individuals in areas where human activities are not present, and on the other side, Park agents and nature protectionists, who present a more moderate attitude and careful preconisation of intervention. Second, another element of wild nature is linked to the relationships between pastoralism and biodiversity. Indeed, wild large herbivores are identified as interacting with domestic herds but the attitudes expressed about the nature of these interactions are very different from the ones developed around the arrival of the wolves. Most of the respondents display positive attitudes towards wild herbivores presence, although we could have assumed that these animals could be perceived as nuisances due to competition over feeding resources with or transmission of diseases to domestic animals. We will then present a comparison of the attitudes displayed towards these two categories of animals in order to understand why large herbivores tend not to be considered as problematic for pastoralism while wolves are generally perceived as a major issue.

Different values and beliefs about biodiversity and nature influence local actors' attitudes towards large herbivores and wolves:

In contrast to large herbivores, wolves are not considered by hunters and farmers as being an autochthonous species. This feeling regarding wolves as strangers in the territory is first due to the confusion that came with the arrival of this animal in Les Bauges. The lack of information about the condition of this arrival and the misinformation of the National Authorities concerning this return led to the propagation of rumours about the reintroduction of the wolf by extremist nature conservationists. Moreover, wolves are not considered as elements of the local ecosystems. It is believed that this predator hunts preys that are not present in the geographical and climatic conditions of Les Bauges:
"What do we need a predator for? If we had herds of reindeer in the wild, or I do not know what else that is subjected to this large Canidae predation, but it does not exist in our area" (F 1)

It is thus believed that wolves do not have a place in chain foods and in the ecosystems of the territory, as their role have been taken by humans and particularly farmers:
"How can you justify that it will relaunch an ecosystem? It relaunches nothing. Well the wolf is somehow like humans, isn't it? It is at the top of the food chain. It has no predator. So if you remove the wolf, you do not remove anything else before it" (F 3)
"The wolf necessarily had a role to play. Superpredator. But […] well afterwards we lived without the wolf and Man took a little bit its place" (F 4)

In contrast, Park agents and nature conservationists tend to highlight the natural character of the arrival of the wolves by relating it to a normal migration of these animals from Italy and evoking then the dynamic feature of nature.

The notion of allochthony also informs the way hunters and farmers judge large herbivores. The mountain sheep that have been introduced from Corsica to Les Bauges in 1953 was denigrated and accused of being responsible for damages on forests regeneration. Nevertheless, the diffusion of research results about alimentation of the species tended to moderate this image and to reintregrate mountain sheep into the local fauna. Interestingly, species like the red deer have also been introduced but are not subject to negative attitudes. Research results about feeding behaviour seem then to have an important influence on the way these species are perceived, proving that they do not engender the damages they were blamed for. Roe deer, for instance, were believed to have an alimentation essentially based on fir, local knowledge that has been invalidated by stomach content analyses, result that had an impact on the culling pressure applied by hunters.

Large herbivores presence is generally not seen as a problem for pastoral activities. According to most of the respondents from all of the groups, domestic and wild herbivores have always been in contact, without problems of cohabitation. The competition between them is of course evoked but rarely seen as problematic if wild populations are not overabundant. Similarly, transmissions of diseases are perceived as infrequent. According to numerous respondents, "it is nature" and one cannot go against it. Nevertheless, according to some hunters, the non-diffusion of some research results enlightening the large quantity of grass eaten by wild ungulates and therefore the actual risks of competition with pastoralism, also maintains the beliefs of normality of the interactions between wild and domestic herbivores.

The notions of balance and stasis/dynamics are important in the construction of attitudes towards wolves and large herbivores. First, according to farmers and hunters, wolves have a harmful effect on ecosystems because they are a source of perturbation of a stable and harmonious state of nature that established after its extinction:
"Here, the last wolf might have been killed at the end of 1800. We spent one century, ONE century without this creature. Someone should explain me why it was a problem for the massif" (F 1)

"Whatever they [wolves supporters] say concerning the environment functioning, I think that it is perfect. Considering fauna in the massifs we have never been in such perfect running order […] I think that this natural environment and human activity are a very good combination" (F 1).

Large herbivores populations also have to be balanced, overpopulations being considered as responsible for the emergence of diseases and problems of competition with human activities such as agriculture and forestry. Hunters believe that populations have to be accurately managed and selectively culled in order to maintain a certain proportion of individuals of each species but also of each gender and class of age. Wolves behaviour is often associated with an anarchical way to attack that cannot maintain this delicate equilibrium:

"Hunters have to regulate the problem [of game populations] and not the wolf, because the wolf will not make any difference. It will first kill the young and then it will attack the biggest" (F 2/H 6)

In contrast to hunters and farmers' arguments that support the uselessness of wolves in ecosystems in the Massif des Bauges, naturalists affirm that this animal has a role to play in food chains and is then important to preserve:

"[The wolf] participates to the equilibrium in all systems, in all ecosystems" (C 1)

They argue that wolves do not have harmful effects on large herbivores populations because of their capacity to sustainably use their feeding resources and to maintain the population equilibrium. Wolves are then elements of biodiversity that contribute to the balance of nature.

"To me, it seems coherent to let all of the relationships between predators and preys reinstall in an equilibrium that will emerge. Wolves know very, very, very well how to regulate the number of preys that they can cull, to use the jargon…or not cull. They know very well whether they can settle or not, whether they can create a pack or not, all of this, their knowledge is absolutely extraordinary" (C 1)

Farmers and hunters tend to emphasize the fragility of wild herbivores populations confronted to the arrival of the wolf. They argue that wild ungulates tend to get closer to dwellings to find protection against the predator. Moreover, dead deer have been discovered in the Massif and declared as wolf attack. Wolves represent then a serious threat for populations:

"We have to plan the return of predators and be careful because they can decrease roe deer populations very quickly" (H 5)

Moreover, farmers and hunters evoke the violence of wolves attacks, the cruelty with which they kill their preys and their perceived abnormal intelligence, that make some respondents doubt about the origin and nature of the animals present in Les Bauges:

"It looks weird to me […] when you look at documentaries, I do not know but the wolf or wild beasts kill the animal. Here they eat goats alive […] your goat has the udder and the leg eaten but it is still alive […] it is horrible […] for me they are not real wolves" (F 4)

According to naturalists, the attacks recorded in Les Bauges are not the result of particularly fragile herbivores populations or extraordinarily Machiavellian wolves but are a normal consequence of the arrival of the predator in the territory:

"Current studies show that there is no problem with wildlife. It [the wolf] takes [preys] but it is a predator, it is normal that we find eaten deer, it is absolutely normal" (C 2)

Furthermore, knowledge that refers to the adaptive and resilient functions of nature are used to argue that, confronted to a change like the arrival of wolves, nature will buffer and adapt until reaching a new equilibrium:

"When the wolf arrived in Mercantour[18], the mountain sheep got a big slap in the face. Numbers of animals were divided by 5 or 6. Now the mountain sheep starts to increase again. In wolves areas, roe deer also gets a big slap in the face when the wolf arrives. And the ones that stay, they understand what is happening and now the numbers of roe deer

[18] Mercantour Natural National Park

increase and are sometimes higher than before the wolf. Because sick, weak, reckless individuals have been selected and the smartest remain. And when hunters say 'we do not see any animals anymore, the wolf ate everything', that is a mistake! They do not see animals anymore because they are hidden, because if we can easily see them, at the fringe in the evening, the wolf will also easily see them" (PA 1)

Finally, the last notion influencing local actors' attitudes towards wolves and wild herbivores are the perceived benefits they bring to humans. Large ungulates are appreciated because of their aesthetic qualities and the source of wonderment they represent. Farmers and hunters oppose this vision to the image of the wolf, arousing fear and potentially being a brake on touristic activities. This image, fed by several stories and legends about man-eaters wolves, represents this animal as humans' competitor over the use of natural resources, which compromises humans' position as legitimate exploiter of nature and decreases the anthropocentric value of nature:
"It pinches mountain goats and roe deer from us and I do not accept it either on fauna or domestic herds" (H 1)
"I would always put humans on the top of the pyramid. I would never put an animal there. When we are reduced to put an animal on the top of the pyramid, it means that something goes wrong […] I think it is worthless to give it back to animal kingdom in comparison to the richness of life here, with people who were born here, who enjoy the living setting in which they evolve and all that it brings to them" (F 1)

In contrast, some members of associations for nature protection also see wolves as a source of amazement and beauty.

To conclude, the protection of large herbivores is not perceived as a threat to pastoralism. On the contrary, these animals are seen as a common richness, a form of biodiversity that everyone can enjoy, as long as hunters and other users of natural areas communicate and define management plans of populations, based on accurate knowledge about animal behaviours that is produced in research networks. On the other hand, the arrival of the wolf requires more than an adjustment of hunting plans. It arouses indeed the need for adapting pastoral practices, changes that are perceived by some farmers as a deep shift in their profession. This predator is seen as a threat to pastoralism because of the reactivation of conflicts between farmers and other social groups it triggers. Tensions between hikers and farmers due to the use of sheepdogs to protect herds are evoked. The story of a bauju farmer, who appeared before the Court because his sheepdog has been found divagating near a village, whereas this dog has actually been killed during a wolf attack 2 months after the event that triggered the complaint lodging, is told to highlight the paradox of the system that tend to accuse farmers for defending their interests. The arrival of the wolf and the uncertainties surrounding this event compromise the harmony that has been established through time with other groups. More specifically, the authorities in charge of the attack statements are blamed for questioning the reality of these attacks that seem obvious to farmers. ONCFS, the relevant institution officially in charge of these statements, is indeed disapproved for its so-called slow reactions in case of attack that reduces the chance to establish a right diagnosis and for dedicating the task to non-permanent employees such as interns to avoid conflicts with farmers. Numerous stories about the non-recognition of attacks are told with a certain feeling of bitterness:
"There is a cow that died at M. More than 20 kilos of meat was missing on it, well besides a wolf I cannot see what can make such damages to a cow. And then afterwards, one questions that because well the guys come over too late so foxes helped themselves on the carcass and…so after everything was done well M. was not recognized as wolf [attack] and I think that it is very hard towards farmers" (F 3)
The structure of the Park, which is still in a process of instituting its legitimacy on the territory and gaining trust of its stakeholders, is pushed in a delicate position when confronted to the problem of wolves:

"Since the arrival of the wolf in the massif…the relationships with farmers, with whom we have worked really well, or relatively well for a while, got tense because…they immediately wanted its eradication […] The Park is neither for nor against, being for or against the wolf does not mean anything at all. The wolf is here and that is it. We have to do with it" (PA 1)

The arrival of the predator and the mitigate attitude of the Regional Park representatives towards the behaviour that should be adopted is negatively perceived by farmers who draw a link between the current situation and the history of the hunting reserve. The return of the wolf indeed echoes back the exclusion of human activities from the reserve in the 50's as farmers fear that their activities will be sacrificed in favour of the implantation of the predator. This apprehension reinforces and re-launches then the stereotypes that they used to formulate towards ecologists, as said by this conservationist:

"[these difficult relationships between farmers and ecologists] that existed at one point came back a little bit with the wolf. Farmers used to easily classify people who they did not feel totally with them in the group of 'écolos' who do not do a damn thing, etc. So these black and white classifications are very quickly made" (C 3)

Farmers blame ecologists for employing this notion to illegitimately justify the preservation of wolves. According to two farmers, the public is manipulated by powerful organisations for nature protection that diffuse propaganda in favour of the re-colonisation of wolves in areas dedicated to human activities in the name of biodiversity sake:

"They [organisations for nature protection] say to lay-people that the wolf is the guarantor of biodiversity, the emblem […] this is a vision of urban people" (F 1)

"There is a huge majority of people that have been orientated for 15 years in regards of this wolf issue by showing wolves as a nice cuddly toy. And if you question this people on the street, are you for or against the wolf, they are for the wolf because they do not see why they would be against" (F 1)

The attitude of these two farmers seems reinforced by exchanges with researchers:

"M. told us that in 15 years […] all the publications about wolves have been multiplied by 10. Publications for children. […] M. said that everything has been planned […] he has a colleague, also researcher […] who did a huge work on that and […] who has proved that all this implantation of the wolf has been programmed […] by people […] who consider the wolf as their totem" (F 1)

According to them, wolves are the antithesis of biodiversity and experts bring support to this attitude:

"Nobody approves the utility of the wolf in biodiversity […] you cannot prove biodiversity that depends on the wolf. It is only one species. Even if it is one more species so somehow it is a little bit more of biodiversity" (F 3)

"I think that nowadays, we [farmers] are ecologically more able to justify the benefit for biodiversity than the wolf defender the benefit for biodiversity that will be brought by the wolf" (F 3)

Besides the direct impact of wolves on the biological diversity represented by wild fauna, changes in pastoral practices, like enclosing domestic herds at night on a limited area, generate damages due to the concentration of animals and therefore trigger other biodiversity issues. In contrast, a member of association for nature protection criticizes the use of biodiversity as an argument against wolves. He indeed thinks that blaming wolves for being an enemy of biodiversity is an extreme turn of phrase that is developed by farmers' professional groups to defend their activities and legitimate the eradication of the predator.

