High-Pasture Dairy Farming in Protected Areas.

INTERPLAYS BETWEEN BIODIVERSITY CONSERVATION AND LIVELIHOOD ENHANCEMENT. THE CASE OF THE LEPONTINE ALPS

Brown Swiss cows grazing in Alpe Buscagna. Author's photo

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Master Thesis

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Settembre, andiamo. È tempo di migrare
[September, let us go. It's time to migrate]

Gabriele D'Annunzio, The Shepherds (Pastori),
Halcyon, 1903

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List of Acronyms

CAP - Common Agricultural Policy

CCIAA - Camera di Commercio, dell'Industria, l'Artigianato e l'Agricoltura (Chamber of Commerce, Industry, Craft and Agriculture)

CIA - Confederazione Italiana Agricoltori (Italian Farmers' Confederation)

CPRs - common pool resources

EAFRD - European Agricultural Fund for Rural Development

EEA - European Environmental Agency

FAO - Food and Agriculture Organization of the United Nations

HPDF - high-pasture dairy farming

ICDPs - Integrated Conservation and Development Projects

IMELS - Italian Ministry of the Environment, Land and Sea

IUCN - International Union for the Conservation of Nature

LCIE - Large Carnivore Initiative for Europe

m.a.s.l. - meters above sea level (altitude)

OPAs - Ossola Protected Areas

RDP - Rural Development Programme

SOIUSA - Suddivisione Orografica Internazionale Unificata del Sistema Alpino (International Standardized Mountain Subdivision of the Alps)

VCO - Verbano-Cusio-Ossola province

WWF - World Wildlife Fund

Summary

High-pasture dairy farming (HPDF) is a seasonal form of animal farming for dairy production. In the Alpine area HPDF is still widely practiced. This research presents a case study on high-pasture dairy farming in protected area in the Ossola area, in western Italian Alps.

The relation between environmental and human livelihoods is complex and is characterized by both trade-offs and synergies. The objective of this research is to understand whether high-pasture dairy farming in protected areas can contribute both to environmental conservation and to livelihood enhancement, and thus if it could be considered a sustainable livelihood.

This research adopts the following definition of sustainable livelihood: an activity that has a positive or non-negative impact on the environment, provides an adequate income and good quality of life for those who live out of it.

The sustainability of HPDF was assessed by combining its environmental impact and its socio-economic outcome. Then, the sustainability performance of HPDF was related to the influence of the protected areas.

Results of this research show that the environmental impact of HPDF in generally positive, with a positive correlation between cattle density on pastures, and pastures' biodiversity. However, this result is less positive in case of excessive pressure of cattle on pastures. HPDF is a highly subsidized activity, even though, the economic outcome of HPDF is very varied from farm to farm. Despite the non-always bright economic performance, farmers reported a good satisfaction for their livelihood, as indicator for their quality of life.

Overall, HPDF has been assessed as a discretely sustainable livelihood. Synergies have been identified between the conservation goals of the protected areas and farmers' livelihoods. On the one hand, high-pasture dairy farming can be an asset for the conservation strategies when adequately managed. On the other hand, the protected areas support directly and indirectly high-pasture dairy farming, up to a certain extent. Nevertheless, the future of HPDF as a sustainable livelihood need to face future potential reduction of the capacity of the protected areas to support it.

Preface

In the Spring of 2015 I conducted a research in the Osa Peninsula, in southern Costa Rica on the perception that local people had on the impact that environmental conservation had on their livelihoods. I got challenged and fascinated by complicated nexuses between environmental conservation and the enhancement of livelihoods in one of the most biodiverse areas of Costa Rica and yet one of the poorest.

During and after fieldwork however, I experienced some ethical concerns about international programs for sustainable development, as once I was told: "I don't understand why all these foreign people come here to tell us what to do. As they didn't need to do anything where they are from". This made me think that also in my own backyard there were marginal areas where local livelihoods needed to be sustained not at the detriment of the natural capital.

The decision to focus on local livelihoods based in protected areas came as a joining link with my previous research experience, while the choice to focus on high-pasture dairy farming was a consequence of personal interests, particularly in the Slow Food movement.

Despite my studies in international development brought me far away from home also geographically, I eventually went back. I do not criticize those who work elsewhere, often in the Global South but I am deeply convinced that sometimes these boundaries are not so marked.

I believe in the necessity of supporting sustainable livelihoods in order to promote sustainable development, regardless in Sub-Saharan Africa or in the hearth of Europe.

Chapter 1: Introduction

1.1 Grassland or Pastureland? The dual interpretation of high mountain prairies

Alpine herbaceous biodiversity and the way it is considered lie at the background of this thesis. Alpine prairies are important because of their ecological as well as economic value. The point of view adopted to consider the value of Alpine prairies affects the terminology used to refer to them. The term "grassland" is used when adopting an environmentalist perspective. The term "pastureland" stresses instead on use of Alpine prairies as the basis for high-pasture dairy farming (HPDF).

The adoption of different point of views to consider Alpine herbaceous biodiversity entails also different management priorities. While environmentalists stress on the need of preserving such ecosystem, other people instead would support the extraction of natural resources to allow livelihood to be sustained. The conservationist position is supported by the importance of the ecosystem services provided by grasslands such as biodiversity, carbon storage, soil protection and recreation (Silva et al., 2008). On the other hand, the extraction of resources (biomass and biodiversity) is claimed in name of the right to support local livelihoods.

These two perspectives could clash, generating conflicts between advocates of the two positions and between management goals. Otherwise, they could complement each other, and thus give origin to synergies. The central idea behind this research is therefore to look into the interrelations between the conservationist and the extractive viewpoints.

1.2 The problem: high-pasture dairy farming in protected areas

High-pasture dairy farming is a seasonal form of animal farming for dairy production purposes, which includes breeding, grazing, milking and dairy transformation.

Herds are seasonally moved to high-mountain pastures where they graze during the summer months. Being an extractive activity, grazing has been criticized for putting pressure on grasslands' biodiversity. It was proved though that grazing has contributed to create, enhance and maintain pasture' biodiversity (e.g. FAO, 2015; Metera et al., 2010; Penati et al., 2011).

Alpine grasslands are a human-modified ecosystem, which has undergone anthropic influence for about 5000 years (Maurer, et al., 2006), mainly from high-pasture dairy farming

activities. Grasslands were created by cutting wood and bushes, while grazing has prevented non herbaceous species to regrow. Such modification of the ecosystem did not directly imply a loss in biodiversity. On the contrary, Alpine grasslands account for three times more plant species than woodlands (Zoller & Bischof, 1980, cited in Maurer et al., 2006) and have a great ecological importance (Galvánek & Janák, 2008; Tessaro, 2003).

The maintenance of such valuable biodiversity depends on the continuation of HPDF activities that contributed to the creation of grasslands ecosystems. Nevertheless, an excessive pressure of HPDF activities can be detrimental to the environment it contributed to create (Galvánek & Janák, 2008). The impact of HPDF is therefore still controversial and depends on variables such as animal pressure on the environment and on HPDF management.

High-pasture dairy farming is an important livelihood in the Alpine area, both for its historical tradition and in economic terms (Mack et al., 2013; Penati et al., 2011). The value of HPDF as the basis of livelihood in mountain areas is even higher because of the marginality of the regions where it is carried out.

Some studies proved that a good management of HPDF can have positive impact both on the environmental and on the socio-economic side (Metera et al., 2010). Still, it is unclear what would HPDF entail when practiced in a context of protected area, whose primary objective remains environmental conservation, including the reintroduction of wild species.

Agricultural activities in protected areas are quite common in Italy (Grandi & Triantafyllidis, 2010). However, little literature has been produced about the interactions between dairy farming and environmental conservation, i.e. to what extent protected areas regimes limit or enhance agricultural production and how agriculture contributes to protected areas objectives.

In the Alpine region, environmental conservation has quite a long tradition. Still, conservation policies have been encountering resistance both from farmers and scholars who support the maintenance of farming activities in mountain areas (Corti, 2012; Grasseni, 1998). These voices claim that environmental protection threats farming activities and adduce the contribution of HPDF in supporting local development of marginal territories. This research will focus on whether a protected area hampers or benefits farmers' livelihoods.

1.3 Research Aim and Research Outline

The objective of this research is to understand whether high-pasture dairy farming in protected areas can contribute both to environmental conservation and to livelihood enhancement, and thus if it could be considered a sustainable livelihood.

HPDF's effect on pastures' biodiversity, its socio-economic impact and the influence that Protected Areas have on HPDF's environmental and socio-economic performance will be analyzed. Comprehending these latter interactions will highlight whether and how is it possible to trigger (or improve) synergies between biodiversity conservation and local development, and thus overcome potential conflicts between farmers and conservationists. In doing so, this research aims to contribute to the discussion on environmental conservation and local development around high-pasture dairy farming in the Italian Alps.

The research question behind this thesis is therefore:

To what extent can HPDF in protected areas contribute to socio-economic enhancement and biodiversity conservation, and thus be the basis for sustainable livelihoods?

The following pages present at first the theoretical framework that constitutes the base of this thesis (chapter 2). Grasslands' conservation is introduced as form of management of a common pool resource. Then, the conservationist and the extractive viewpoint and their interaction is described. The policy framework concerning environmental conservation and support to livelihoods is also presented in order to consider the interaction of the two from a policy-making point of view. Finally, it is outlined the position of farmers within this dualism. Chapter 3 presents the research question and sub-questions and the conceptual framework behind this thesis. It mainly focuses on the concept of sustainable livelihood and on the dynamics around HPDF in protected areas.

The contextual background of the research is described in chapter 4. The Ossola area in the Lepontine Alps, in North-Western Italy are presented and an outline of HPDF activities and conservation strategies in the research area is portrayed.

Chapter 5 describes data collection methods, while the following chapter presents the results. Results consist in an initial assessment of the sustainability of HPDF in protected areas, and then in and analysis of the role and influence of these latter on HPDF activities and sustainability performance.

Results are then discussed in chapter 7. The conclusion in chapter 8 provides an overarching answer to the research question. Finally, some policy recommendations are proposed in chapter 9, in order to enhance the synergies between biodiversity conservation promoted by the protected areas and HPDF's contribution in supporting locals' livelihoods.

Chapter 2: Theoretical Framework

2.1 Environmental conservation as common pool resources' management

In 1968, Garrett Harding presented pastures as the exemplifying case of common pool resources (CPRs). Pastures are indeed characterized by both key elements of CPRs, i.e. non-excludability and rivalry in use. On the one hand, it is not possible in fact to limit the access to pasturelands without facing some costs, such as for enclosing the pasture area. On the other hand, pastures can support only a limited number grazing cattle.

A further contribution to the definition of CPRs is owed to Elinor Ostrom (1990) who describes them as a system formed by resource units, which in the case of pastures would be the single plants. Ostrom presents furthermore CPRs as a stock variable, whose subsistence is not bound to the persistence of its individual components. Instead, in order for a CPR to be maintained it is necessary that the rate that the resource units are withdrawn is equal

to their renovation rate (Ostrom, 1990). For example, in order for pastures to persist, it is necessary that new plants regrow at the same pace that others are removed.

Overall, literature suggests that some habitats (e.g. a forest, a pastureland) can be viewed as a common pool resources' system. An adequate management of the resource withdrawal is therefore indispensable to the maintenance of the system. Therefore, CPRs management can be considered as a form of conservation of the habitat.

Scholars have extensively debated around the form of governance that allowed for such adequate management (Agrawal, 2003). First, in its "Tragedy of the Commons" (1968) Hardin stressed that resource systems could not persist if access to the resource would not be limited. Otherwise, the rate of withdrawal of a "free" resource would be inevitably higher than its renovation and the resource stock would inevitably disappear. According to Hardin (1968), the only possible way to escape the tragedy of the commons is to either privatize common pool resources or to turn them into public goods and subordinate them to central government management.

Elinor Ostrom proposes a third solution stating that it is possible to manage a common pool resource system through collective action (Van Laerhoven, 2010). However, a successful management of common pool resources depends on the characteristics of the group (Van Laerhoven, 2010). Small groups, whose components live close to each other and that share

a common interest in the maintenance of the resources are more likely to put into practice successful examples of CPRs management. Also, social capital within the group is a key element in order to avoid free-riding behaviors and thus grant a successful collective management of the commons (Van Laerhoven, 2010).

2.2 Trade-offs and synergies between environmental conservation and enhancement of livelihoods

There is an extensive body of literature that focuses on the relations between development and environmental conservation. Some authors (Adams et al., 2015; Naughton-Treves et al., 2005) state that environmental conservation is necessary in order to sustain local livelihoods because of the ecosystem services a pristine environment provides. Others instead (e.g. McShane et al., 2011) stress on how environmental conservation and local development are very hard to reconcile.

Trade-offs between biodiversity conservation and local development are twofold. On the one hand, environmental conservation is considered as a barrier to the improvement of local livelihoods particularly in least developed and marginal areas, as it restricts investments in infrastructure and natural resources extraction, and limits agricultural activities (Brandon et al., 2005). On the other hand, preservationist arguments state that protected areas allowing human activities cannot be effective in their conservation efforts. Such arguments state that even a sustainable use of resources entails depletion of biodiversity, which goes against conservation goals (Redford & Richter, 1999; Robinson, 1993; cited in Wilshusen et al, 2002). The trade-offs' thesis is supported by the numerous documented failures of Integrated Conservation and Development Projects (ICDPs) (Larson et al., 1997; cited in Wilshusen et al., 2002) whose objectives is to attain conservation goals by supporting local development, based on the assumption that better livelihood options would reduce human pressure on biodiversity (Hughes & Flintan, 2001).

In some cases, it seems possible to achieve synergy between environmental conservation and local development goals. Salafsky (2011) shows this, explaining that it is possible to identify and trigger win-win strategies, which enhance both conservation and local people' livelihoods. This is possible when an adequate management of economic activities within protected areas is in place and the regime of environmental protection considers local people' livelihoods (Sayer et al., 2013).

Many attempts to combine biodiversity conservation to local development have entailed developing an eco-touristic sector. Ecotourism aims to enhance local development through a non-exploitative use of the natural capital, whose value depends on its touristic attraction (Fletcher, 2012; Honey, 1999). Despite ecotourism synergic goal, literature reports that in

many cases ecotourism encountered pitfalls in its conservationist and/or developing goal (Horton, 2009; Hunt, Durham, Driscoll, & Honey, 2014)

Much attention has been given also to agricultural activities, because both agriculture and conservation make use of the same areas for conflicting purposes i.e. biodiversity conservation and extraction. Indeed, when protected areas are established in rural areas, agricultural economic activities are the most conflicting with conservation purposes (Brandon et al., 2005). Yet, some traditional farming systems and techniques may enhance biodiversity (Altieri & Toledo, 2011; Avondo et al., 2013). In some cases, traditional agriculture has even contributed during the centuries to shape, and maintain so-called human-modified ecosystems.

Interactions between environmental conservation and agricultural practices have been recognized by the International Union for the Conservation of Nature, IUCN, to the extent that new protection regimes have been established "where the interaction of people and nature over time has produced an area of distinct character with significant aesthetic, cultural and/or ecological value, and often with high biological diversity" and where human activities are envisages "to ensure the maintenance of habitats" (Dudley, 2008).

Therefore, interplays between human activities (such as agriculture but also tourism), and environmental conservation regimes are much more complex than they might seem, entailing both cooperative and competitive relations.

2.3 The solution: land-sparing and land-sharing?

The position of agricultural activities with respect of biodiversity conservation have been addressed by the land-sparing and land-sharing debate. This debate focuses mainly on whether biodiversity conservation and agricultural activities should coexist in the same area or be separated, i.e., whether land should be spared from agricultural activities or shared with agricultural activities. The land-sparing advocates argue that in order to attain the most of both agriculture and environmental conservation it is necessary to dedicate specific areas to high-yield farming, which would allow others to be entirely dedicated to conservation, i.e. would allow to spare land for nature. The land-sharing supporters, on the other hand, propose a wildlife-friendly agriculture that is able to simultaneously provide agricultural production, although with lower yields, and protect biodiversity (Fischer et al., 2008; Pearce, 2013). This latter approach is in line with the view of environmental conservation as CPR management as it aims towards an adequate management of land, allowing for a form of resource extraction that guarantees for conservation of the resource system.

The land-sharing and land-sparing approaches are based on different reasoning on the relation of human activities with the natural environment. Nevertheless, their application

in reality is more nuanced and responds to context specific situations, such as geographical location, historic land use pattern and socio-economic aspects (Fischer et al., 2008).

The case study presented in this research is a clear case of (seasonal) land-sharing between environmental conservation and agricultural activities. High-pasture dairy farming has been practiced in the Alps for a millennium (Corti, 2011) and since the establishment of Alpine protected areas, grazing has been coexisting with environmental conservation goals.

Yet, coexistence is not always easy. There is an ongoing debate between "preservationists" who promote re-naturalization by the removal of human pressure on the environment (Schmidtz, 1997), and supporters of Alpine agricultural activities, who consider the reintroduction of wildlife as a menace for the subsistence of mountain dairy farming, because of documented attacks by predators and damage to pasturelands (Corti, 2012; Ruralpini, 2016). The preservationist position is backed by experts and environmental organizations headed by the World Wildlife Fund (WWF) and the Large Carnivore Initiative for Europe (LCIE), which are campaigning and taking action for the reintroduction of wildlife in the Alps, including bears and wolves (LCIE, 2013; WWF, 2012). Public opinion is divided between preservationists and supporters of mountain agriculture, which are led by farmer trade unions and experts (Corti, 2012; Ruralpini, 2009).

The land-sharing and land-sparing perspective can be adopted to interpret the ongoing phenomenon of the abandonment of Alpine farming, which sees a constantly decreasing number of farmers engaged in high-pasture dairy farming (Penati et al., 2011). Such abandonment can be seen as an equilibrium shift towards a "rewilded" ecosystem and thus towards sparing of land for conservation (Plieninger et al., 2013). It is undeniable that a reduced human footprint has been indispensable for the repopulation of the mountain areas by large mammals, both herbivores and carnivores (Russo, 2006). Nevertheless, others argue that mountain abandonment should be tackled, allowing traditional livelihoods to survive (European Parliament, 2013; Ruralpini, 2009) because the abandonment of mountain agriculture may also result itself in biodiversity loss, particularly of herbaceous species that risk to disappear if grazing activities get abandoned (Avondo et al., 2013). Such debate seems to depend ultimately on a conflict between prioritization of species, i.e., about the relative importance of some species over other, some of which have become dependent on centuries of mountain agriculture.

2.4 Policy framework for environmental conservation and local rural development

The International Union for Nature Conservation (IUCN) defines protected areas as specific spaces that undergo some kind of management aimed to attain long-term conservation of the environment and its associated ecosystem services (Dudley, 2008). This is a very wide definition that includes both pristine nature areas and human-modified ecosystems. Protected Areas can be very diverse and according to that the IUCN has identified six categories (Appendix 1).

Ia. Strict Nature Reserve
Ib. Wilderness Area
II. National Park
III. Natural Monument or Feature
IV. Habitat/Species Management Area
V. Protected Landscape/Seascape
VI. Protected Area with sustainable use of resources

Categories set the conservation goal and methods, and define to what extent protection measures need to be strict including the extent conservation and human activities are or not interwoven between each other (European Environmental Agency, EEA, 2012).

In Italy, protected areas are categorized according to their relevance, and not to management criteria by the law number 394 of 1991 (L 394/91). Italian protected areas system[1] pays much attention to the conservation of the cultural (and historical) capital jointly to the natural capital, because of the "intimate link" between the two (Italian Ministry of the Environment, Land and Sea, IMELS, 2014). To this regard the IMELS has been promoter of the Charter of Rome on Natural and Cultural Capital.

Governance of Italian protected areas is entrusted to a complex institutional mechanism that involves specific institutions for the management of the protected areas in accordance with local or national authorities to whom they have to report back. This form of governance is recognized by the IUCN as "shared governance" (EEA, 2012). Italian protected areas are to a great extent part of Natura 2000[2], the main European network of protected areas. The goal of Natura 2000 is to ensure the long-term survival of Europe's most valuable and threatened species and habitats according to the European Council Directives 79/409/EEC (Birds Directive) and 92/43/EEC. (Habitat Directive). To do so, it promotes

[1] http://www.parks.it/ministero.ambiente/

[2] However, the Natura 2000 network extends in many cases beyond nationally established protected areas systems (EEA, 2012)

the sustainable use of natural resources taking into account the anthropic dimension, i.e. social, economic and cultural context (EEA, 2012).

The conservation of the Alpine region is ruled by the Alpine convention (1991), an international treaty among the eight Alpine countries (Monaco, France, Italy, Switzerland, Lichtenstein, Germany, Austria and Slovenia) and the European Economic Community. The Alpine Convention sets the principles to inclusive environmental conservation (i.e. that involves human activities) and for the sustainable development of the region (EEA, 2012). It is possible thus to notice that the environmental conservation policy of the Alpine region is essentially bound to the anthropic presence in the area.