While agriculture tended to be more and more integrated in environmental policies as an activity that can potentially have a role in biodiversity conservation, the arrival of the wolf in French Alps questions this position, leads to a new marginalisation of farmers and the reinforcement of gaps between users of natural resources on one side and nature protectors and managers on the other one. The social representations of nature and biodiversity are at the heart of these new conflicts.

4.3.2.2. The effects of pastoralism on biodiversity and nature

All of the respondents perceive positive and negative effects of pastoralism on biodiversity preservation.

- ***Alpagistes[19] as nature managers***

Although pastoralism is first described as an activity of production, which is a core element of the representation of this profession, most of the actors acknowledge ecological functions to this activity, in particular a role in "landscape gardening". Part of the farmers recognizes that this activity represents the future of their profession and that the development of quality products such as the Tome des Bauges is already a first step towards a more multifunctional agriculture. Why is this activity of landscape gardening perceived as positive by the majority of respondents?

When cow grazing maintains biodiversity and a desirable state of nature

Pastoralism is first seen as a positive activity in nature management because of its perceived effect on landscape closure. Even if the topic is not evoked with the same intensity by all the respondents, this phenomenon remains the object of consensual negative attitudes. Vegetation dynamics is a well-known issue among the actors of the Massif des Bauges. It is directly and easily observable in the landscape by comparison to old maps and pictures from the beginning of the 20th century. Several farmers showed these testimonies during the interview in order to demonstrate the rapidity of the process and the differences of landscapes resulting from it. A lot of respondents referred to a limit of altitude under which the phenomenon occurs:
"On R. it is above the limit of woods, so there is no overgrown. There is only a loss of value in grass quality. Whereas if it is a mountain pasture at an altitude of 1300 [meters] that is abandoned, it is all taken by woods" (H 1).
"All that is above an altitude of 1500 meters […] basically the whole timberline between the edge and the mountain pastures" (PA 2)

Several species of invasive plants are considered as responsible for landscape closure but the green alders, the so-called "arcosses" in local dialect, are seen as the main colonising shrubs. Rural exodus and the multiplication of neglected pastures it triggered are considered as the central cause of landscape closure, a dynamics that seems to accelerate because of climate change and other global issues according to some respondents:
"Now brambles grow fast, aren't they? I do not know whether it comes from pollution or something else, even here where it is grazed, I see that it grows better than before" (F 2)

We will see now how different representations of biodiversity and nature converge towards the formulation of landscape closure as a problem and the promotion of pastoralism as a potential solution to it.

Respondents from all the studied groups explain landscape closure as a problem for biological diversity. Park agents and nature conservationists suggest that plant dynamics and mainly the colonisation of mountain pastures by green alders generally leads to homogenising a habitat which state of complexity was maintained by a fragile equilibrium. The function of biodiversity as a factor of stability of ecosystem is then threatened. On the short term and at the scale of the territory concerned by the dynamics, the environment is less various and loses lots of small scale habitats:
"We do know that closure means to go towards less diversity […] near our house after a while there will be either forest alone, beech grove, fir forest, or valley meadows alone. There will be no dry meadows anymore" (C 3)

[19] Farmers practicing pastoral activities

The loss of habitat variety is causally linked to the erosion of biological diversity at the species level as some species dependant on particular habitats would not have their place anymore:
"It does not mean to let everything close but it means to leave space for everyone" (C 1)
In particular, landscape closure is considered as responsible for the disappearance of grouses in the national hunting reserve and with a lesser impact in the Massif du Semnoz in the northern east part of the Regional Park.
Moreover, some respondents claim that forest is less rich in term of species variety:
"It is classical in ecology, when an agricultural area is abandoned, [biodiversity] explodes and then after 30 years it decreases" (PA 3)
A hunter participating in a study aiming at establishing grazing index values tells that he discovered during the fieldwork that the forest was actually really poor in species:
"*You walk across the forest, the forest is pretty, it is beautiful but when you look at the ground, you realize that there are only spruce and fir […] underneath there is nothing, there is no light anymore" (H 1)*
In this case, the participation in a research made the respondent aware of a situation of biodiversity threat that he did not realize. The issue of landscape closure becomes then one of the first signals of the arrival of ecological problems in the most rural parts of the massif such as the Heart of Les Bauges, which is generally considered as quite preserved and where environmental problems, such as urbanisation threats, seem less apparent in particular to mayors who continue to follow a logic of development.

In the same way, a Park agent also argues that forests contain a lower number of different species and smaller populations than in mixed landscapes:
"[Interviewer: what about biodiversity in forests?] Poorer. Different" (C 1)
In this quote, the respondent admits that biodiversity in forest is different from the one in open or semi-open areas. He implicitly associates this difference with a negative judgement, suggesting that biodiversity in forests is less desirable than in various habitats.

This statement is supported by other respondents who regret the loss of light species due to landscape closure but do not see the development of forest species like wild boar as positive. Landscape closure indeed seems to touch species that have a particular value to local actors in Les Bauges. These species are rare, so important to protect in order to avoid biodiversity erosion but they are also emblematic and therefore have a special symbolic meaning to the respondents. In this perspective, the believed decrease in grouses populations consequently to plant dynamics largely contributes to legitimate a negative attitude towards this phenomenon. It is then difficult to distinguish sound ecological arguments from more symbolic values given to nature. Similarly, forest species such as wild boars are immediately negatively judged, being considered as common and damaging species.
"Populations [of light species] start to decrease as soon as the clumps of alders increase. And then inside there are only wild boars" (PA 1)

Ecological arguments are then entangled in more anthropocentric values that contribute to people's evaluation of the utility of a species compared to another. While the loss of habitats and species diversity is considered as problematic because of the disequilibrium it arouses in nature, the disappearance of particular landscapes and living beings is the actual core of the problem. Landscape closure is therefore also a problem for humans.

Indeed, plant dynamics represents first a landscape issue. It leads to the uniformity of the landscape what mostly farmers perceive as very negative. They tend to associate the loss of diversity in the landscape with a feeling of monotony, boredom and lack of liveliness:
"There will be only trees!" (F 1)
"If you go for a walk in a forest the whole day, forest is nice for a while but well […] if you do not see the sky, it is not worth to go to the forest, isn't it? It has to move! It has to move! There must be life. If there is no life, there is no life […] there is normal life but there is no life" (F 2)

Furthermore, forests resulting from a process of re-colonisation are perceived as messy and do not have the charm of meadows and fields to which they are frequently compared:
"We cannot realize it but if we do not intervene, in 20 years it will be a forest and that is it. Even not a nice forest, it will only be scrubs" (F 6)
"Well I do not know but either you prefer to see some green, a nice meadow, or forests" (F 2)

Natural evolution of habitats would then lead to the loss of this particular agro-pastoral landscape that local actors and especially farmers value a lot. This ideal landscape, constituted of meadows, hedges and mowed fields and referring to Arcadian images of nature, seems to be particularly important as a source of touristic attractiveness:
"It is not spectacular, it is not ski stations […] but with experience, we see that some people are extremely sensitive to this type of landscape" (C 3)
This conservationist evokes the importance given to people and in particular tourists to the anthropic landscape of Les Bauges that seems to constitute, with the hunting reserve, the main potential on which touristic activities can be developed. For that reason, aesthetical issues arisen by plant dynamics could also have an impact on the economy of the territory.

Indeed, Les Bauges are considered as the *"green lung"* of the large urban areas that surround the Massif, which provides people with an *"exceptional setting"* to *"get some fresh air"*. Farmers particularly see landscape closure as a threat to the whole economy of the territory:
"If you leave everything abandoned for a year, I can tell you that it would move, because if we do not mow, well, it would be horrible. It would be all yellow, red, everywhere and we would not have the green landscape that people are looking for here" (F 5)
"There would be no tourist. Pff, what can they do in a forest if you cannot see anything?" (F 2)

Related to the topic of recreational activities, the problem of natural risks is also evoked, with some farmers, arguing that the development of undergrowth enhances the risks of avalanches and fires.

Moreover, respondents tend to refer to a more symbolic dimension of the issue of plant dynamics that is seen as a reversal in the normal relationships between humans and nature:
"[Interviewer: what is the problem with landscape closure?] (Blank) It is so obvious that I even cannot explain it. Really, the progress of forest is the symbol of humans stepping back" (H 1)
This quote expresses the vision of humans' domination over nature, humans who are seen as legitimate exploiters by most of the respondents belonging to the group of users of natural areas. Limiting plant dynamics through active interventions is then legitimated by a way of taking control over an overwhelming and wild nature that should be tamed. Wildness of nature is explicitly feared by this respondent who associates it with a loss of control of humans over a hostile nature and its unpredictable dynamics:
"When we go hunting, when we move into the forest, we find back some places where we can feel that human presence has been there, where it has been mowed, where it has been grazed before forest [develops]. So it starts with thorn bushes, brushwood growing and then come woods, large woods and then brushwood goes away and forest is here" (H 1)
The notion of humans as responsible for having shaped nature in Les Bauges is also surprisingly used by a conservationist who thinks that hands-off management is generally desirable for biodiversity. Confronted to the particular issue of plant dynamics, he advocates hands-on measures that are justified by the view that humans should continue to intervene on nature to maintain its static features:
"Let habitats close, no! Anyway we are here; the landscape that we have in front of us is not natural anymore […]. The landscape has been built by humans for millenniums and that is it, it is the result of our activity" (C 1)

While most of the respondents regard landscape closure as a problematic phenomenon, the same persons also showed that this problem is only relative and also has positive aspects. This dual view is developed by a majority of naturalists, both Park agents and members of associations and deals with the following points:

- Climax theory vs. human interventions: on the long term, landscape closure will lead to the emergence of another biodiversity that could even be richer than the current biological diversity in Les Bauges:
  "On the long term and large scale, another biodiversity will emerge" (PA 2)
  "30 years ago, I almost did not know the black woodpecker, the red deer, the roe deer, the mountain goat. Only 30 years ago […] actually forest species, I did not know them because, at the time, forests did not reach maturity as it was a recolonisation after cultures abandon and so, in around 30 years, we saw lots of new species appear: the common treecreeper, the Tengmalm's owl. The new forest species. We increased biodiversity in the region because we abandoned pastures. Involuntarily but…" (C 2)
- Dynamic vs. static vision of nature: nature is characterized by its dynamic feature, maintaining a static state is not better for biodiversity itself but enhances social functions of biodiversity by freezing a socially and economically desirable state of nature.
- More richness in open areas vs. scientific uncertainties: uncertainties surround the state of nature that should be reached to enhance biodiversity and in particular species like grouses. Consequently, plant dynamics, which are seen as negative today, could later be proved to be beneficial to biodiversity.

Grazing and constant presence of animals maintain open and "bucolic" landscapes that are both considered as beneficial to biodiversity itself and to anthropocentric values of nature (aesthetic, economic). This knowledge belongs to common-sense but is also confirmed by the research about cows feeding behaviour and their impact on green alder regeneration in the rehabilitated mountain pasture. Researchers largely diffused pictures of cows eating the leaves of green alders, showing first that this ligneous plant can be part of cows alimentation but also that domestic herds can limit the propagation of green alders. Farmers and Park agents, in particular, tend to justify the role of pastoral activities by evoking the INRA Toulouse research results, saying that scientists discovered that a whole class of age is missing among green alders population. While farmers immediately establish a causal link between cow grazing and this missing class, Park agents are more cautious, suggesting that other factors should be first investigated.