Support to such anthropic presence of the Alpine territories relies on the European policy framework for rural development. The EU's rural development policy is part of the Common Agricultural Policy (CAP) and is funded through the European Agricultural Fund for Rural Development (EAFRD). Each member state or region, as it is the Italian case, presents for funding their own Rural Development Programme (RDP) the EAFRD (European Commission, 2014). RDPs need to be coherent to the EU priorities for rural development:

1. fostering knowledge transfer and innovation in agriculture, forestry and rural areas;
2. enhancing the viability and competitiveness of all types of agriculture, and promoting innovative farm technologies and sustainable forest management;
3. promoting food chain organization, animal welfare and risk management in agriculture;
4. restoring, preserving and enhancing ecosystems related to agriculture and forestry;
5. promoting resource efficiency and supporting the shift toward a low-carbon and climate-resilient economy in the agriculture, food and forestry sectors;
6. promoting social inclusion, poverty reduction and economic development in rural areas.

The regional RDP concerning the research area include measures to foster agricultural activities in mountain areas, support agricultural practices that preserve local biodiversity and compensations for farming restrictions in areas included in the Natura 2000 network (Regione Piemonte, 2012).

Overall, there are quite important policy linkages between local rural development and environmental conservation.

2.5 Farmers and Protected Areas: exploiters or stewards?

The establishment of protected areas has clearly an impact on human activities within their boundaries. Protected areas objectives may differ from local people interests and environmental regulations may affect local livelihoods (de Koning, 2014). Such divergence

of objectives is likely to generate adversity towards conservation. On the one hand, local people living or operating in protected areas report feeling less valued than the wildlife protected areas are safeguarding, and also report that they are prohibited and excluded in their access to natural resources (Nepal & Weber, 1995). On the other hand, a good and inclusive planning of Parks' operations may make people feel involved and boost (directly or indirectly) their revenues from environmental conservation actions (Nepal & Weber, 1995).

When environmental conservation involves farmers, this entails particular dynamics. Besides their role of extractor of natural resources, farmers may also be environmental stewards (Verzijl & Quispe, 2013). Particularly, farmers' activities play a key role in supporting the biodiversity of human- modified ecosystem, as it is the case of Alpine pastures. Still, recognizing this role does not deny that farming activities might also have a negative impact on the ecosystem and thus jeopardize biodiversity.

Farmers are aware of their potential role in ecosystem conservation and they vindicate such role to defend and support their livelihoods (Liebrand et al., 2012). They might claim to obtain subsidies for the added value their activities have in maintaining ecosystems. This argumentation might as well be used in opposition to environmental restrictions that protected areas might impose on farming activities.

These considerations reflect the plurality of roles farmers and agriculture have in general (Renting et al., 2009). They can be considered drivers of local development in marginal rural areas, exploiters of natural resources, opponents of environmental regulation and maintainers of the ecosystem. One role does not necessarily exclude others.

Chapter 3: Sustainable HPDF livelihoods in protected areas.

3.1 Research Question and sub-questions

Within the intricate interrelations between environmental conservation and the enhancement of local livelihoods that have been highlighted in the previous chapter, this research presents the specific case of one kind of (traditional) agricultural livelihood in protected areas. It is hypothesized that these latter will have an influence on livelihoods.

As introduced in chapter 1.3, the main question underlying this research is:

To what extent can HPDF in protected areas contribute to socio-economic enhancement and biodiversity conservation, and thus be the basis for sustainable livelihoods?

This research is then subdivided into three themes: environmental, socio-economic and protected areas, which are addressed by the following sub-questions:

SQ 1: What is the impact of high-pasture dairy farming on Alpine biodiversity?
This part of the research will reveal whether there is an effect of HPDF on species richness and diversity of Alpine grasslands.

SQ 2: To what extent is high-pasture Alpine dairy production a viable option for local producers?
For "viable option" is intended that it is economically profitable but also rewarding for farmers. This question thus includes both personal satisfaction and the economic dimension.

SQ 3: What (collective) actions are taken by high-pasture dairy farmers in order to enhance their livelihoods?
This question focuses on farmers' individual or collective activities beyond dairy production, including relations with the park authorities, lobbying, commercialization of their product etc., which might improve the viability of HPDF.

SQ4: How do farmers perceive park policies?
This question aims to eventually detect if and to what extent there is a conflict between farmers and conservationists.

SQ 5: To what extent is the socio-economic outcome of HPDF affected by the fact of being located in a protected area?

This question aims to understand whether and how the fact of being situated in a protected area is an added value or else as an obstacle for farmers' livelihood. This information will ultimately contribute to understand whether and how parks' management could generate synergies between environmental conservation and local development.

3.2 Theory and concepts' definition

As it is possible to presume from the research question this research rotates around the concept of *sustainable livelihood*.

The meaning of the term sustainable, should not be misinterpreted as "environmentally friendly". It is undeniable that the environmental aspect is crucial. Indeed, the main frame for the definition of sustainability is provided by the natural sciences (de Vries, 2013). Nevertheless, there are other aspects that are taken into consideration when defining a sustainable livelihood. Livelihoods are by definition[3] bound to an economic dimension, which is necessary to provide for people's necessities. Quality of life is another factor that is necessary for defining sustainability of livelihoods (de Vries, 2013; Levett, 1998). Quality of life, which can be defined also as happiness or satisfaction depends on several (social) variables, e.g. family ties, social environment, personal freedom, the financial situation is only one of which (Layard, 2005 cited in de Vries, 2013).

The concept of sustainable livelihood is therefore formed by an environmental, an economic and a social dimension. This research adopts the following definition of sustainable livelihood: an activity that has a positive or non-negative impact on the environment, provides an adequate income (i.e. enough to provide an acceptable standard of living), and good quality of life for those who live out of it.

The sustainability of HPDF is defined in terms of its environmental impact, profitability and satisfaction provided to farmers. To these dimensions is attributed equal importance.

The environmental sustainability of high-pasture dairy farming is considered in terms of impact of cattle on pastures' biodiversity. This latter depends of course on the number of cattle but also on its distribution among and within pastures. Indeed, even though the amount of livestock in protected areas might be regulated, their distribution might not be. For this reason, livestock's presence might be unbalanced, being much stronger in some areas, e.g. more accessible ones, which could therefore suffer from excessive exploitation, while others might be abandoned. Cattle distributions depends also on farming intensity. Beside the abandonment of farming, it is common to assist nowadays to an intensification of farming activities, i.e. less farms with a higher number of cows (Penati et al., 2011). Also in this case, grazing pressure would be unbalanced. For this reason, it is important to understand the pattern of the abandonment of HPDF activities.

[3] http://www.collinsdictionary.com/dictionary/english/livelihood

The hypothesis underlying this thesis is that the sustainability performance of HPDF activities, when these are carried out within a protected area, will be subjected to the influence of protected areas' regulation (Figure 1). These regulations might affect (positively or negatively) the environmental as well as the social and economic performance of HPDF. Farmers for their part can promote or get involved in (collective) actions that can possibly influence protected areas management and their influence on HPDF.

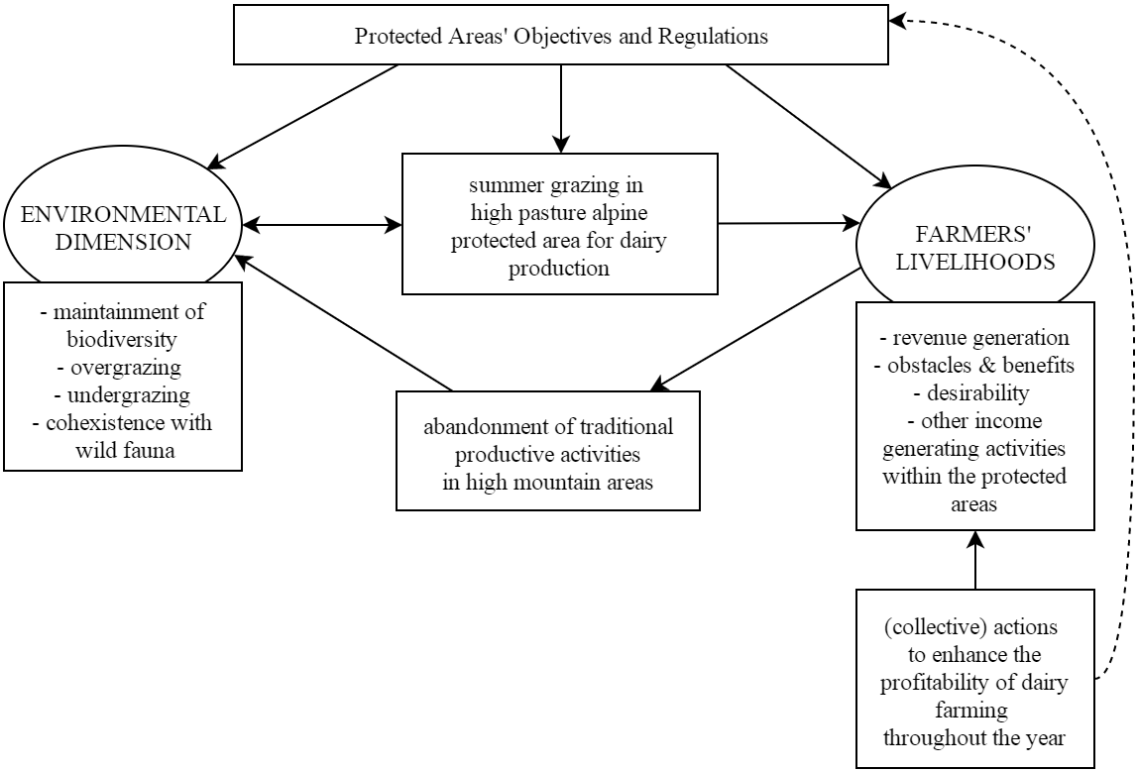

Figure 1: Conceptual framework.
Protected areas regulation might affect (positively or negatively) HPDF activities and its environmental as well as socio-economic performance. This may affect the decision of abandoning the area and/or HPDF activities, which is likely to have repercussion on the environmental dimension of HPDF in the protected areas. At last, farmers can exercise influence on the protected areas, to their advantage.

Chapter 4: HPDF and environmental conservation in the Italian Lepontine Alps

4.1 Study area

Situated in the North-western Alps, the Lepontine area, as defined by the International Standardized Mountain Subdivision of the Alps (SOIUSA) extends from the Simplon Pass to the West, to the Splugen Pass to the East and runs between Italy and Switzerland (Figure 2). The Italian part of the Lepontine Alps corresponds approximately to the Ossola area, the Northern part of the Verbano-Cusio-Ossola province (VCO) in Piedmont.

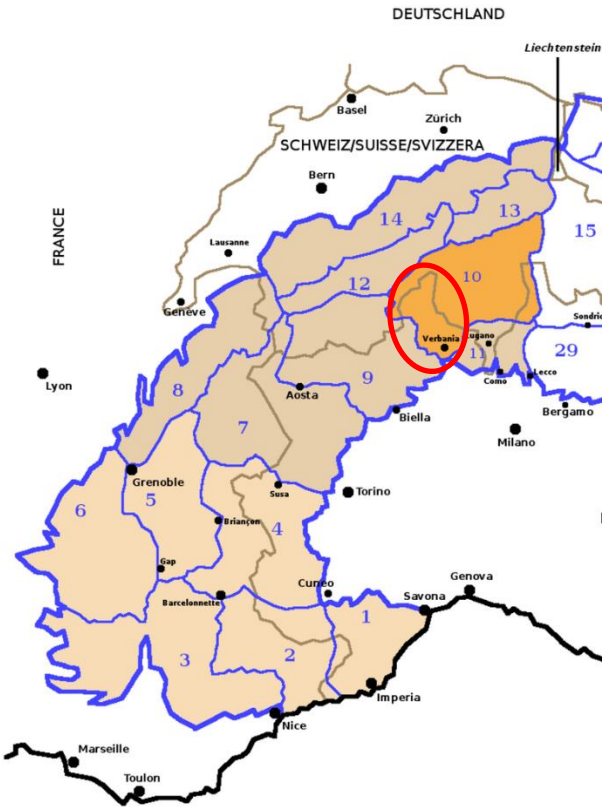

Figure 2: SOIUSA division of Western Alps. Highlighted the Lepontine Alps. Research area is circled in red. Author's elaboration on Marazzi (2005).

The Ossola area is a mountain border territory and can be considered a marginal area both geographically and socio-economically. The area is rather isolated, particularly in higher mountains, because of poor infrastructures, which limit physical accessibility (streets) and communication (ICTs network) (Fassio & Zanini, 2014). Economic possibilities in the

mountain area are limited and mostly dependent on natural resources (CCIAA-VCO, 2012). Economic activities include hydropower generation, stone extraction, exploitation of mineral and thermal water, and mountain agriculture, which is mostly characterized by animal farming (cows and goats) for dairy production (Gazzola & Rizzi 2004). In the 1970's there was an important wave of industrialization in the valleys, mainly in the metallurgic and chemical sector, which was favored by abundance of hydropower. These industries however were not able to keep pace with emerging markets and since the 1990's they only provide limited and unsecure employment (Fassio & Zanini, 2014). Employment rates in Ossola also decreased following the recent economic crisis and undeclared work is not uncommon especially in less formalized sectors, such as agriculture. Tourism has instead gained importance and economic relevance both in the winter and summer season. Such development of the touristic sector has however occurred at the detriment of agriculture, which has declined as much as tourism took pace (Fassio & Zanini, 2014).

The marginality of the territory, the few economic opportunities, lack of welfare services, and the ageing population have led to a significant abandonment of mountain areas resulting in a negative demographic rate up to -35.4‰ according to the latest census (Corrado, Dematteis, & Di Gioia, 2014; Urbistat, 2012).

4.2 Dairy farming in mountain areas in Ossola

Dairy production in Ossola has a long tradition. The first written documents explicitly mentioning mountain pastures date back to 1000 A.D., when land was granted to farmers by landlords in exchange of part of their production. Cheese, in particular, was then considered as currency for paying access to land and other taxes (Corti, 2011). Dairy production in high mountain pastures has had both economic relevance and marked local culture identity (Grasseni, 2011).

Animal farming in this Alpine area involves mostly cows and goats (Paltani, 2010). Traditional animal farming follows a transhumant pattern. Herds move throughout the year to different altitudes according to vegetative phases of grasslands (Figure 3). During winter months (approximately from November to March, depending on the area and the weather) animals stay in sheds in the lower valleys, usually in proximity of villages. During this time of the year animals are fed mostly with hay that is grown and cut in hay fields in the valleys or at mid-altitudes. During spring and autumn (April, May, June and October) herds start grazing mid-altitude pastures. It is only during the summer months (July to September) that animals reach high mountain pastures, up to 2500 m.a.s.l.

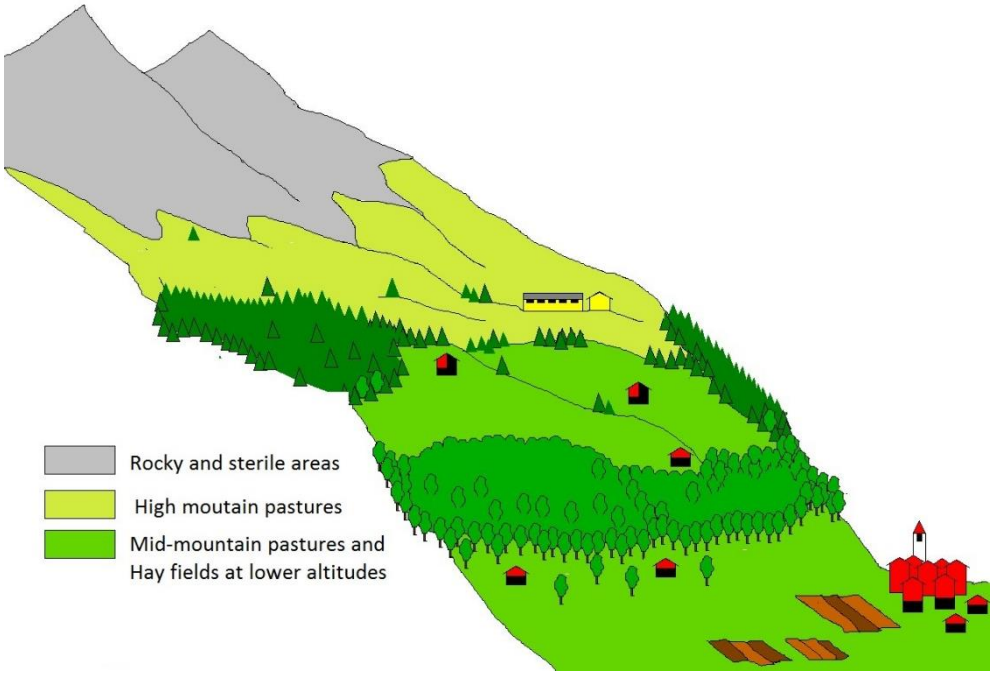

Figure 3: Scheme of herds' transhumance in the Alpine region. Authors elaboration on Ruralpini (2008)

The main reason of moving herds to mountain pastures is economic. Animals can be fed at no costs, or at a minimum cost in case a rent is asked by pasturelands' owners. Winter feed is mostly self-grown, and only in the last decades has been boosted with maize or soy that is bought from the feed industry. Also, the quality of milk produced from mountain grazing is higher producing better products, which can be sold at a higher price.

As it concerns pasturelands, ownership is public and managed by municipal institutions. Farmers are entitled to the use of specific pasture areas by payment of an annual rent. High-pasture farming activities are regulated by a contract between the farm owner and the municipality, which stipulates reciprocal duties, including maintenance of pastureland and other mountain areas assigned to farmers. However, according to some farmers there is little or no surveillance by the municipalities on farmers to actually comply with the terms of the contracts.

4.3 Abandonment of high-pasture dairy farming

Dairy production in the Alpine area is generally characterized by family-run small and medium businesses producing relative small amounts of dairy, a part of which is not sold but kept for self-consumption (Ruralpini, 2010). The low productivity of this kind of businesses comes with high amount of labor, resulting in abandonment of dairy production in the Alps, and in the Ossola area (Zerbini, 2005) as shown in Figure 6.

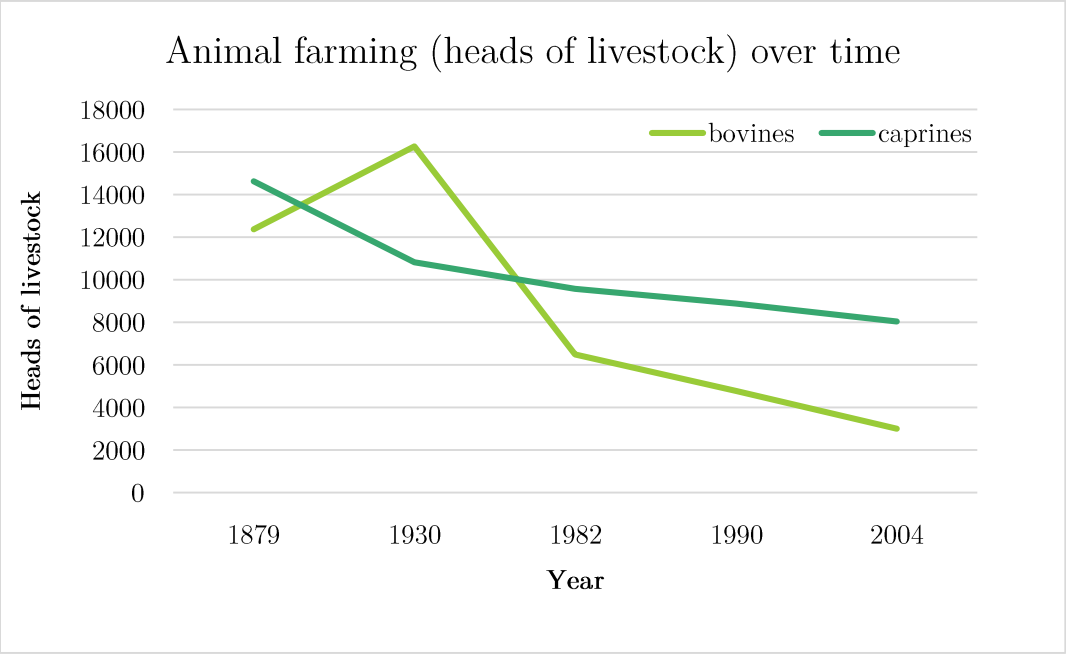

Figure 4: Evolution of animal farming in Ossola. Author's elaboration on Zerbini (2005) *and Calpini* (1880).

Abandonment of mountain pasture dairy production is common to the whole Alpine area, at least in the Italian part, and was recognized to have significant environmental, socio-economic and cultural implications (European Parliament, 2013; Penati et al., 2011).

4.4 High-pasture dairy farming in the past

In the past, farming activities and dairy production was not so different, making exception of mechanization of milking and of increased hygiene standard for dairy production. Grazing was free along mountain pasturelands, but farmers surveilled cattle grazing in the pastures, which were also maintained collectively by farmers.

A noteworthy difference is that in the past decades HPDF was carried out at a much smaller scale and at a more subsistence level. Farmers owned a smaller number of cattle, but there were many more the nowadays and overall, the number of cattle in pastures was higher (see Figure 6). However, cattle were smaller than nowadays, due to genetic selection of breeds, which implies also that the impact of each animal on pasturelands was lower both in terms of grazing and excreta.