Indeed, uncertainties concerning the actual effect of cows on biodiversity remain. First, most of the interviewed actors do not believe that cows can open landscapes but that they are just able to contain the extension of bushes and closing phenomenon. Some actors think that goats or sheep might put a more intense pressure on ligneous plants but nature managers remain reluctant to the use of these pastoral solutions because of the risks of disease transmissions, perceived as higher than with bovine species. Moreover, according to Park agents, the ecological purpose of mountain pastures rehabilitation is not to open the area but to recreate a habitat that would be suitable to grouses. The first remark is that these habitats are very poorly understood and that consequently the ecological goals remain unclear. Second, research on grouse habitats shows that, more than open areas, grouses need an entanglement of woody patches and clearings. Therefore, cow grazing management requires the development of precise practices in order to create this specific complex habitat. Practices have to be adapted to generate favourable conditions to biodiversity: systems of pens, strategic position of water spots and salt blocks, etc.

Then, whereas Park agents and conservationists mostly see the benefits of pastoralism on biodiversity in the way these activities maintain open landscapes, farmers and hunters also evoke the notion of facilitation of domestic herds towards wild herbivores. Indeed, cow grazing is considered as enhancing the quality of grass that can in return benefit

to game. Although this issue of facilitation is still studied by researchers and remains an object of uncertainties due to the complexity of the problem, this belief is deeply rooted in hunters' and farmers' system of knowledge and thus does not come from contacts with researchers or studies results but more from observations on the field:
"In spring, when you come at 5:00 in the evening, there are red deer everywhere in every pen and if they would not need that, they would simply eat in the forest clearings. No, they come to eat what cows graze" (F 5)
"In the mountain pastures on which you work, well, fauna will benefit from it, at spring because it is clear…snow will disappear more quickly, flora will be so diverse that…they will go there by themselves. In spring, mountain sheep are all in grass new growth" (F 1)
"I think that mountain goats […] like grass better than 'arcosses'. I think…I see them all the time in grass, eating grass, I do not really see them eating 'arcosses'. Sometimes but…I even do not know what they eat in the middle of 'arcosses'. I see them eating something in 'arcosses' but I do not exactly know what they eat but…I do see them more often [in grass rather than] in hectares and hectares of 'arcosses'. Mountain goats stay more in it [grass], to my mind. Because they already have hard time to move into 'arcosses', aren't they. They are more in calm in somehow clean pastures, in nice grass" (H 4)

According to all of the actors who were interviewed, no competition exists between domestic and wild herds, as long as both populations are managed properly. This knowledge is more justified by the evocation of personal observation than research results. Numerous respondents suggest that each species has its own spatial and feeding behaviour:
"There is no competition between a wild animal and a domestic animal. By the way, sometimes we see doe and fawns with cows, there is no problem at all […] each one has its behaviour. Considering how long it has been done, we have always seen as many animals as usual. We even see more animals than before so, automatically, there is no impact" (H 5)

The traditional and ancestral character of pastoralism also contributes to the belief that there is no competition. It is argued that cows and wild animals have cohabitated for centuries and therefore "are made" to live in the same habitat. As we already said, transmission of diseases are perceived as very rare by all of the respondents, who cannot remember any case in the region and think that domestic animals prophylaxis is sufficient to avoid risks.

"Good" practices on mountain pastures and the protection of nature

Another argument, mainly used by farmers, relies on the view of humans as responsible for and engineers of nature. They claim that as they live from nature, they have an interest in maintaining its qualities through sustainable practices based on empirical and traditional knowledge. The presence on their territory of scientists, dedicating time and means to study their practices, is used as a proof of the common-sense of these practices. Moreover, the presence of researchers helps them to explain in scientific terms the ecological validity of their ancestral "innate" practices and their ability to live in harmony with nature. Therefore, the presence of scientists does not tend to change these practices but more to confirm them.

Some farmers describe the "good" alpagiste as the one who invests on and manages his mountain pasture in a perspective of optimization of the outcomes of this production tool. The optimization leads to fight against ligneous plants invasion but also to facilitate the exploitation of the pastures by cows. Removing bushes or setting up enclosures are then practices that allow distinguishing the good and the bad alpagistes:
"None tries to manage in order to save grass for autumn or anything […]. For them, when it is eaten, it is eaten and that's it […] they do not see the mountain pasture as such, if they do some good or not to it […] they have no management plan" (F 6)
"They enclose less than me because they do not manage the same way as me. They go up in spring and they go back and that's it! […] it is neglected so of course it is not the same management" (F 2)

The good alpagiste's practices are thus linked to environmental considerations that are often not directly seen as an objective for the farmer but as a consequence of their activities:
"[Maintaining mountain pastures without brambles is not] an environmental initiative. First, they [farmers] are obsessed with tidiness on principle and they cannot accept to have a piece, an enclosure that is full of bushes, of Rumex or damned nuisances, of brambles. So I think that it is more an initiative like that. It is not really…they have not thought 'we have to maintain the landscape, for them it is something that we have to maintain'" (F 5)
It is argued that scientists' works such as the study informing the different practices of calves' education to steep mountain pastures, help farmers to identify the positive impact of practices that are not intentionally reasoned in an environmental perspective.

Pastoralism: an economic activity that is potentially damaging

The main finality perceived in pastoralism, the economic production, is also seen as a threat towards agriculture functions in biodiversity management. Nevertheless, pastoralism itself is rarely directly accused. The economic context is indeed seen as the main issue disturbing the relationships between pastoralism and biodiversity:
[Do you think that nature protection is compatible with agriculture?] Not anymore because […] they have too many production problems, they just take the best" (H 1)
"Nowadays farmers, who pretend to be the great protectors of nature move back in front of invading nature […] before when forests would go down, the farmer would attack the forest to preserve the meadow. Now, the farmer escapes in front of the forest" (H 1)

According to many respondents, encompassing farmers themselves, the economic context pushes farmers towards the intensification of the most productive meadows while abandoning steep plots, practices that decrease species diversity, particularly autochthon species, but also aesthetic qualities of nature:
"In the bottom of E. there is much less diversity than for instance at M. […] [where] the fields around look more like the inclined meadows here. There are real colours, flowers and so on while here […] it is all yellow with dandelions and buttercups and then all white with rough chervil or other Apiaceae, hogweed and so on. And that's all. And we have to go a little more on inclined meadows to have sainfoin, meadow sage and so on […] it is probably due to the cultural mode because here sometimes when they put liquid manure, they do in a really big quantities" (C 3)

Farmers tend to rely on agro-environmental subventions that are proportional to the exploited surface. This leads to a race for purchasing new plots that eventually cannot be managed properly and are sometimes abandoned to bushes and brambles.

Moreover, mountain pastures seem to benefit from a more careful treatment, these pastures representing more than a simple production tool:
"[Farmers] are really proud of their mountain. For that matter it cuts both ways because in consequence they are maybe less careful to plots at the bottom" (AT 1)

Conservationists regard intensification of mowed meadows as an important problem for biological diversity – touching in particular insects and birds variety due to the development of monocultures and the removing of hedges – but also for soil erosion and the landscape quality. Hunters also pinpoint the issue that they mostly see as problematic for small game, blaming in particular intensive practices for being the cause of the disappearance of hares. Park agents recognize the problem but affirm that it is more useful to develop agro-environmental measures on meadows that are still rich in biodiversity rather than to try to avoid the intensification of the plots the closest to the farm. A compromise between economic needs and biodiversity conservation has to be found.

Finally, the issue of the construction of tracks, meant to access to mountain pastures is evoked by Park agents and conservationists as a potential problem that might lead to erosion and landscape damages. Nevertheless, the problems do not seem to be extremely salient.

4.3.2.3. Conclusion on the relationships between social representations of biodiversity and pastoralism

The description of local actors' social representations of biodiversity enables to have an overview of the diversity of understandings and evaluations that are attributed to the concept of biological diversity. In this section, we tend to show how these different social representations inform attitudes towards specific elements of biodiversity management that are directly in relation to pastoral activities. In particular, four problems are evoked: the arrival of wolves in the Massif des Bauges, the presence of wild large herbivores in interaction with domestic herds on pastoral lands, the issue of landscape closure and the management of mowed meadows in the valleys. The attitudes displayed towards these issues largely depend on local actors' social representations of nature and biodiversity, while scientific works seem less influential, although they have a role in supporting these attitudes.

- Mowed meadows management is negatively perceived by conservationists, who highlight the damages provoked on a fragile nature that loses its valued diversity and local character. Humans are then seen as enemies of nature that is valued for its own sake.
- All of the interviewed actors but particularly farmers and hunters display a positive attitude towards the presence of large wild ungulates populations in the territory of Les Bauges, mostly because of their anthropocentric values. Moreover, their interference with economic values of nature is not seen as problematic if the populations are maintained static and balanced through human interventions.
- Landscape closure is unanimously seen as a problem for ecological and human-related goals. It goes against an ideal vision of static and balanced nature and has to be counteracted by human interventions.
- Wolf belongs to bad biodiversity according to farmers and hunters because it is seen as useless, unpredictable and imported from outside. It is a threat against a fragile nature and its stable and balanced desirable state. It is then humans' enemy, as it tends to take their role of exploiters of nature.

While the interviewed stakeholders display different social representations of biodiversity, we can see here that they agree on some elements of biodiversity management. Maintaining open landscapes is particularly perceived as a priority, albeit for different reasons: loss of landscape scenic qualities (loss of typical agro-pastoral landscapes), disappearance of emblematic light species, natural disasters, etc. The consensus on the formulation of landscape closure as a problematic phenomenon is at the basis of the agreement on the promotion of pastoral activities in a perspective of nature protection. Because the interviewees think that pastoralism enables to maintain a desirable state of nature and biodiversity, farmers' activities should be supported.

In contrast, the differences in local actors' social representations of biodiversity also lead to the emergence of oppositions between attitudes towards biodiversity management measures. The presence of wolves in the massif crystallises the conflicts between representations, by inducing a separation of users of natural resources and managers or protectors of natural areas. Equally, species or types of habitats are not unanimously valued among the groups. Farmers, for instance, recognize the importance of preserving rare and emblematic species, although they do not have a direct utility in their economic activity. Nevertheless, they distinguish biodiversity defended by ecologists from their own biodiversity, which tends to include natural elements that present an anthropocentric value. In consequence, the protection of species like *Potentilla delphinensis* or of habitats like peat bogs arouses less support from farmers than from conservationists or Park agents.

The relationship between biodiversity conservation and pastoral activities is complex, a complexity that is in line with the tension between the two extreme social representations of pastoralism. This tension is particularly seen among the group of farmers who display the

finality and attributes of their profession. Among our respondents, we could identify three main tendencies, albeit the limited size of the sample:

The food producers

They mainly talk about agriculture and pastoralism in terms of productivity and income. These farmers are particularly focused on technical aspects of animal production, emphasising their technical knowledge about the animal, in the domains of genetics or alimentation. They also orientate their production strategy towards intensive practices. The initiatives based on the development of quality products are contested for an abusive attachment to folklore that goes against modernity. Research should be oriented towards the production of more precise technical knowledge, based on classical references. This group is in minority in our sample and according to their talks in margin of the main tendency in Les Bauges.

The protectors of biodiversity…in spite of themselves

The majority of the respondents' views fit this category. These farmers recognize the two functions of mountain agriculture with more or less concern for nature protection itself. Pastoralism mainly remains an activity of production and the mountain pasture a production means:
"We go up there to milk, we do not go up there to…I do know that we have to maintain the pasture but we have to live on it too" (F 2)
The good alpagiste tries to maximize the productivity of his pastures by intervening and investing on it. In consequence, he has a role in maintaining open areas. Farmers acknowledge then their role in nature management although it is not always intentional and this function is not the main finality of the profession. Research results help them to identify and understand the positive impact of their "innate" practices on biodiversity.