> *"It is true that in the early 1900s there were more than thousand heads of cattle only in Alpe Veglia* [a specific area within the OPAs], *but they weighted at least 200 kilograms less than nowadays and they produced less milk. And they ate much less. If once you needed half a hectare to sustain a cow's feeding*

needs, now you need one hectare. So it is not so true that nowadays there are too few heads of cattle"[4] (I. De Negri, OPA's Director)

4.5 Protected areas in Ossola

In Ossola, there are three major protected areas of Alpine ecosystems (Figure 5): the Val Grande National Park, the Alta Valle Antrona (High Antrona Valley) Natural Park, and the Veglia-Devero Natural Park. The latter two are reunited in the management authority of the Ossola Protected Areas. Despite the aim of protected areas being mainly biodiversity conservation, protected areas are also engaged in the touristic promotion of the territory, and of sustainable economic activities.

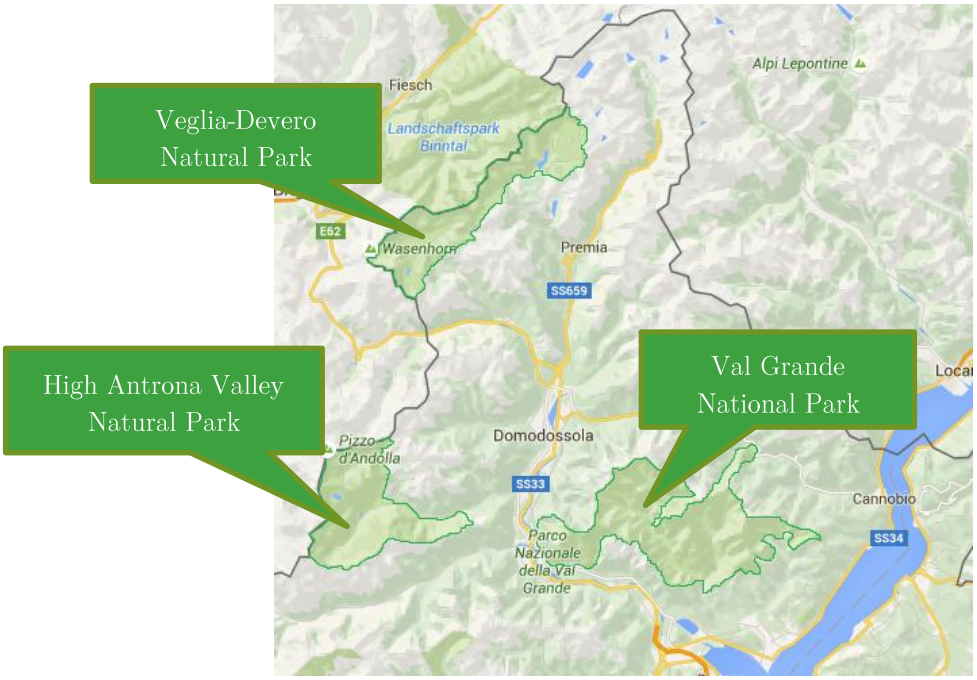

Figure 5: Protected Areas in Ossola. Author's elaboration on Google map

The Val Grande National Park is the biggest and first park in the area, being established in 1992. It extends over 15.000 hectares, including the territory of 13 municipalities, and its orography goes from hilly (272 m.a.s.l.) up to mountain peaks of 2299 m.a.s.l. According to its name, the Val Grande National Park fit in the IUCN category II (National Park)[5],

4 Translation from original interview: *"Quando si dice che in Alpe Veglia agli inizi del 900 c'erano mille capi, è vero, però pesavano almeno 2 quintali meno di quelli di oggi e producevano molto meno latte. E mangiavano anche molto meno. Quelle di oggi, se prima ci voleva mezzo ettaro per capo, adesso ce ne vuole uno intero per riuscire a sostenerne la necessità alimentare. Quindi non è poi così vero che adesso abbiamo troppo pochi capi."*

5 IUCN category II, National Park: large natural or near natural areas set aside to protect large-scale ecological processes, along with the complement of species and ecosystems characteristic of the area, which also

although a considerable share of this area is characterized as Wilderness Area[6], i.e. category Ib (Wiederwald & Chodziesner-Bonne, 2000). In most of the Val Grande National Park human presence is absent or not significant, and human activities within the park have been almost completely abandoned (Parcovalgrande.it). Only animal farming is practiced by a couple of farms at the outskirts of the Park (Barbaglia, Cresta, & Monti, 2009). For this reason, this Park has been excluded from the research.

The second park is the Veglia-Devero Natural Park, which covers an area of 8.539 ha in high mountain territory, going from 1600 up to 3553 m.a.s.l. It has been established in 1995 and comprises the territory of 4 municipalities (Areeprotetteossola.it). The Veglia-Devero Natural Park can be defined as a border park. Indeed, it runs for over 35km along the Swiss border. This park is connected and twinned to the Swiss Binntal Landscape Park. This park hosts several human activities both in the summer and winter season. During summer its mountain pastures host several herds and huts where farmers live and cheese is produced.

The third park is the High Antrona Valley Natural Park. It is the smallest of the three parks, covering an area of 7435 ha divided between two municipalities, and it ranges from 500 to 3656 m.a.s.l. The High Antrona Valley Park is the most recent park in Ossola, and its declaration dates back only to 2009. Its management is joint with the Veglia-Devero Natural Park and forms together with it the Ossola Protected Areas (OPAs).

Despite the official nomenclature for the latter two parks is "Natural Park", both the Veglia-Devero and the High Antrona Valley Natural Parks fit into IUCN category V, Protected Landscapes[7] (Wiederwald & Chodziesner-Bonne, 2000). It was within the Ossola Protected Areas that data collection took place.

4.6 Objective and organization of the Ossola Protected Areas

The Ossola Protected Areas are managed by an institution of the same name, i.e. Management Authority of the Ossola Protected Areas (Ente di Gestione delle Aree Protette

provide a foundation for environmentally and culturally compatible, spiritual, scientific, educational, recreational, and visitor opportunities https://www.iucn.org/theme/protected-areas/about/protected-area-categories/category-ii-national-park

[6] IUCN category Ib, Wilderness Area: usually large unmodified or slightly modified areas, retaining their natural character and influence without permanent or significant human habitation, which are protected and managed so as to preserve their natural condition. https://www.iucn.org/theme/protected-areas/about/protected-area-categories/category-ib-wilderness-area

[7] IUCN category V, Protected Landscapes/Seascapes: A protected area where the interaction of people and nature over time has produced an area of distinct character with significant, ecological, biological, cultural and scenic value: and where safeguarding the integrity of this interaction is vital to protecting and sustaining the area and its associated nature conservation and other values https://www.iucn.org/theme/protected-areas/about/protected-area-categories/category-v-protected-landscapeseascape

dell'Ossola, 2009). The Management Authority was established by the Piedmont Region by the Law n.19, on June 29th 2009 (Regione Piemonte, 2009). Despite being an autonomous institution, the Management Authority depends on the Regional government.

The Ossola Protected areas' management authority is divided into a management and a political part. This latter is composed by the President, who is nominated by the Regional government, a Board and the "Community of the OPAs", which includes representatives of the local governments included in the OPAs.

The Ossola Protected Areas' core objectives are:

1. Safeguarding natural capital;
2. Promoting historical, cultural and architectonic capital;
3. Promoting a sustainable and conscious fruition of the territory;
4. Enhancing research and environmental education;
5. Enhancing community engagement in initiatives in line with the objectives of the OPAs;
6. Fostering sustainable development.

For the achievement of such objectives the OPAs dispose of few staffs, among office employee, workmen, rangers and a naturalist expert.

4.7 Alpine biodiversity and its conservation within the Ossola Protected Areas

The research area hosts a high richness of plant and animal species, and its ecological importance is recognized by the European protected areas network, Natura 2000 (Piazza, 2011). High mountain areas are characterized by several Habitats of Community Importance, according to the EU Habitats Directive (92/43/EEC), some of which are labelled as priority for conservation purposes (Casale & Pirocchi, 2005). Among the priority habitats, there are "species-rich *Nardus* grasslands" (habitat 6230), most commonly referred to as Alpine grasslands (Tessaro, 2003), which are at the focus of this research. Other priority habitats in the OPAs are bogs (habitats 7110, 7140, 7230)[8] and heaths[9] (habitat 4060).

The first two habitats are subject to cattle impact. In order to restore and maintain Alpine Habitats of Community Importance, the Ossola Protected Areas started in 2003 a three-years-long conservation project in the framework of the European programme for nature conservation and climate action, LIFE. As it concerns Alpine grasslands, the LIFE project foreseen a first phase (during the first year) during which the conservation state of

[8] Active raised bogs (habitat 7110);
Transition mires and quaking bogs (habitat 7140);
Alkaline fens (habitat 7230).

[9] Alpine and boreal heaths (habitat 4060)

the habitat was assessed and a pastures' management plan was developed. On the one hand, the pastures' management plant aimed to preserve bogs from excessive pressure of cattle. On the other, it was designed for a rational exploitation of pasturelands (Scalabrini, et al., 2003).

The following two years the management plan was put into practice. Farmers, considering the importance of human activities for the maintenance of Alpine grasslands, played a considerable role in the implementation phase (Casale & Pirocchi, 2005).

Farmers collaborated on a voluntary basis in the implementation phase both adopting the measures included in the pasture management plan and in the removal of invasive shrubby plant species to allow herbaceous species to regrow. Farmers who participated to the implementation phase of the LIFE project were receiving necessary equipment and a financial contribution. Overall, participation rate to the project among farmers was rather high (Casale & Pirocchi, 2005).

The OPAs' conservation efforts are also focused on the wild fauna, continuous monitoring is carried on, with particular attention to ibexes (*Capra ibex*), chamois (*Rupicapra rupicapra*), deers (*Cervus elaphus* and *Capreolus capreolus*) and birds' population. Particular attention is dedicated to those species nesting in priority habitats such as the black grouse (*Tetrao tetrix*).

The OPAs were recently included in WOLFALPS, a LIFE project for the monitoring and preservation of wolves in the Alpine region[10].

Of course biodiversity conservation passes as well through limitations to human activities. Fishing is strictly regulated and hunting is prohibited throughout the Protected areas. Also construction of new buildings is prohibited in the OPAs, while renovations undergo specific limitations. An important aspect of the OPAs rangers is therefore to assure the observance of the OPAs environmental regulations and to prevent environmental offense (Ente di Gestione delle Aree Protette dell'Ossola, 2012).

[10] http://www.lifewolfalps.eu/en/

Chapter 5: Methodology

5.1 Policy analysis

Policy analysis was carried out in order to understand how conservation of the Alpine habitats, high-pasture dairy farming, and their interrelations are treated in the public policy sphere. First I reviewed the literature on bills for conservation strategies for the Alpine ecosystems (European Union, 1996), policy recommendations and regulations on the support of mountain livelihoods (European Parliament, 2013; NORDREGIO, 2014) and of mountain agriculture (Commission of the European Communities, 2006; EuroNatur Foundation, 2012; European Parliament, 2013).

This literature review provided information about policy on environmental conservation and support to local development at the European and National scale. In order to get information on how such policies are implemented at local scale and what their implications are, it was opted to get first-hand information from interviews to the Director of the Ossola Protected Areas (Appendix 2) and to representatives of the two farmers' trade unions active in the area (Appendix 3).

5.2 Farmers interviews

During the months of June, July and August 2016, interviews to high-pasture dairy farmers were prepared and carried out. The sample for the interviews to farmers included all people who are directly involved in high-pasture cow farming for dairy production within the OPAs. One person per farm was interviewed, including in the sample only those people in chief of farms, even though more people are involved in farming activities.

Initial information on the presence of high-pasture dairy fairy farmers in the Ossola area was retrieved from a census that was conducted in 2009 and whose results are collected in a book available only locally (Barbaglia et al., 2009). More specific information about who these people are, where do they live and work and their contacts was retrieved from farmers' trade unions, from the OPA's website[11] and from word of mouth.

Overall, 13 farmers were interviewed. Semi-structured interviews were carried out because they have the double advantage of allowing freedom of speech to the interviewee, thus making the interview more fluent and responses more open, but at the same time the conversation is guided allowing thus to better aggregate data during analysis.

[11] http://www.areeprotetteossola.it/fr/parco-naturale-veglia-e-devero/valli-e-comuni/prodotti-tipici

Farmers interviews (Appendix 4) focused on what HPDF is like, on the social and economic dimension of HPDF and on their relation with the Protected Areas.

As it concerns the economic dimension of HPDF, interviews focused on aspects such as dependency from external subsidies, investment capacity as well as reported economic satisfaction. Moreover, farmers have been asked whether and to what extent the fact of being located within a protected area influences HPDF activities and their economic outcome in terms of profitability. This information was then used to assess the economic viability of HPDF (see chapter 5.5) and the influence protected areas have on it.

The social dimension of HPDF in protected areas was addressed in questions on the relations with other farmers, which provided information about the social capital (i.e. cohesion and cooperation) among farmers and on farmers' satisfaction.

Farmers were also asked about on their perception of OPAs' activities, the influence these latter have on farmers' livelihood and on their opinion. These questions were addressed in order to have an overview of eventual clashes between protected areas' and farmers' actions and priorities that could be source of conflict. At last, farmers were asked to evaluate the relations between them and the protected areas management authority.

5.3 Other interviews

In June 2016 representatives of the OPAs and of farmers' trade unions were interviewed. Namely these were Ivano De Negri, the Director of the Ossola Protected Areas, Bruno Baccaglio and Enzo Vesci coordinators for the Ossola area respectively of Coldiretti and the Italian Farmers' Confederation (CIA).

Interviews to institutions' representatives focused mostly on local policy about environmental conservation and support to mountain agriculture (see chapter 5.1) and on the relations between farmers and the Protected Areas.

Interviews with farmers' trade unions also focused on the economic dimension of HPDF, particularly on the amount of subsidies that farmers are granted and on their weight on farms' balance. It was also asked whether there was any specific strategy to support farmers' livelihood in the OPAs. Moreover, since all farmers are necessarily associated either to one or the other trade union, these provided contacts of dairy farmers working within the OPAs.

The interview with the Director the OPAs focused mainly on the Protected Areas' objectives and implementation strategies. Also, the interview included questions on what was the impact of the OPAs' actions on HPDF. The rationale behind such questions was to get insight on whether there was correspondence between farmers' and OPAs' points of view on the impact that the Protected Areas' actions have on HPDF.

5.4 Environmental analysis

To understand the effects of HPDF on biodiversity cattle pressure (number of cows per hectare) was related to pastures' biodiversity. Cattle pressure on pastures was used as a proxy of the overall impact of HPDF and is expressed as the number of cows per hectare of pasture, or cattle density.

Cattle density was calculated dividing the net pasture area by the number of cows grazing within the pasture. Information about the number of grazing cattle was provided directly by farmers during interviews. Each farmer is entitled (by contract) to use only a specific area of pasture. The net pasture area consists in such area minus the parts that are not fit to be grazed such as areas covered with woods, bushes, stones or water. This data is calculated on the basis of aerial images and has been retrieved from the agronomists working for the farmers' trade unions.

Pastures' biodiversity is expressed in terms of plant diversity. This was measured in random locations within those pastures grazed by cows for dairy production in the Ossola Protected Areas. Plant diversity has been measured in 12 different pastures. In total 20 measurements have been carried out. In general, two measurements per pasture were carried out. However, in some cases it was not possible to do so because of difficult accessibility, which entailed long hours walk to get to the field and time constraints for actual biodiversity measurement. Plant diversity was also measured in a pasture (Alpe Satta) that has been abandoned for more than 15 years and that has been considered as "pasture zero" being free of any cattle pressure.

Plant diversity was measured by means of the Shannon diversity index (H). This index was chosen because it includes both biodiversity richness (i.e. the number of species n) and the relative abundance (pi) of each species (Spellerberg & Fedor, 2003).

$$H = -\sum_{n=1}^{1} pi \ \ln pi$$

At each sampling location the number of different plant species and their relative abundance was counted within plots of one square meter divided into 25 sub-plots of 20 centimeters (Figure 6). In order to have more precise information about the relative abundance of species within the plot, the count of the number of specimens per species was carried out for each of the 25 squares. Then, information about the number of species and number of specimens per species from the sub-plots was averaged and relative abundance was calculated for the entire square meter. An example is provided in Annex 5.

Figure 6: Measurement of pastures' biodiversity. Author's photo

Finally, the values of the Shannon diversity index per plot were correlated with cattle density using the Pearson correlation coefficient. The use of the Pearson coefficient is motivated by the normal distribution of plant diversity index values.

5.5 Integration into a sustainability indicator of HPDF

To answer the question of to what extent can HPDF be the basis for sustainable livelihoods, it was elaborated a "sustainability" indicator, that includes information from all the angles of sustainability. This aggregated indicator was calculated for each farm that was included in this research, as the average of the three scores.

The environmental performance of high-pasture dairy farms (i.e. to what extent cattle pressure influences the pastures' biodiversity) was calculated by comparing cattle pressure and plant diversity of each pasture. Values of cattle density and plant diversity were normalized to the range from -1 to 1, where the minimum value was converted to -1 and the maximum value to 1. All the values in between were normalized according to the relative distance from the minimum and the maximum. Normalized values scoring higher than 0 were labelled as "high", while those scoring zero or less were considered "low" values. Then cattle density and plant diversity were related as in the following table (Table 1).

Table 2: HPDF performance given "cattle density" and "plant diversity"

		Cattle density	
		Low	High
Plant diversity	High	Low-Positive performance To low cattle density corresponds high plant diversity	Positive performance To high cattle density corresponds high plant diversity
	Low	Low-Negative performance To low cattle density corresponds low plant diversity	Negative performance To high cattle density corresponds low plant diversity

Finally, to these four categories of environmental performance of HPDF were attributed a score from -1 to +1, as reported in Table 2.

Table 3: Values for the environmental performance of HPDF

Environmental performance of HPDF	
- 1	Negative performance: high cattle pressure and low biodiversity
- 0,5	Low-negative performance: low cattle pressure and low biodiversity
+ 0,5	Low-positive performance: low cattle pressure and high biodiversity
+ 1	Positive performance: high cattle pressure and high biodiversity

Farms are often entitled to use more than one pasture and usually more than one measurement was carried out for each pasture. For this reason, the environmental performance per farm is calculated as the average of the environmental performance values of each measured plot.

The economic dimension was measured in terms of dependency from external subsidies, investment capacity as well as reported economic satisfaction. The first two variables are indicators for the subsistence capability of farms, i.e. to what extent farms would be able to continue their activity in the future. The future dimension is important aspect when dealing with sustainable livelihoods: without a medium/long term perspective, socio-economic achievements would not be sustainable (Brundtland, 1985). The economic satisfaction of farmers was as well included in the assessment of farms economic performance, in order to include all the dimensions of quality of life as indicated by Layard (2005). Information about the overall economic situation of high-pasture dairy farms was retrieved from interviews to the farmers' trade unions. Specific information about the situation of each farm, was instead obtained from interviews to farmers.

Values of the economic dimension indicators were grouped in positive (+), neutral (o) and negative (-), where high economic satisfaction and high investment capacity is positive,

while high dependency from subsidies is negative. The overall economic dimension index value was then ranked as expressed in Table 3.

Table 4: Ranking of the economic dimension of HPDF

Economic performnce of HPDF	
- 1	Farms could not continue their activities in absence of subsidies. Reported low economic satisfaction.
0	Farms can generate profit and/or make investments only thank to external subsidies. Moderate economic satisfaction
+ 1	Farms would be profitable despite the presence of subsidies. High economic satisfaction, long-term productive investments.

The social dimension is expressed in terms of quality of life, which was measured by reported farmers' satisfaction. According to the subjective well-being approach, satisfaction, or happiness, is considered a good indicator of quality of life (Veenhoven, 1991, cited in de Vries, 2013). It was therefore asked to farmers to assess their general satisfaction in their working activities beyond the economic aspect in a scale going from 1 to 10. The values of farmers' satisfaction were then grouped and ranked from negative to positive.

The values of the social dimension of the sustainability indicator correspond to the grouped reported satisfaction and score as reported in Table 4.

Table 5: Ranking of the social dimension of HPDF's sustainability

Social performance of HPDF	
- 1	Farmers assess their satisfaction in HPDF as 1, 2, 3, 4 out of 10
0	Farmers assess their satisfaction in HPDF as 5, 6, 7 out of 10
+ 1	Farmers assess their satisfaction in HPDF as 8, 9, 10 out of 10

The score of the sustainability indicator was then calculated for every single farms. The overall sustainability of high-pasture dairy farming in the Ossola Protected Areas was calculated as the average of all farms' scores.

Chapter 6: Results

6.1 Characteristics of high-pasture dairy farming in the Ossola Protected Areas

There are 17 active farms in the Ossola Protected Areas, of which 4 did not consent to an interview.

All but three farmers are hailing from the Ossola, and almost everyone (9 out of 10) continued the family business. They are generally people aged between 40 and 60 with an average age of 47. The education level of farmers, has increased with the newer generations. The majority of people aged up to 50 reached a secondary education level (high-school), many of which attended a local high school with a specific agrarian orientation. Older generations instead, mostly completed only elementary education. Descriptive figures with information about farmers can be found in Appendix 6.

The majority of the farms (7 out of 13) are of big dimensions, i.e. they own and raise more than 40 heads of cattle[12]. In addition, during the summer some farmers take with them cattle that belongs to other farms[13] in exchange of part of the production or part of the revenues from HPDF.

The most common cattle breed is the Brown Swiss, which is an autochthonous variety of the Alpine area and has been traditionally adopted for high-pasture dairy farming. Half of the farms included in this research only breed Brown Swill cows. Another cattle breed that is rather commonly bred is the Italian Simmental, a so-called dual purposes breed, suitable for both milk and meat production. In two cases farmers made a specific choice of shifting to dual-purposes cattle in order to differentiate their production and to maintain profitability of the farm also during winter months, when HPDF cannot be carried on.