The landscape gardeners

These farmers see their profession in a phase of transition and imagine its future in the production of environmental services rather than the production of goods:
"The activity that we have here, I do not see it as an "agricolo-agricole[20]" activity. It goes way further than agriculture. You see, for a strict farmer, what we do here is almost not agriculture. The guy who sees you going to the mountain with cows, he says poor you, you have understood nothing" (F 1)
Different orientations are suggested from the production of firewood, snow clearing for municipalities or maintaining domestic animals in mountains to improve the landscape qualities or to enhance biodiversity.

The confrontation of the social representations of biodiversity and pastoralism leads to the perception of different types of interactions between pastoral activities and biodiversity situated in between two extremes: intensive agricultural practices as damaging biodiversity and biodiversity conservation as decreasing the function of food production of pastoralism, tending to change the profession towards multifunctionality and eventually a radical change of its finality.

[20] Agricolo-agricole = purely agricultural

Chapter 5: Discussion

- ***Discussing relation 1 (Figure 1): relationship between research and social representations of biodiversity***

The fuzziness of the concept of biodiversity

The first result relative to the representations of biodiversity concerns the fuzziness of the definition of the term biodiversity and local actors' difficulties to explain it in a comprehensive manner. Soini and Aakkula (2007) similarly describes a "vague understanding of the concept of biodiversity" among a Finnish rural population with, in particular, the absence of the genetic level of biodiversity in the definition of the concept, result that we also obtained in our study. Local actors do perceive variety in species and landscapes without explicitly linking it to the word biodiversity. Nevertheless, the respondents of the Massif des Bauges seem to develop a more elaborated understanding of this term and a definition more closely related to experts and policy-makers' meaning than interviewees of Soini and Aakkula's research. In contrast to their results, the issue of biodiversity is identified, probably because our respondents all have a relative involvement in nature conservation issues.

A concept anchored in scientific and political domains…

Local actors' understanding of the concept is anchored in the scientific and political domains. Indeed, most of the respondents borrow elements of biodiversity scientific definition (variety of species in a habitat) and concepts of biodiversity conservation policies (erosion, endangered species but also ordinary nature with agro-environmental measures) to make sense of biological diversity. The study reveals that the Regional Park and its agents but also agricultural technicians are important actors in the diffusion of scientific knowledge and of information directly related to biodiversity. The position of the Regional Park as the operator of three Natura 2000 sites in the territory of Les Bauges indeed legitimates this role in information diffusion. The implementation of agro-environmental programmes and measures imply then the circulation of knowledge about biodiversity. This may explain why, among the interviewed users of natural resources and areas, farmers are the most familiar with the concept of biodiversity, a result also shown by Soini and Aakkula (2007). The introduction of this notion in the hunters' community seems less significant although identified as the concomitance of the formulation of biodiversity as a hunting stake by the Federations and the concerns developed by the new generation of hunters directed towards the adoption of more ecological practices. Nevertheless, biodiversity is only barely integrated into hunters' vocabulary. For both groups of users, biodiversity is a concept "imported" from outside, from the scientific and political spheres but also from media. Biodiversity is indeed considered as a concept in fashion, for the same reasons as sustainable development or climatic change, a concept in fashion in politics as well as in media.

…but modulated by daily experiences…

Although definitions of biodiversity are generally based on the scientific meaning of the concept, the presence of research constellations in Les Bauges does not seem to have a critical role in the construction of the descriptive elements of social representations of biodiversity. A possible explanation relies on the lack of direct contacts between scientists and grass root actors like farmers and hunters. Furthermore, when contacts actually exist, local actors can barely remember having had conversations directly implying the term and concept of biodiversity, even if topics such as wolves or pro-environmental practices are evoked. The descriptions of biodiversity are rooted in daily experiences with nature, diversity

and even more erosion of this biodiversity, being observed in familiar spaces such as meadows near the villages or small game populations for hunters.

…and rooted in other social representations

While the definition given to biodiversity can mainly be associated with discourses of other actors (Regional Park, Hunting Federations, media), the evaluation of biodiversity, the values that are attributed to it, are more rooted in pre-existing social representations. All of the respondents understand the functions of biodiversity in relation to their conception of what nature is and should be and which type of relationship between humans and nature is appropriate. We found then similar components of social representation of biodiversity as in the model developed by Buijs, Fischer et al. (2008). This entanglement between representations of biodiversity and nature was particularly found among Dutch residents, who mainly based their understanding of biodiversity on their representation of nature and landscape in general. The meaning of biodiversity, the core that gives the signification of the representation and organises its elements, is found in the more general concept of nature. We can then conclude that the representation of biodiversity developed by local actors in the Massif des Bauges is not autonomous but is framed within pre-existing images of nature, its perceived values, attributes and relation to culture.

"Good", "bad" biodiversities and conflicts between actors

The perception of natural areas as productive or recreational spaces implies the emergence of a vision that considers biodiversity as a resource that is legitimately usable by humans. We saw that farmers and hunters consequently develop a dual representation of biodiversity, separating "good" and "bad" forms of nature according to anthropocentric norms, condemning species that cause damages to farmlands and privileging useful or aesthetic animals and plants. This dichotomy in representations of farmers in the Northern Alps has also been described by other authors (Mauz and Rémy 2004; Fleury and Larrère 2006). Mauz and Rémy (2004) conclude that this separation of two forms of nature explains farmers' reluctance to talk about biodiversity, this concept including objects that are seen as incompatible with their activities. It could imply that hunters and farmers might exclude themselves from biodiversity conservation political arenas because they do not recognize the concept of biodiversity as legitimate. To some extent, the classification of "good" and "bad" biodiversity tends to evolve through the diffusion in research constellations of new knowledge about the economic and agronomical benefits of plant diversity and information about large wild ungulates feeding behaviour. For instance, the transmission of scientific knowledge produced by researchers in the Massif des Bauges might have improve farmers' attitude toward the concept of biodiversity that was deeply rooted in stormy historical relationships with nature managers and in the implementation of coercive agro-environmental measures. Some knowledge, acting as pieces of evidence of the benefits of biological diversity on farmers' activity seems to improve farmers' acceptance of this concept, a shift that is nevertheless hindered by pre-existing beliefs and technical knowledge.

The dynamic aspects of social representations of biodiversity

Farmers and hunters evaluation of "good" and "bad" biodiversity essentially relies on their anthropocentric view of nature rather than on scientific arguments. Nonetheless, the appreciation of biodiversity is also based on value-laden principles derived from scientific notions of ecology. The concepts of equilibrium and dynamics are particularly salient. These notions are central in the two main currents of the science of ecology and related ecological engineering principles (Larrère 2004). Oduman and modern principles of ecology could be identified in local actors' description and evaluation of natural processes. While the ecological turn in the 90's led to the adoption of a dynamic conception of ecosystems and the recognition of their historical constitution, through natural and human perturbations, the

principle of balance is at the basis of respondents' understandings of ecosystems functioning, from users to conservationists and nature managers. The concept of balance is sometimes mixed with modern principles.

Through the use of the matrices of Moliner (1996), we could highlight the coexistence of different values, or evaluative elements, and beliefs that describe nature and biodiversity between the studied social groups as well as within the groups. This is coherent with the finding that social representations of biodiversity are not autonomous. The variety of understandings and appreciations of biodiversity might reveal that representations of biodiversity are changing and are in the state of "symbolic coping" evoked by Wagner, Duveen et al. (1999b). The entanglement of ancient and modern principles of ecology and nature management, among nature protectionists and Park agents, reflects the current ecologists' debates around the validity and pragmatism of some principles of ecology. This "concurrence with nonequilibrium views" is described by Moore, Wallington et al. (2008), who pinpoint the general agreement on some modern ecological principles: for instance, the recognition of perturbations as elements that contribute to ecosystems, acknowledgement of the importance of biodiversity in ecosystems adaptability. Moore, Wallington et al. (2008) show in particular that while scientists agree on the necessity to take into account different levels of organisation, part of the scientific community advocate for a focus on species for pragmatic reasons. This tension between the consideration of ecosystems in their complexity and a focus on managing a limited number of species is also found in nature protectors' and Park agents' views over biodiversity management. This duality is also documented by Mauz (2008), quoting Pinton (2001), who evokes the difficulties of naturalists involved in Natura 2000 to adopt the concept of biodiversity and to apply a shift from the "protection of patrimonial species" to the "preservation of biodiversity".

The coexistence of different values attributed to biodiversity and perceived relationships between humans and nature is also identified among farmers and hunters, who mainly perceive anthropocentric function to biodiversity and see humans as legitimate exploiters of nature but tend to develop alternative ways of understanding nature and its relationship with humans. Some farmers and hunters particularly distinguish an intrinsic value to nature and the necessity to protect all species for their right to live. Similarly, the two groups develop different ways of understanding the role of humans in nature, with the tendency to see humans as stewards and managers, beyond pure users of natural resources. As social representations form the identity of a group and determine the relationships of the group to the object of the representation (Moliner 1996), the variety of actors' representations might be the sign of the redefinition of the position of these users towards nature and the constitution of a new role in biodiversity management. We will come back to this point in the last part of this discussion.

- ***Discussing relationships 2 (a, b): the role of representations and scientific knowledge in the construction of attitudes towards biodiversity management***

The preponderant role of social representations in the perception of pastoralism/biodiversity interactions

The study shows that the formulation of pastoralism as a possible solution in biodiversity management is influenced by social representations of biodiversity but also of the activity of pastoralism itself.

Social representations of biodiversity and nature deeply influence the way local actors formulate specific biodiversity issues and display attitudes towards them. The values given to biodiversity, from anthropocentric to ecocentric functions, and the beliefs concerning natural processes and relationships between humans and nature determine which phenomena are perceived as problematic, as going against an idealised view of nature and biodiversity. Attitudes expressed by the respondents towards specific issues in the Massif des Bauges are indeed always rooted in their system of immediate knowledge and values. This relationship between representations of biodiversity, or values and beliefs about nature, and

attitudes towards management measures has already been enlightened by several authors like, among others, Van den Berg and Koole (2006), who showed the influence of perception of wilderness on people's landscape preferences, Fischer and van der Wal (2007), concluding on the importance of the principle of balance and naturalness as guiding attitudes towards biodiversity management measures or Buijs, Fischer et al. (2008), who state that lay-people attitudes towards biodiversity management are not "free-floating" but based on representational systems. Notions like autochthony, balance of nature or fragility are identified as important principles that guide the respondents' attitudes towards biodiversity management.

The perceptions of the interactions between pastoralism and biodiversity are also informed by the way local actors understand and value pastoral activities. The notions of finality of pastoralism and the degree of modernity of this activity are identified as important beliefs in the construction of the relationships between pastoralism and biodiversity. The consensual positive attitude figuring pastoralism as an activity that can maintain and even enhance biodiversity is often seen as obvious. The representation of traditional pastoral activities, undertaken by a responsible steward of nature incarnated by the local farmer, is deeply rooted in local actors' imaginary and in their social representations of the rural. One of the most spread representations of the rural is the so-called rural idyll (Halfacree 1995; Woods 2005), a society based on traditions and a quiet and authentic lifestyle in contact with nature. Local actors and particularly farmers and Park agents see in the preserved and rural character of the Massif des Bauges an asset that should be promoted to construct flourishing touristic activities and relaunch the development of the area. They defend then the role of farmers in the construction of this rural idyll that could guarantee a new lease of life to the massif. Although the core of the representation of pastoralism remains its function of production of dairy products, "good farmers" practices, even though not "intentionally" (Débit 2005) reasoned in a perspective of biodiversity protection, are seen as consistent with biodiversity conservation (Soini and Aakkula 2007).