[12] The concept of small, medium and big farms has been defined in line with the characterizations adopted by farmers' trade unions and the OPA's director during interviews. It is important to notice that farms are defined as small, medium and big in relative terms for a high mountain area and are not comparable with industrial-like farms in the lowlands.

[13] These heads of cattle were not considered when outlining the dimension of farms. However, they were taken into consideration in the environmental analysis of grazing impact on pastures biodiversity.

6.2 Impact of high-pasture dairy farming on Alpine biodiversity

6.2.1 Biodiversity of Alpine pasturelands and cattle grazing

In the most biodiversity rich plot, 28 different plant species have been identified[14], in the least rich only 8 species. The average diversity index scored 2.414, with values ranging from 1.472 to 2.892. The boxplot in Figure 9 shows that the values are rather concentrated in the upper part of the distribution (quartile 3 and 4), while the lowest quartile presents a much lower concentration of values, meaning that more plots had lower diversity values.

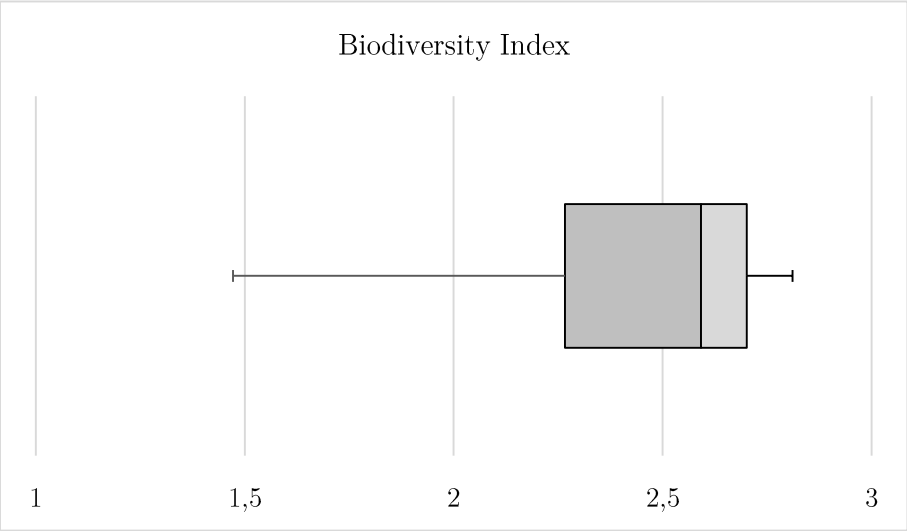

Figure 7: Box plot for diversity index values

Cattle density scored instead between zero, for the sample pasture in Alpe Satta to 1.882 in a pasture in Alpe Veglia. Data on pastures' plant diversity and cattle density in pastures are reported in Table 5.

There are four plots with very low diversity value, scoring less than 2. Two of them are the measurements of the "pasture zero", where cattle pressure on pasture is none. The third and the fourth lowest values of diversity correspond to plots that were situated in the immediate vicinity of milking areas (Figure 12). These are areas that support throughout the whole summer a much higher animal pressure compared with the rest of the pastureland, because all cows wait there twice a day for being milked and often spend the night in the nearby area. It is important to notice that not all pastures have a fixed milking area and this depends on different variables such as the existence of a milking hut or the presence of a dirt road where mobile milking stations can be moved around.

[14] Note that not all of these species are palatable for cows, so not all of them might be subjected to grazing.

Table 6: Cattle density in pastures and plant biodiversity information measured plots, with corresponding farm

Corresponding Farm #	Plot #, Pasture name	# of species per plot	Diversity Index	Cattle Density
No Farm	P1, Alpe Satta	8	1.781	0.000
	P2, AlpeSatta	8	1.472	0.000
Farm #1	P5, Alpe Buscagna	21	2.613	1.400
	P6, Alpe Buscagna	23	2.779	1.400
Farm #3	P10, Alpe Veglia (A)[2]	23	2.607	0.707
	P11, Alpe Veglia (A)[2]	11	2.317	0.707
Farm #4	P12, Alpe Veglia (B)[2]	21	2.422	0.707
Farm #5, Farm#6	P16, Alpe Forno[1]	11	1.758	0.666
	P17, Alpe Forno	25	2.692	0.666
Farm #7	P3, Alpe Colbernas	14	2.157	0.666
	P4, Alpe Colbernas	20	2.352	0.461
	P18, Alpe Fontane[2]	21	2.648	0.461
	P19, Alpe Fontane[2]	22	2.576	0.461
Farm #8	P7, Alpe Bondolero	27	2.826	0.459
Farm #9	P8, Alpe Veglia (C)[2]	17	2.648	1.882
Farm #11	P13, Pian Sass Mor	23	2.892	0.515
	P14, Pian Sass Mor	22	2.728	0.515
	P15, Pian du Scricc[1]	14	1.842	0.515
Farm #12	P9, Alpe Veglia (D)	19	2.302	0.291
Farm #13	P20, Alpe Cheggio	28	2.958	0.527

[1]within 50 meters from fixed milking area

[2]fenced grazing

Fenced grazing, as a measure to rationalize cattle grazing did not show to make a great difference in terms of pastures' plant diversity. The average Shannon diversity index for pastures where fenced grazing was carried out scores 2.536, against a value of 2.483 calculated in pastures where cattle were grazing free. Nevertheless, it was possible to spot the signs of cattle selective grazing (Figure 10) more in open (non-fenced) pastures than in fenced ones.

Figure 8: Selectively grazed pasture in Alpe Colbernas. It is possible to observe higher (and drier) Nardus plants, which are less palatable to cows and thus have not been grazed. Author's photo

On the whole, the correlation between cattle density and plant diversity index values (Figure 10) shows a positive trend between the two variables.

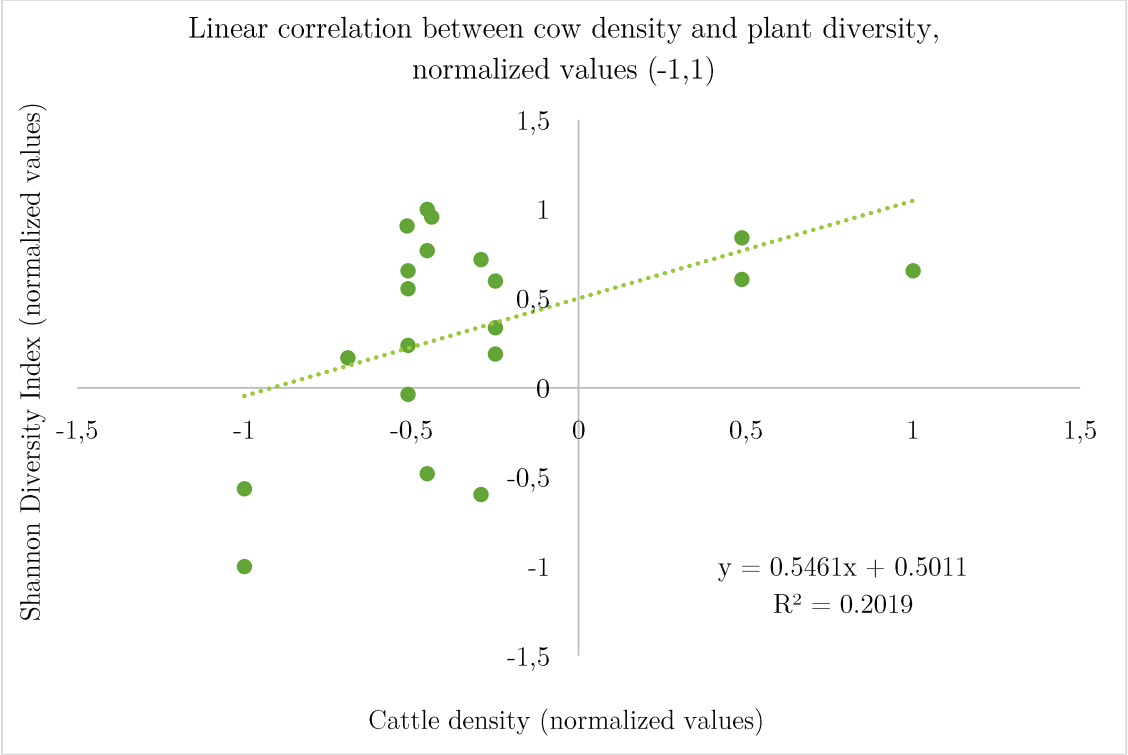

Figure 9: Linear correlation between cow density and plant diversity

The correlation coefficient Pearson's P between the variable "Cattle Density" and "Diversity Index" scores 0.450. This is a rather clear positive correlation as well as a significant result (p-value=0.047, n=20).

6.2.2 Other impacts of high-pasture dairy farming on biodiversity

Despite not being at the focus of the environmental analysis of this research there are other sources of impact connected to cattle pressure on pastures, such as cattle stepping and excreta. This is particularly visible around milking areas (Figure 14) and water troughs or in very frequented and narrow passages. Here, vegetal cover can be removed by hooves. Also, biodiversity can be altered by high concentration of nutrients, particularly nitrogen, from animal excreta, which allows proliferation of nitrophilous species such as the *Rumex Alpinus* (Figure15) over others that are more typical of nutrients-poor Alpine pasturelands.

Figure 10: Disrupted grassland in milking area in Alpe Devero

Figure 11: Rumex Alpinus surrounding an HPDF hut

Biodiversity can also be threatened by the construction of dirt roads for the access of farm vehicles to the pastures and farm huts, as well as from leveling the ground by the (milking) huts in order for farmers to work more conveniently.

6.2.3 Environmental Performance of Farms

According to the categories defined in Table 1, the environmental performance of HPDF was assessed for each measured plot, as in the following table.