The research findings are along the same line as other studies, which deal with the causal relationship between values, beliefs or representations and attitudes. But more originally, we identified the coexistence of contradictory elements of social representations that inform attitudes towards particular issues such as landscape closure or the arrival of wolves in the Massif des Bauges. Farmers and hunters show the propensity to regard wild animals such as ungulates and predators in a different way. Whereas they anchor the wolf in the domain of wilderness and in a view focused on the unpredictability of nature, large herbivores do not follow the same treatment. They are also associated with wild nature that, nonetheless, does not seem to be in opposition with the domestic world. The recognition of human perturbations as factors that have shaped and still construct nature in Les Bauges leads to reposition wild nature and to develop a dual meaning of the term wilderness as suggested by Micoud (1993): in the case of the wolf, wilderness designates forms of nature that cannot be tamed and domesticated. In contrast, farmers' and hunters' evocation of roe deer or mountain goats refer to wilderness that is the sign of naturalness. Preserving these animals then means protecting the "real" nature while maintaining wolves in the Massif automatically signifies a "threat for Culture[21]" (Micoud 1993). Wilderness can then be an ambivalent attribute, possessing both negative and positive values and presenting two distinct meanings. Contradictions in social representations are not impossible and can be tolerated because of the regulative action of the peripheral system (Abric 1994). The topics of wolves or landscape closure are emotionally involving for farmers because they directly threaten their professional activity. Confronted to this threat, they develop then different understandings of biodiversity (for instance a "bad" and a "good" diversity) that enable them to defend their group in face of these "disruptive events" (Wagner, Duveen et al. 1999b).

[21] Own translation

The role of research in the construction of attitudes

Our results suggest that attitudes towards biodiversity management, and more particularly the role of pastoralism in this management, mostly rely on social representations of pastoralism and biodiversity rather than on scientific knowledge. The complexity of the interactions between the effects of pastoral activities and biodiversity is often reduced to the perceived positive action of domestic herbivores grazing on landscape opening. Vegetal dynamics is indeed unanimously described as problematic, although for different reasons. Nonetheless, even though we could not show that scientific works influence local actors' attitudes towards biodiversity management, the results produced by experts seem to support and reinforce these attitudes.

About the consensual positive attitude towards pastoralism and the design of biodiversity management policies

The consensus observed towards the promotion of pastoralism in the name of biodiversity protection can nevertheless be moderated. Indeed, the lack of interventions of associations for nature protection in the debates surrounding the development of Natura 2000 or plans like the PLGE that we evoked in the introduction cannot exclusively be explained by an agreement on the positive effects of pastoralism against the dynamics of landscape closure. Indeed, the position of the Park as official operator of the largest Natura 2000 sites leads to the effacement of associations for nature conservation like the Conservatoire du Patrimoine Naturel de la Savoie in charge of other Natura 2000 sites in the Les Bauges. These associations might judge that it is preferable to dedicate time to areas that do not privilege from any form of organised protection or management. The absence of associations in the debates could explain then why the relations between pastoralism and biodiversity are rarely evoked in all of their complexity even by naturalists in our sample. They might not have heard about more controversial projects such as the construction of tracks financed on Natura 2000 subsidies, a distance from the debate might then be a reason for the apparent consensus.

Moreover, this study shows that this consensus strongly depends on representations of what biodiversity and pastoralism are, and is not only an agreement on technical and scientific facts that indubitably prove the win-win character of the combination pastoralism/biodiversity. This can be illustrated by the statement of this mayor:

"The proofs [of the positive effects of pastoralism on biodiversity] I do not know at all, well it should be looked at more carefully if we want to be totally scientific, it should be quantified, but I…but otherwise sure, globally it is good" (M 1)

In other terms, we could not demonstrate that the presence of researchers and the production of scientific knowledge in Les Bauges are the cement of the consensus observed but we can conclude on the important role of images like the rural idyll at work in positive attitudes towards pastoralism. Maintaining support for the inclusion of pastoral activities in biodiversity management plans requires then probably more than the development of scientific information and pedagogy about the effects of cow grazing on these well-known 'arcosses' or on the benefits of plant diversity on "the nice smell of flowers" in local cheeses. It also necessitates taking into account the diversity of stakeholders' social representations of biodiversity and pastoralism. Biodiversity is often rooted in broader concepts such as nature, particularly according to farmers and hunters, for whom enhancing nature valued features seems often more important than increasing biological diversity as such. It has to be acknowledged that there is not one natural patrimony in the Massif des Bauges but several ones, just like there is not one biodiversity but multiple ways of understanding this concept. In consequence, an emblematic flower might be extremely precious for a group but barely valued by another, and unless this group associates a value to it, it is not likely that it will try to protect it, albeit all the scientific information it might have about this plant. Equally, the protection of biodiversity could be perceived as a denaturation of the profession of alpagiste, a remark that is actually a criticism directed by several respondents at the Natural Regional

Park, participants who regret the lack of consideration for the "real" pastoralism, this activity of dairy production on the field, in traditional but functional chalets.

- ***Discussing relationship 3: relationships between researchers and local actors***

Integration of local actors into research

The development of effective and win-win biodiversity management plans that bring pastoralism – or more generally human activities of natural resource exploitation like hunting, forestry or agriculture – into play requires that different representations of biodiversity and human activities hold by various stakeholders should be taken into account. This study highlights that the elaboration of these plans necessitates the intervention of scientists. According to actors like agricultural technicians, they indeed have an important role in the exploration of different management solutions that reflect the complexity of environmental problems such as the conservation of biodiversity. Nevertheless, the production of scientific knowledge excluding local stakeholders is highly contested by our respondents, in particular by hunters and farmers. Some hunters indeed appreciate the valorisation of their role in research that is seen as a way of recognizing hunters as important actors in nature management after several decades of exclusion, in particular from the hunting reserve management. The enrolment of farmers in biodiversity management also requires the development of policies and plans that take into account their needs. In this study, we can see that some farmers display a negative attitude towards biodiversity because of their doubts concerning the positive effects of biodiversity on their activities and the benefits they can take from its preservation. These doubts might be due to a lack of transmission of research results, praising the nutritive qualities of brambles and green alders, but it seems that farmers less question the veracity of these scientific results than their relevance in the face of a serious situation of threat concerning the economic viability of farms in the Massif des Bauges. Some representatives of farmers' groups highlight the importance of their presence in initial discussions about scientific projects and suggest that enhancing the voice given to farmers from the very first steps of research is necessary to improve the adjustment of scientific work to local concerns. As argued by Callon, Lascoumes et al. (2001), "confined research[22]" has to be avoided in order to allow the diffusion of the controversies and the exploration of the "possible states of world[23]". According to them, research forums have to be opened in the three main steps of research or "translations": the formulation of problems, the research collective and finally the choice of the possible state of world.

Considering more pragmatic issues, some testimonies collected among members of research constellations, such as PhD students or technicians, suggest the importance of establishing bilateral relationships between researchers and actors in charge of data collection. The ONCFS technician involved in the herbivores/environment constellation indeed highlights the importance of organising the transmission of results but also of channelling hunters' comments and suggestions. First, the recognition of the precious contribution of the individuals in charge of data collection and the acknowledgement of their crucial role in the quality of scientific results is important to maintain a trustful relationship and make people on the field more aware of their responsibility. Moreover, the transmission of information in return and particularly of knowledge that answers to local actors' concerns is particularly appreciated. Mauz (2008) also evokes the importance of maintaining a reciprocal "contract between users and suppliers of data" in order to enrol on the long term local actors in operations of biodiversity protection. The organisation of research, facilitating or not the involvement of non-experts but nonetheless stakeholders, is indeed seen in our study as a factor that determines the appropriation of biodiversity.

[22] Own translation
[23] Ibidem

The role of research in local actors' appropriation of biodiversity

Although we could not demonstrate a significant impact of research carried out in Les Bauges on local actors' understandings and appreciation of biodiversity, the development of research constellations on this territory leads to other consequences. First, the presence of scientists and research results are mobilised by Park agents and agricultural technicians to give more legitimacy to their objectives of biodiversity conservation, in front of users of natural resources. These users, represented in particular by farmers and hunters, display worries about the future of their groups. Their marginalisation in political arenas, due to the loss of weight in the demography of rural areas but also to contestations of their activities, leads at first to the construction of negative attitudes towards biodiversity. Biodiversity is indeed somehow seen as a way to exclude, a threat imposed by ecologists, whom some respondents perceive as dominating nature management decision-making at the expense of "people of the country". The construction of such representation of biodiversity maintains then the opposition between protectors and users of nature that seems to be rooted in the history of the Massif des Bauges and more particularly of the hunting reserve. Buijs, Fischer et al. (2008) observed among farmers and hunters an anchorage of biodiversity in pre-existing representations of nature. They described it as a way of "neutralising" the ecological meaning of biodiversity that tends to threaten these groups' utilitarian vision of and relationship with nature. Nevertheless, in contrast to their findings, we see that farmers and hunters in the Massif des Bauges also develop understandings of biodiversity based on the scientific definition of the concept and tend to make sense of phenomena, such as the arrival of wolves and its consequences, by referring to ecological principles (food chains, balance of ecosystems, superpredation). Instead of developing "competing representations", as evoked by Buijs, Fischer et al. (2008), farmers and hunters interviewed in this study seem to progressively construct a social representation of biodiversity that follows the scientific meaning given to the concept. Wagner (2007) suggests that lay-people's most important motive to acquire scientific knowledge is the necessity of mastering this knowledge to participate in "the web of generalized social exchange and discourse". Keeping a place in political arenas might then be a reason for trying to appropriate the scientific meaning of the concept of biodiversity, an appropriation that can be translated in the construction of a social representation of biodiversity that incorporates biological and ecological elements to define and describe what biodiversity is.

The need for appropriating the concept of biodiversity is reflected in hunters' willingness to participate in research, which goes in the same line as the major shift in hunting observed in the 80's and characterized by the adoption of ecological practices (Guimelli 1998) or discourses (Fabiani 1984; Dalla Bernardina 1989) in this community. Through their involvement in research constellations, hunters tend to gain knowledge and techniques enabling them to manage wildlife population in its complexity. Even though they barely talk about biodiversity, they use concepts related to this notion by showing concerns for dynamic interactions between species, for the relationships between herbivores and their habitat, involving more the principle of ecosystems in the way they see wildlife management. Moreover, the study shows that hunters' participation in research is also a way to communicate to the public this modern image of the ecological hunter (Dalla Bernardina 1989), who does not only manage fauna but also contributes to the production of knowledge about it. The results concerning hunters' social representations of biodiversity are characterized by a large heterogeneity of understandings of the term biodiversity and values attributed to it. While some hunters know about it and give an ecological meaning to it, others seem to be less willing to adopt this scientific concept. This variety in representations might reflect some hunters' reluctance to follow the development of a more scientific way of hunting, the use of sophisticated indicators and techniques to observe and quantify game populations. The diversity of representations appears to us as a reflection of debates within the hunting community about the place of hunters in the protection of nature and biodiversity.

Farmers' representations of biodiversity present similar variety, with negative attitudes towards the concept balanced by the recognition of its value as a public good, a common

richness for the territory that is created and maintained by farmers, but also as a private resource that can benefit to farmers' production. Just like hunters, farmers try to find their role in biodiversity but also the place of biodiversity in their activities. Farmers' representatives tend to mobilise research results to value the positive effects of pastoral or more generally farming practices on biodiversity but, in return, practices are barely changed by research. The construction of a representation of biodiversity seems to evolve in parallel of shifts in the perceived finality of pastoralism towards the integration of the notion of multifunctionality.

- ***Research shortcomings and perspectives***

This research presents some points that are problematic in the interpretation of the results. First, we can question the relevance of the geographical unit chosen for the study. Indeed, the area of the PNRMB can hardly be considered as a homogenous territory. It presents large differences in terms of geographical and climatic conditions that lead to the differentiation of types of land uses over the area. The proximity of gate-cities at the periphery of the massif generates the emergence of different concerns between these areas and the most rural part of the massif, situated at the heart of the Park territory. Moreover, people do not feel culturally close to each other, often evoking the differences of people's mentalities and practices in the neighbour "département". This heterogeneity in culture and daily concerns questions the unity of the social groups we interviewed. Can we still consider our sample as composed of distinct social groups and then how can we interpret the variety of representations within a same group?

This issue of heterogeneity on the territory and consequently in our sample makes difficult the distinction of different factors influencing representations of biodiversity. It is indeed hard to say whether a representation is influenced by research and scientists' presence or by other factors due to individual characteristics like age, education or hobbies. The integration of these factors in the analysis, combined with larger samples that would allow the use of statistical tools could help to understand the relative role of research on the construction of representations compared to other factors. The involvement of actors in other networks such as professional structure or more informal arrangements might also influence their representations as the characteristic of this form of knowledge is that it is socially constructed and shared. Network analysis could then be deepened, what might also enlighten the channels of transmission of scientific knowledge. It indeed seems to us that other ways of communication of information from scientific spheres to non-experts could be investigated. We evoked for instance the role of media but without being able to determine the importance of this channel in the propagation of representations of biodiversity. Another sampling shortcoming relies on the very limited number of members of associations for nature protection who accepted to participate in this research.

Moreover, the sampling method does not seem totally satisfactory to us considering our research questions. Indeed, when examining the studies carried out in the Massif des Bauges in the two constellations we focused on, we can notice that a lot of researchers used a snow-ball sampling procedure and followed a similar methodology as the one presented in this study. They referred first to technicians in order to get advices and contacts. By developing the same approach, we might then have walked in the same steps as other researchers and in consequence have included the same actors in our sample. The snow-ball sampling procedure might then have biased the results, by giving more importance to actors close to research constellations.

Chapter 6: Conclusion

This study was based on several assumptions that we proposed to investigate and check. First, we started our questioning on observations suggesting that the Massif des Bauges was the theatre of the stabilisation of a controversy about the positive role of pastoral activities on biodiversity. These observations also highlighted the existence of a multidisciplinary research network, the “Herbivorie” network, dedicated to the production of knowledge about the interactions between three components: herbivores, habitats and humans. The assumption of the stabilisation of the controversy over pastoralism led then to the formulation of a second hypothesis that establishes a relationship between the presence of this network in Les Bauges and the apparent consensus of actors’ positive attitudes towards the promotion of pastoralism in the name of biodiversity. The assumption initially formulated relies then on a possible impact of scientists’ contacts with and transmission of innovative agro-ecological knowledge to local actors of Les Bauges. The presence of scientists might indeed have an influence on the way these actors understand and value biodiversity, in other terms their social representations of biodiversity, and on their attitudes towards biodiversity issues such as the involvement of pastoralism in nature conservation.

The interviews carried out among different actors of the Massif des Bauges tend to confirm the hypothesis of a consensus that gathers several groups of stakeholders around the idea that pastoral development could legitimately be supported in an environmental perspective. The majority of the interviewed actors indeed displays very positive stances towards pastoralism and its impacts on biodiversity but this result can be moderated by the fact that some actors like members of associations for nature protection did not respond positively to our invitation to participate in this study. Nevertheless, the causal relationship between this consensus and the presence of a research network is less obvious. Indeed, firstly, only few actors are actually in contact with researchers. Stakeholders like mayors or members of associations for nature protection barely have knowledge about research, knowledge that is mainly transmitted to three groups of nature users: hunters, farmers and foresters. Then, among these groups, mostly representatives of (professional) organisations have a direct access to information and are involved in research activities. Moreover, we could identify the absence of an actual network but a structure of research organised in two constellations presenting a dissymmetry in actors’ relationships. On the one hand, on the topic of pastoralism and environment, research is organised on the partnership between the Natural Regional Park and a research unit of INRA Avignon. This constellation is characterised by disparities in actors’ empowerment. The regional park is the main actor that is enabled to put its objectives and priorities in the research agenda while farmers tend to exclude themselves from studies that sometimes seem too far from their daily concerns. In contrast, the constellation dealing with the relationships between herbivores and environment shows more involvement of actors on the field at different stages of research and in consequence a more equal distribution of power resources among stakeholders and particularly towards the group of hunters. This group maintains in the research constellation more frequent and trustful relationships with ONCFS and other natural resources users. The different levels of involvement of local actors in research show that the consensus on the positive impacts of pastoralism on biodiversity cannot be explained by a simple causal relationship between their contacts with researchers and their perceptions of pastoralism/biodiversity interactions.

In the same way, the study shows that the perception of these interactions is not based on technical knowledge and scientific understanding of the effects of pastoralism on biodiversity. These perceptions also depend on common-sense knowledge that is socially constructed and are then informed by values and beliefs about biodiversity and pastoralism. Social representations of biodiversity developed by four groups of actors (farmers, hunters, members of associations for nature protection and Park agents) show the presence of different descriptions and evaluations of biodiversity between and within social groups. While

biodiversity is stably rooted in scientific and political domains across the groups, variety comes from its anchorage in different views of nature that are shaped by individual experiences and social interactions with, among others, colleagues or persons sharing the same hobby. Direct influences of research on social representations could hardly be identified although some results seemed to have had an impact on farmers' evaluation of biodiversity, helping them to enlighten a possible value of biological variety in their own activity.

Finally, the diversity of representations of biodiversity seems to be the sign of a representation in a dynamic state of anchoring and objectification. In particular, farmers' and hunters' identities are found to be at a turning point. They indeed tend to find a new role in changing rural spaces, where their classical position of pillars of the rural social fabric is questioned. Biodiversity might then be a key-element in the construction and valorisation of a new socially accepted identity. The appropriation of the concept of biodiversity, originally emerging from scientific spheres, into pre-existing social representations of nature might become an important objective for hunters and farmers.

The study shows that the use of the theory of social representations can be fruitful in the analysis and understanding of controversies about environmental issues. Because these problems are too complex to be totally solved by win-win solutions and indubitable scientific certainties, lay-knowledge such as beliefs and values about nature have an important role in the construction of attitudes and eventually the elaboration of policies. The analysis of issues such as the effects of pastoralism on biodiversity necessitates to go beyond technical aspects and to come back to what finally appears to be the basis of the problem: what do people call biodiversity or pastoralism and which kind of nature and human activities do they want to promote? The use of qualitative methods of data collection and analysis seems extremely useful in the determination of the structure of social representations. Indeed, our study highlighted the complexity of people's representations, presenting variety of meanings and statements that could seem at first contradictory. The analysis of peripheral elements of social representations requires, according to us, the use of methods based on interviews or observations of people's actual practices on the field, which enable to enlighten these zones of contradiction that might remain inaccessible through quantitative methods such as words association exercises. Similarly, the use of semi-structured interviews seems to better exploit the complexity of Moliners' bi-dimensional model of social representations. He indeed describes dimensions of representations as gradients more than fixed boxes, while the use of quantitative methods might lead to a static categorisation of their constitutive elements. Interviews enable for instance to show that elements can alternatively have a descriptive or evaluative function.

Nevertheless, the level of complexity interviews might allow to grasp can also be seen as a source of fuzziness. The difficulties that we encountered in determining core and peripheral elements in small size samples and on the basis of interviews suggest that a combination of quantitative and qualitative methods would be more suitable to explore the structure of social representations of biodiversity and in particular the two dimensions of Moliner's model. The findings of our study could then be confirmed and deepened by the use of statistical methods that would also clarify the relative impact of research compared to other factors possibly influencing social representations of biodiversity such as age, education, involvement in activities of nature protection, hobbies or residence.

Moreover, the use of network analysis in combination to methods of identification of representations could be useful to understand the dynamic aspects of social representations. Indeed, we saw in this study that people never belong to one specific social group but are integrated in multitude of interconnected and multi-levelled networks such as the family, the neighbourhood or the professional organisation. Taking into account individuals' belonging to different networks, the interactions between these networks and the circulation of information and other resources could then open new perspectives to the theory of social representations.

Last but not least, our findings suggest that the development of biodiversity management plans and the elaboration of nature conservation policies should not be based only on technical and scientific knowledge but might gain in legitimacy by integrating more various understandings of nature and biodiversity. The implementation of agro-environmental measures for instance might be improved by taking into account the natural patrimonies that farmers value but also the vision they have of their profession, its functions and its threats. This might lead to the design of more fair agro-environmental measures and a better appropriation of these measures and related practices by farmers themselves, who could then perceive biodiversity conservation as a solution to economic problems more than a constraint imposed by "backward" ecologists and scientists with "a string of academic titles" as evoked by some of our respondents.

Acknowledging that environmental issues are not only technical but result from a social construction that implies different types of knowledge and various views of nature gives to research a new function. It might indeed represent a new opportunity for participative decision-making, where scientific arguments get balanced with lay-knowledge and public values towards nature. Research should therefore be opened to a large range of publics, from nature users to protectors, policy-makers and scientists. Efforts have therefore to be undertaken in order to inform people of research, to transmit results in a comprehensive manner to all types of audiences but also to negotiate the objects of research from the very first steps of the formulation of problems. A common criticism towards researchers is indeed their perceived attachment to the production of fundamental knowledge that does not answer to local issues or generate practical applications. Negotiating the research objects have also to be opened in order to avoid the amalgam that is sometimes done in Les Bauges between scientists and policy-makers. The relationships between the Natural Regional Park of the Massif des Bauges and scientists sometimes tend to devaluate the perceived neutrality of researchers and therefore their scientific legitimacy. The influential position of the Park necessitates an effort from researchers to justify their neutral position and independence towards a structure that remains an important financer. Finally, opening research to participation might privilege a more equal situation of empowerment among various actors towards the question of biodiversity, in particular the appropriation of the concept by non-experts. This could reduce scientists' monopole over the issues related to biodiversity and allow other actors to intervene in the debates.

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Appendix 1: the case of Les Bauges

The Massif des Bauges is located in the French Northern Pre-Alps, to the North-East of the Massif de la Chartreuse, straddling the “département” of Savoie and Haute-Savoie (Figure 6) and is one of the 45 Natural Regional Parks of France. The massif itself forms a distinct geographical unit bordered by the Isère valley (Combe de Savoie), the cluses of Annecy and Chambéry, the Albanais plain and the Bourget Lake. The massif is relatively isolated because of limited and difficult accesses. Its highest point is the Arcalod, at an altitude of 2217 meters. In 2008, it is surrounded by six “gate-cities”: Chambéry, Aix-les-Bains, Rumilly, Annecy, Ugine and Albertville and the area of the Natural Regional Park encompasses 64 communes. The area has been classified as Parc Naturel Régional du Massif des Bauges (PNRMB - Natural Regional Park of the Massif des Bauges) in 1995.

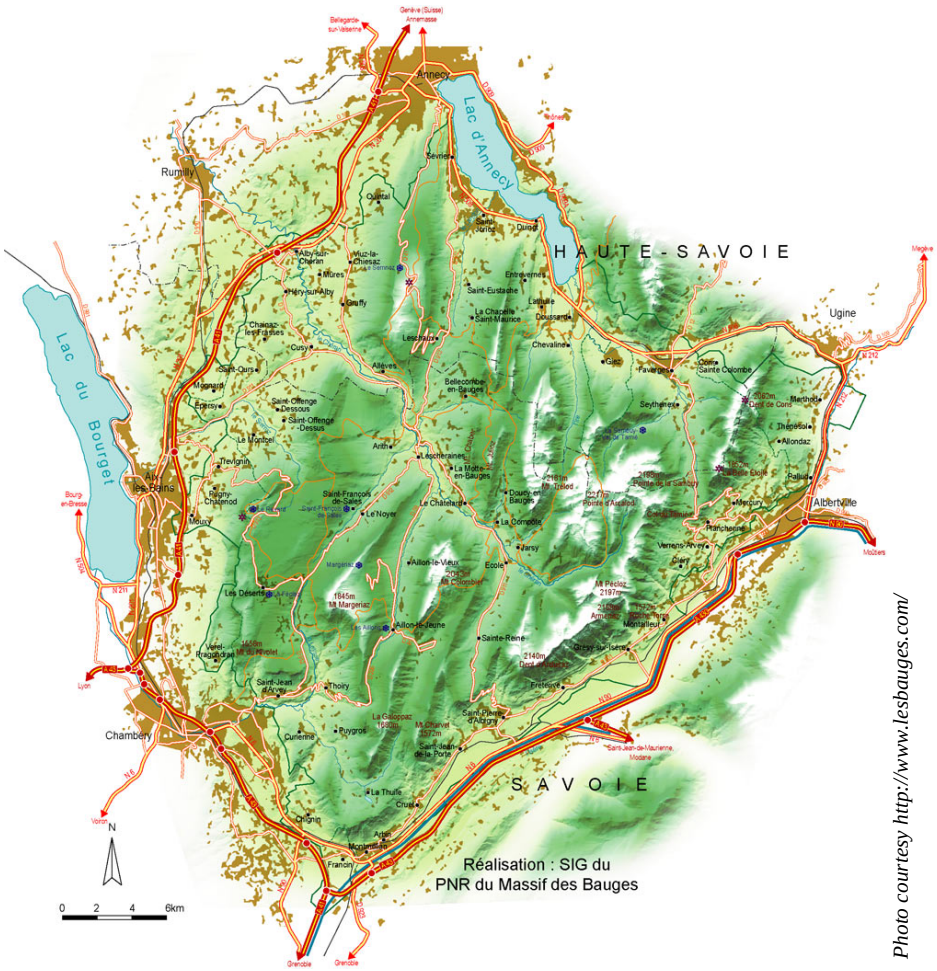

Figure 6: Map of the Parc Naturel Régional du Massif des Bauges

The name Les Bauges actually designates several geographical units. Palisse (2006) relates the term to three concentric areas:

- Historically, Les Bauges designate the valley situated in the centre of the massif, including 14 communes separated by the river Chéran, which leads to distinguish two territories connected at the Canton du Châtelard: the “Bauges-Devant” (in front

Bauges), located near the Combe de Savoie and the "Bauges-Derrière" (behind Bauges) on the other side of the Canton.

- In the beginning of the 20th century, geographers started to use the name of the valley to designate the whole geographical massif and enlarged the territory to 26 communes.
- Finally, the term Bauges is nowadays used in the context of the Natural Regional Park of the Massif des Bauges, initially covering 58 communes from the massif and beyond its natural limits.

Palisse (2006) notes that the term Bauges is still associated to its historical meaning and that the word "Bauju" and its related signification remain the name of the inhabitants of the 14 communes of the Canton du Châtelard. This remark has also been observed in our own interviews, where we were careful with explaining that we understood the word Les Bauges as the territory of the Natural Regional Park.

The territory is therefore nowadays quite heterogeneous, comprising relatively isolated areas like the Canton du Châtelard and communes situated at the periphery of big agglomerations.

- ***Historical overview***

The area surrounding the massif has been concerned by an important growth from 6th-5th centuries B.C. to the High Middle Age (Piccamiglio 2005). 11th century sees the settlement of three monastic orders in the heart of the territory, under the intiative of the Counts of Savoie: the Benedictines in the Vallon de Bellevaux, the Carthusians in Aillon and the Cistercians have then an important role in the construction of the landscapes of Les Bauges. The end of 13th and the beginning of 14th centuries are characterised by an active phase of deforestation, period that ended with the Great Plague in 1347 and 1348 that killed one third of the population of Les Bauges (Mouthon 2005).

In 17th century, the seigneuries are all possessed by the Family of Lescheraines and this century sees an important economic growth of the heart of the Massif until the industrial revolution that makes the two main economic sectors of agriculture and metallurgy collapse. The beginning of rural exodus and later the two world wars depopulate the area (Parc naturel régional du Massif des Bauges 2000).

The creation of the Parc Naturel Régional du Massif des Bauges

The creation of the park has been very well documented by Marianne Palisse in her PhD dissertation dedicated to "patrimonialisation" in the Massif des Bauges. We will present here a short overview based on her own description of the events at the origin of the structure. The Parc Naturel Régional du Massif des Bauges has been created in 1995 but the idea of an enlargement of Les Bauges from the valley to the whole geographical unit has been initiated in the 80's by members of the association "Les Amis des Bauges" (Friends of Les Bauges). Nevertheless, the project developed only in the 90's, when this association managed to enrol the future president of the Park, who had an important role in the persuasion of the other mayors of the territory. In 1991, the association for the creation of the Parc Naturel Régional du Massif des Bauges is founded. The main argument for the creation of the Park is to enhance the value of natural and cultural patrimonies in order to relaunch the dynamism of the territory. This message is concretized in the first charter of the Park, structured in three points: "preserving a quality patrimony, with a strong identity", adopting a "revitalising development policy" and "hosting and communicate". These objectives are reformulated in the new charter of the Park, articulated around three "vocations": developing a territory based on a "sustainable economic and social life" (maintaining the rural identity by managing the spread of urbanisation and supporting activities like agriculture, improving access to services and developing employment), maintaining "appropriate patrimonies",

orientating the “resourcing” character of the territory (developing recreational and touristic activities) (Parc Naturel Régional du Massif des Bauges 2006).

- ***The current challenges of the Massif des Bauges***

The whole alpine furrow is concerned by a rapid demographic growth and a spreading urbanisation that touches the lowest parts of the Massif des Bauges. For the same reasons as the natural regional parks of the Massif de la Chartreuse and of Vercors, the Massif des Bauges is at the heart of issues related to the relationships between urban and rural areas. One of the main questions of the regional parks is indeed how to exploit the dynamism of the alpine furrow in terms of employment and services while preserving the natural and rural character of regional parks that represent important space of nature and recreation surrounding the urban line situated between Genève and Grenoble (Parc naturel régional du Massif des Bauges 2004). The social and economic structure of the territory of Les Bauges is then changing and the preservation of natural and cultural patrimonies become preponderant points in the Park policy orientations (Parc Naturel Régional du Massif des Bauges 2006).

The protection of remarkable and “diffuse” patrimonies

The publications of the PNRMB state the existence of two distinct patrimonies: the remarkable patrimony that includes rare and emblematic species or habitats and the “diffuse” patrimony related to ordinary nature, architectural features or traditional practices and know-how (Parc naturel régional du Massif des Bauges 2004). The landscape, product of farming activities, is particularly seen as an important asset of the massif.

The heterogeneity of the territory is seen by the Park as an asset through the large diversity of natural and semi-natural habitats it offers (Parc naturel régional du Massif des Bauges 2004).

- Diversity of types of soil.
- Variety in the relief: the altitude is scaled between 250 and 2200 meters with different orientations.
- Climatic or micro-climatic variations due to the altitude, orientation and shelter effects.

This diversity of geologic and climatic conditions but also the different human activities that modified the landscape engender a variety of habitats and species that the Park tends to highlight in its publications. At its creation, a large survey was undertaken in order to identify, map and count the emblematic or “didactic” species (Table 7), on which they develop certain knowledge:

Table 7: Number of species surveyed in the PNRMB (Parc Naturel Régional du Massif des Bauges)

Group	Number of species	Number of species in France
Flora	1300	6700
Fresh water fishes	45	63
Amphibians	9	27
Reptiles	10	35
Birds	150	300
Mammals	80	110

These species include particularly rare ones such as *Potentilla delphinensis* (Potentille du Dauphiné), grouses or orchids.

The economic development

The three main economic sectors of the territory are agriculture, tourism and forestry:

Agriculture remains the first economic activity of the massif although the activity is deeply affected by the urbanisation (1000 ha lost between 1970 and 2001) evolution less significant concerning natural and forested areas. The number of farms has decreased of 56% between 1979 and 2000, simultaneously they tend to be bigger and specialised. Agriculture, farmers but also agro-industries, veterinarian and technical services, remains nonetheless one of the first sectors of employment of the massif.

Agriculture is oriented towards the fabrication of quality products with 7 AOC, 3 IGP[24] and the development of organic agriculture. The productions are diverse (cheese, wine, fruits, walnuts…) but the main activity is dairy production (essentially bovine) with 65% of the milk transformed in cheese in the cooperatives of the territory in 2003. Mountain pastures represent 6000 ha, which three quarters are dedicated to heifers breeding and one quarter to dairy production.

Touristic activities consist in hiking, outdoor sports like skiing (four skiing stations), canyoning or climbing. Cultural patrimony is also included in the touristic offer through the valorisation of museums or the development of pedagogic farms.

58% of the land is covered by **forests**, which represents a surface of 34 000 ha that comprise 48% of public forests and 52% of private forests characterizes by very small fragmented properties. In 2003, 60 000 m^3 of wood were collected in the area of the Park.

[24] IGP: Identification Géographique Protégée – Protected Geographical Identification

Appendix 2: Example of conceptual matrix

We will present in this appendix an example of conceptual matrix used to analyse farmers' interviews. Table 8, Table 9 and Table 10 show the concepts used to code the information contained in the interviews while Table 11 is an extract from one of the constituted matrices.

Table 8: Information about pastoralism and biodiversity

		Quotes	Quotes evolution	Conclusion	Definition pastoralism/biodiversity	Biodiversity/nature values	Nature attributes	Humans/nature relationships
Pastoralism	Finality							
	Positive/negative practices							
	Factors of evolution							
	Threats and brakes							
	Ways of supporting pastoralism							
Pastoralism and biodiversity	Positive/negative effects of pastoralism on nature/biodiversity							
	Positive/negative effects of nature/biodiversity on pastoralism							
	Intentionality of pro-environmental practices							
	Adaptations of practices improving impact pastoralism/biodiversity							
	Transformation of nature improving impact biodiversity/pastoralism							
Relationships farmers/other social groups								
Biodiversity	Definition							
Descriptions	Context of the use of the term							
Descriptions	Knowledge about natural elements and processes							
Evaluations	Valued/unvalued natural elements and processes							
Evaluations	Positive/negative impacts of human activities							
Evaluations	Good/bad management measures							

Table 9: Information about research networks

Organism	Topic	Protocol	Results	Role	Role other actors	Degree of involvement	Frequency/nature relationship researchers	Resources	Strong points	Criticisms/problems	Consequences on practices	Consequences on representations	Consequences on relationships between actors
Conclusions													

Table 10: Information about the respondent (involvement in professional groups and education

	Organisation	History	Who?	What?	Where?	Partners	Interviewee's function	Education
Conclusions								

Table 11: Extract from a conceptual matrix (F 2/H 6)

		Quotes	Quotes evolution	Conclusion	Definition pastoralism/biodiversity	Biodiversity/nature values	Nature attributes	Humans/nature relationships
Biodiversity	Definition	(2537) c'est comment dire euh…ben c'est comme les plantes, plusieurs plantes sur une prairie euh…plusieurs espèces d'arbres, plusieurs…tout, tout ce qui est…tout ce qui est euh…comment dire euh…merde. Ben tout ce qui est fleurs, tout ce qui est fleurs et arbres et tout…tout ça mélangé quoi;(2596) y aura plus de biodiversité parce que y aura plus de plantes, y aura plus, y aura plus que des buissons ou des saloperies. Bon c'est bien une biodiversité aussi ça mais c'est pas dans le bon sens quoi [rires].		Biodiversity = different mixed (plant) species, existence of a good and bad biodiversity	Species variety, plant (flowers), separation good/bad biodiversity	Anthropocentric		Exploiters
	Context of the use of the term	(2521) c'est familier parce que bon on en parle avec Natura 2000 tout ça; [vous en parlez avec les gens du parc?] Ben ouais avec les gens du Parc;(2533)[utilisation entre éleveurs?] Oh ben non parce que bon…y a déjà la plupart qui savent pas ce que ça veut dire		Biodiversity evoked in the context of agro-environmental measures, with Park agents, term not well known among farmers	Anchorage in political domain			
	Unvalued natural elements and processes	(1831) y aura plus de touristes. Pff, aller faire quoi se promener dans une forêt si tu vois rien. Bon c'est sûr qu'après tu montes en dessus du bois euh…tu vois mais c'est, c'est pas le même paysage y a rien à faire;(1883) Les buissons vous pouvez pas vous promener dedans. C'est comme ça quoi, si y a pas d'agriculture, pas d'éleveurs		Landscape closure is a problem for touristic activities and scenic beauty, farmers have a role in maintaining open spaces		Aesthetic, economic		Exploiters, stewards
	Good management measures	(2319) Géré, faut que ça soit géré voilà. Si c'est pas géré c'est le bordel complet. Après c'est la brousse hein;si y a rien d'entretenu, c'est toujours pareil ça, c'est…; (2623) c'est une histoire d'équilibre [qui doit être géré] par le chasseur		Hands-on management to limit the dynamics of nature, in favour of hunting to maintain balance of populations			Balance, wilderness	Stewards

Appendix 3: Example of synthesis

Farmer 2 – Hunter 6
About 35 years

1. Descriptive elements

The respondent associates biodiversity with the number of species in a same habitat and the relationships between species. He particularly speaks about plant diversity in meadows. According to him, the term is rarely used among farmers as they are not familiar with its meaning:
[Interviewer: Do you use the term biodiversity with other farmers?] *"Oh no because most of them do not know what it means".*
They hear and talk about biodiversity with Park agents and in the context of Natura 2000.
He particularly positively value biodiversity in "semi-wild" areas, in other terms in zones that are not intensively exploited such as the valley meadows. Legitimate biodiversity tends to be associated with wildness. The "good" form of nature should also be economically beneficial to humans and farmers in particular. Therefore, plants that do not have a nutritive value and animals that interfere with agricultural activities such as rats or wolves are not considered as part of the right nature:
"If we do not put animals then it will become woody and then…and then it will be over, there will be nothing. Precisely, there will be no biodiversity because there will be no plants, there will only be shrubs or damn nuisance. Well, this actually is biodiversity as well but it is not in the right way, isn't it? […] all the shrubs, brambles and stuff, I do not really see the point"
Diversity of habitats was also evoked but not directly named as biodiversity.

2. Evaluative elements

The respondent used to evaluate natural elements according to three criteria:

- Aesthetical values: species but particularly landscapes were judged on their scenic beauty.
- Economic values: beautiful landscapes were judged as positive because of the nice living environment they create but also because of the touristic and therefore economic activity they generate. Moreover, species are evaluated according to their usefulness in farming activities.
- Leisure values: nature was considered as a working tool but also as a recreational place (hunting and walking were evoked).

He recognized the importance of habitat diversity to maintain game populations, who need both forested and open areas to feed, and the benefits of flowers diversity on milk quality. Nevertheless, he could not identify other direct benefits from biodiversity (even so he evoked an intrinsic value to it: "[Interviewer: do you see other benefits to biodiversity?] *I do not see what other benefits it could have, besides…pff…besides being able to tell us that, well, we have a good area where there is a lot of plants*"). Then, enhancing diversity did not seem to be a priority in nature management. In contrast, maintaining particular species and landscapes that answered to economic, aesthetical and recreational functions seemed more important.

The dynamic features of nature were particularly judged as negative because of their effects on the functions evoked above. Without human interventions, nature anarchically develops and becomes less aesthetical and pleasant for leisure activities. Free from control, nature is even perceived as dangerous as provoking avalanches and fires. Dynamics are the object of daily observations and informed by formal numbers: the increase in game populations is seen on the field but also confirmed by hunters' counting, landscape closure is also observed in comparison to old maps. A desirable state of balance and order should therefore be maintained in order to preserve economic and aesthetical benefits of nature:
"Managed, it has to be managed that's it. If it is not managed it is a complete mess"

Hands-on management is then seen as necessary to maintain nature benefits to humans. Specific measures have to been taken to protect landscapes integrity and valued species. Nevertheless, as nature and biodiversity value are scaled, some areas seem less important to maintain. Only "real" natural areas that are not spoiled by humans' exploitation deserve to be managed.

3. Attitudes towards specific issues

- <u>Maintaining open landscapes</u>

As we already saw, plant dynamics are directly observed on the field in comparing the current state of the landscape to old maps of pastures. According to interviewee, this phenomenon is extremely fast and is difficult to control:
"You keep it like that one or two years without putting anything [domestic grazers] and then if you want to put cows again, you would not believe the work you have to do. To take the spade, the pickaxe and then to cut all the bloody mess that grew"
Plant dynamics are then a source of disorder and anarchy that humans should control.

Landscape closure is seen as undesirable for several reasons:

First, fallow lands are considered as damaging the scenic beauty:
"It would be all ugly, it would not even be nice trees, it would be thorns, it would be shrubs, it would be nuisances"
"Well I do not know but it is either you prefer to see greenery, a nice meadow or forests"
Forests prevent people to see the surroundings and especially presence of life what makes the landscape looks sad and morn:
"It must be pitiful. It must be sad, isn't it? […] I do not know but you go for a walk in the mountains, for God's sake, you see a herd of cows, you see a herd of goats, it is pleasant. You go to the mountains you see nothing, well you see nothing isn't it?"
"If you go for a walk in a forest the whole day, forest is nice for a while but well […] if you do not the sky, it is not worth to go to the forest, isn't it? It has to move! It has to move! There must be life. If there is no life, there is no life […] there is normal life but there is no life"
According to the respondent, forests are not a place characterised by its vitality. Vitality is a very positive attribute of nature that is the key of its attractiveness and aesthetic qualities in particular.

Therefore, landscape closure also reduces the pleasure people can take in walking around in the mountains. It prevents people to see the scenery but also makes the walk difficult:
"The moment he [a tourist] gets into it [fallow lands] he does not get out anymore or he gets out covered in blood. Then he has to know what he wants. Whether he wants to walk in a nice flowered meadow or to walk in shrubs"
"You have a better time walking in a place that is pleasant to walk in than in a place where you cannot get out"

Landscape closure is then a threat for touristic activities:
"There will be no tourists. Pff, what can they do in a forest if you cannot see anything?"
Landscape closure has other direct economic consequences for farmers as it arouses a decrease in available surfaces for agriculture.

Landscape closure is also responsible for increasing natural risks such as avalanches and fires what also compromise touristic attractiveness of the territory.

To conclude, landscape closure represents humans' loss of control over a wild and unpredictable nature. The respondent is particularly sensitive to it because of the work carried out by the ancients to maintain these landscapes open and productive. Fighting against landscape closure is then a sign of respect towards the ancients.

- Eliminating pests

Plants and animals that compromise farming activities so economic functions of nature have to be managed:
Noxious plants such as thistles have systematically to be cut and rats have to be eliminated from the fields. The Flowered Meadows measure is criticized as privileging areas that are not considered as natural and enhancing plants that are not useful to farmers because not good for the fodder.
The wolf is the privileged target of his accusations: wolves are a direct threat in farming activities because of the damages he provokes on herds and the new conflicts that emerge from problems due to protective measures (guard dogs that attack hikers). Moreover, it also attacks the game populations and risks to unbalance their fragile equilibrium: indeed, these populations have to be selectively and precisely managed. Wolves are considered as killers than anarchically cull while hunters seem more able to maintain a balance.

- Managing wildlife

An increase in herbivores populations is observed through counting and direct examination. These animals have to be culled to maintain the balance and assure durable populations for hunting.

- Limiting natural risks

Natural risks threaten human benefits of nature. Once again, the respondent argued that only a tamed nature could provide for benefits to humans.

Appendix 4: Complementary results

We will present here some elements found in the interviews of agricultural technicians, foresters and mayors. Agricultural technicians' interviews were more directed towards their perception of and role in research than on representations of biodiversity, what explains the presentation of the results in appendix. Foresters and mayors tend to have similar views as farmers and hunters. Therefore, to avoid redundance, we decided to present some of the findings in appendix.

- ***Foresters and mayors***

We will present in a synthetic way the results obtained among the groups of foresters and mayors. The two groups will be dealt with together as the respondents who compose them have a double position, which overlap on the two groups. The two foresters are indeed respectively mayor and member of the municipal council. One the interviewed hunters also has a position of mayor but mainly talks as a representative of hunting organisation and is therefore not included in this overview.

Involvement in research constellations

- One of the interviewees has very few contacts with researchers and is very critical towards scientists, who are considered as staying in their "bubble" and studying objects very far from his concerns.
- The other one is much more involved in research of the Observatoire de la Grande Faune et de ses Habitats through his function of forester. The knowledge produced in this network is valuable to him as directly usable on the field. The participation in research also made him more in contact with hunters, with whom he has always tended to be in opposition. The presence of the technician of ONCFS coordinating this network and his role of mediator between different groups of users is also dealt with. Very few knowledge about the research about pastoralism and habitats are suggested. He heard about the research carried out on Armène pasture on a national radio. According to him, the information is not transmitted to people in Haute-Savoie.

Understandings of the concept of biodiversity

- Biodiversity is related to forestry certifications (PEFC) and to renewable energies. This concept and biodiversity enter more and more into the **political domain** and tend to become a concern for mayors.
- Biodiversity is related to **emblematic and endangered** species, which protection is highly **promoted by the Park** through the publication of pedagogic guides for non professional foresters.
- Biodiversity is rarely evoked; the respondents talk more about **landscape or living setting quality**.

Evaluations of biodiversity

- Biodiversity is mainly valued for its **anthropocentric** functions, being regarded as a "renewable product".
- **Diversity of landscape and land uses** is valued but not explicitly included in biodiversity: the entanglement of urban and natural areas, varied landscapes mixing forests, pastures, urban features ("There must be contrasts […] for me, the contrast is when you go from an urban area, so to say, to a meadow, to woods, to meadows, to a mountain meadow" (FO 1)). The presence of natural areas is important because

they open recreational opportunities to urban people. Diversity of land uses is related to socio-economic balance. Respondents explain their particular concern for landscape and living settings because of their position in the municipality.

Interactions pastoralism/biodiversity

- Representations of pastoralism: activity of production that evolves towards landscape management. Activity regarded as modern

- Biodiversity positive towards pastoralism: plans like the PLGE are seen as win-win solutions, enabling to combine an objective of biodiversity conservation with agriculture development (restoration of abandoned agricultural spaces increases the availability of lands).
- Biodiversity negative towards pastoralism: evocation of competition with wild herbivores from one of the respondents who also explain the problems he encounters as forester.
- Pastoralism positive towards biodiversity: the relationship between pastoralism and biodiversity is not scientifically proven but pastoralism has a positive role in landscape management by maintaining its anthropocentric aesthetic functions.
- Pastoralism negative towards biodiversity: practices have to be adapted to make pastoralism effective in landscape management (acquisition of machines to exploit steep plots, increase in the number of employees per farm)

- ***Agricultural technicians***

Involvement in research constellations

- Active involvement of both respondents in research but the contacts with researchers are often mediated by the Park agents
- Two roles of researchers are evoked: first investigating solutions to complex technical problems such as the combination of productive farming activities and biodiversity conservation. Second convincing farmers of the benefits of biodiversity to their activity (proofs of the influence of plant diversity on milk and cheese quality). Scientists enable to give legitimacy to technicians and the experimentations they carry out. They can then more easily transmit their own discourses about biodiversity.

Understandings of the concept of biodiversity

- Biodiversity is deeply related to Natura 2000 and **agro-environmental measures**
- The concept of biodiversity is extended to the notion of **landscape**
- Biodiversity mainly covers **endangered** and **rare wild species**
- One of the respondents recognizes the **social construction** of biodiversity, as the choice of species to be protected depends on social values

Evaluations of biodiversity

- Biodiversity is considered as an asset for the territory in term of **touristic** attractiveness.
- **The balanced character** of wild animals populations is important to maintain biodiversity.
- One respondent in particular makes a distinction between species belonging to biodiversity and others that threaten it such as wolves and invasive weeds. He identifies then **good and bad** biodiversity.

- Humans are considered as **potential enemies** of nature (pollutions, urbanisation, climate change) but also **stewards** of a nature that is **not autonomous**. Nature and culture are not opposed.

Interactions pastoralism/biodiversity

- Representations of pastoralism: activity of production based on empirical knowledge and traditional practices

- Biodiversity positive towards pastoralism: diversity of flowers might have a role in enhancing milk and cheese quality. The local character of these plants is also important in the typicity of the product. Biodiversity by making the territory more attractive to tourists will have indirect consequences on farmers' incomes. Different opinions are displayed concerning the risks of diseases: according to one respondent, the risks are extremely weak especially if wild herbivores populations are regulated. The other technician evokes a lack of knowledge about the transmissions especially from wild to domestic animals and therefore uncertainties about the potential seriousness of the problem. Competition is not evoked, each species having its own spatial behaviour according to one of the respondents.
- Biodiversity negative towards pastoralism: the wolf is evoked by one of the respondents who see the wolf as the enemy of biodiversity because of its negative impact on pastoral activities. Very few other problems are perceived.
- Pastoralism positive towards biodiversity: traditional reasoned practices are at the origin of the remarkable biodiversity of the territory. Pastoralism enables to make mountains alive because of the presence of herds but also because of the effect of cattle grazing on landscape opening, an effect confirmed by recent research. Landscape closure is perceived as a cause of biodiversity erosion but also scenery damages.
- Pastoralism negative towards biodiversity: overgrazing and other deviant practices are evoked but seen as abnormal in their representation of what pastoralism is (extensive, traditional activity, farmers close to nature). The care brought to mountain pastures has negative repercussions on the mowed meadows in valleys that are considered as purely functional spaces.