Table 7: Environmental performance of farms from cattle density and plant diversity index

Corresponding Farm #	Plot #, Pasture name	Normalized Cattle Density Value	Normalized Diversity Index Value	Environmental Performance
No Farm	P1, Alpe Satta	Low	Low	Low-Negative
	P2, AlpeSatta	Low	Low	Low-Negative
Farm #1	P5, Alpe Buscagna	High	High	Positive
	P6, Alpe Buscagna	High	High	Positive
Farm #3	P10, Alpe Veglia (A) [2]	Low	High	Low-Positive
	P11, Alpe Veglia (A) [2]	Low	High	Low-Positive
Farm #4	P12, Alpe Veglia (B) [2]	Low	High	Low-Positive
Farm #5,	P16, Alpe Forno [1]	Low	Low	Low-Negative
Farm#6	P17, Alpe Forno	Low	High	Low-Positive
Farm #7	P3, Alpe Colbernas	Low	Low	Low-Negative
	P4, Alpe Colbernas	Low	High	Low-Positive
	P18, Alpe Fontane[2]	Low	High	Low-Positive
	P19, Alpe Fontane[2]	Low	High	Low-Positive
Farm #8	P7, Alpe Bondolero	Low	High	Low-Positive
Farm #9	P8, Alpe Veglia (C)[2]	High	High	Positive
Farm #11	P13, Pian Sass Mor	Low	High	Low-Positive
	P14, Pian Sass Mor	Low	High	Low-Positive
	P15, Pian du Scricc[1]	Low	Low	Low-Negative
Farm #12	P9, Alpe Veglia (C)	Low	High	Low-Positive
Farm #13	P20, Alpe Cheggio	Low	High	Low-Positive

[1] within 50 meters from fixed milking area

[2] continuative adoption of pasture management plan

The score of the overall environmental performance of each farm (i.e. the average of each plot's scores in case of more measured plots per farm), as defined in Table 2 (chapter 5.5) is ultimately reported in Table 7.

Table 8: Environmental performance score per farm

	Environmental Performance
Farm #1	+ 1
Farm #2	n.a.
Farm #3	0.5
Farm #4	0.5
Farm #5	0
Farm #6	0
Farm #7	0.25
Farm #8	0.5
Farm #9	+ 1
Farm #10	n.a.
Farm #11	0.17
Farm #12	0.5
Farm #13	0.5

6.2.4 Farmers' perception of HPDF environmental impact

Overall, all farmers shared the opinion that HPDF activities contribute to the conservation of the Alpine environment, by maintaining pasturelands clear of bushes and enriching the soil with cows' manure (n=17). Some stress also the indirect contribution that high-pasture dairy farming has on tourism by maintaining pasturelands (n=3).

> "*Grazing cows allow the pasture to keep being green. And this is beneficial also from the aesthetic point of view: everyone, especially tourists, enjoys a neat environment*"[15] (farmer, 29, Alpe Colbernas)

Many farmers also stress how in abandoned pastures, bushes have grown and took prevalence over herbaceous species (n=8).

> *"According to me the* [environmental] *impact* [of HPDF] *is good. Because I noticed that compared to 30 years ago, pastures have receded because they get invaded by rhododendrons. And this is because the pastures are not exploited as they used to be. Being reduced the overall number of cattle, the most inconvenient, dangerous and remote pastures have been abandoned. And this is*

[15] Translation from original interview: *"Le vacche che pascolano permettono al pascolo di tornare verde. E questo è bene anche a livello ottico. A un turista come a qualsiasi persona piace un ambiente pulito e curato."*

bad for the pasture because neglected areas are then difficult to recover"[16] (farmer, 49, Alpe Forno)

Two farmers do not deny that the "re-naturalization" of the Alpine environment would not necessarily be a negative phenomenon. However, they recognize in high-pasture dairy farming a cultural dimension that is characteristic of the Alpine environment and delineate it as an added value of the territory.

6.3 Economic dimension of high-pasture dairy farming

6.3.1 HPDF products

During summer months, milk is used to produce mainly ripened cheese and butter, which can be preserved for longer time, but fresh dairies are also produced (soft cheeses and yogurt). Production is still completely artisanal from raw (non-pasteurized) milk. The Bettelmatt is the most renown of Ossola's *alpage* cheeses, the French term for ripened cheeses produced only in summer months with milk by cows grazing in high mountain pasturelands, which is commonly adopted in international nomenclature (Grasseni, 2011; McMorran et al., 2015). Bettelmatt is a specific brand for *alpage* cheese produced only in certain areas of the Ossola, where pasturelands are characterized by particular biodiversity richness. Its notoriety dates back to the end of the XIX century (Calpini, 1880) and continues nowadays.

Figure 12: Alpage cheese production process: milk curd is put into molds and then pressed. In the background: just prepared soft cheeses. Author's photo

[16] Translation from original interview: *"l'impatto secondo me è buono perchè ho notato che rispetto a 30 anni fa il pascolo si è ritirato perchè viene invaso dai rododendri e questo è perchè il pascolo non viene iù sfruttato come lo era una volta. Riducendo il numero degli animali si è iniziato ad abbandonare le parti più scomode, più pericolose, più lontane. E questo male per il pascolo perchè quello che perdi poi è difficile recuperare."*

Figure 13: Ripening alpage cheeses. Author's photo

During winter instead, most of farms consign their milk to the local dairy cooperative, which transforms milk in place into a communal product.

6.3.2 Sales, revenues and economic satisfaction

With only one exception, all the farms included have a profit oriented business, which means that farmers base their livelihood on HPDF. Revenues of HPDF derive from milk and dairy products sales.

Most of the farmers sell their dairy products mainly on retail (n=10), to local people but also to tourists that visit the Ossola Protected Areas. In 7 cases, farmers also sell directly in high-mountain to tourists and excursionists. Some of the bigger farms sell their *alpage* cheese also to wholesalers (n=6). There two farms that flank farming activity with touristic and catering services, which absorb part of the production (n=2). Another selling channel that is becoming popular, reflecting a national trend, are Solidarity Purchase Groups, SPGs, which are groups of individuals who join to buy food and non-food consumer goods directly from the producers, on the basis of ecological and ethical principles (Grasseni, 2014).

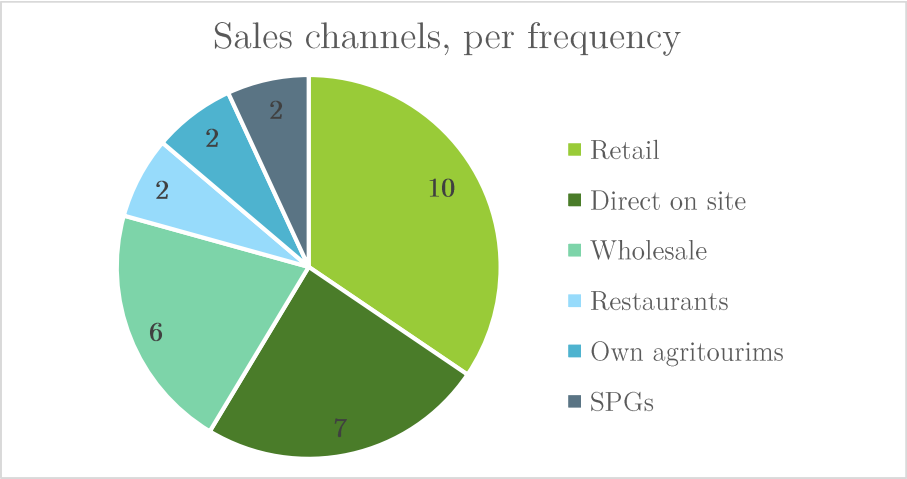

Figure 14: Retail channels for HPDF products, per frequency

Alpage cheese, which is the main product of HPDF is sold from 15 and 30 euros per kilo. Such price gap depends on the brand of the product, on the sales channel and on characteristics of the product such as aging. For the most renown *alpage* cheeses such as the Bettelmatt and, more recently, the Cheggio (an *alpage* cheese produced within the High Antrona Valley Natural Park) HPDF production is particularly profitable.

Farmers' income in some cases (n=7) is boosted by other side activities (see Table 10, Appendix 6). These include in half of the cases breeding of calves and pigs for meat production (n=5). Agritourism is also emerging because of tourists attracted to the Protected Areas, and represents for those farms that undertook it (n=2), a substantial side source of income.

Farms' revenues vary throughout the year and high-pasture dairy farming only represent a part of farms' activities. Farms' viability depends greatly on the winter season, when revenues are lower. Only two farms have a dairy in the lowlands which allows them to transform milk also during winter. Farms with dual-purposes cattle (n=3) shift in part or completely to veal farming and meat production during winter months. Most of the farms (n=8) instead consign their milk to the local dairy cooperative.

Out of the 8 farmers hat consign their milk to the local dairy cooperative, 6 lament that the paid price per liter is not enough to guarantee the economic viability of the farm.

> *"The price we receive for the milk [from the cooperative] is not sufficient, everyone is complaining about it. Actually the price is 35 cents per liter, but producing one liter of milk it costs almost 40 cents to us"*[17] (farmer, 49, Alpe Veglia)

Economic satisfaction increases with HPDF production, which is in fact sold at a much higher price, almost all farmers (n=10) are satisfied for. Nevertheless, overall economic satisfaction of farmers is lower than this data: only 7 farmers reported to be satisfied of their revenues.

Economic satisfaction is also undermined in three cases by the workload that corresponds to HPDF revenues. In fact, high-pasture dairy farming entails a working time going from dawn to night and in those pastures that do not have a road access permanence in the hut, often sometimes in isolation, from June to September.

[17] Translation from original interview: *"il prezzo che riceviamo noi per il latte non è sufficiente, si lamentano tutti del prezzo. Adesso sono 35 centesimi e viene a costarti già 40 produrlo"*

> *"You earn good money, but you do not have to take into account the number of working hours. If you do so, you might realize that you are working for one or two euros per hour"*[18] (farmer, 52, Pian du Scricc)

6.3.3 Economic performance of HPDF

Subsidies play an important role for the economic viability of HPDF. They mostly depend on European funding. Some are general subsidies, i.e. CAP direct support to agricultural production. Others, such as subsidies from the RDP, are specific contributions bound to the farming methods. These include sustainable management of pastures and safeguard of autochthonous breeds for agricultural purposes. Moreover, farmers in protected areas receive compensations for farming restrictions.

The entity of the economic support to HPDF depends on pastures' area and farms' dimension, and it is generally consistent. In fact, out of the 12 profit-oriented farm included in this research, one fourth of the owners depicted subsidies to be essential for the viability of the farm. In three cases, subsidies make the difference in the capacity of farms to invest in productive assets e.g. machineries or modernization of the dairy hut.

In four cases instead, farmers stated that their economic performance is good enough not to be dependent on external subsidies including for investment.

> *"I do not count on it. I mean it's good to have an extra revenue but it's not essential for the viability of my farm. One cannot have a farm and then depend on something else from the outside for your farm to survive"*[19] (farmer, 34, Alpe Forno)

The economic performance of farms has influence also on the employment of workforce. Most of the farms (n=11) employ mainly family members of the owner, often the partner, who do not receive a salary but is *de-facto* a co-owner of the farm. Others (n=4) effectively engage laborers instead of or in addition to family collaboration in the farm. Workers, who live almost for the entire season in high-mountain pastures sites, are provided with food and lodging in HPDF huts. In one case a farm owners figured out an ingenious way to face the need of workforce but the impossibility to pay for legal hiring: voluntary work in exchange of meals and hospitality on the basis of the WWOOF model[20].

On the basis of farmers interviews, the dependence on subsidies, the reported economic satisfaction of farmers and the capacity of investment have been defined as positive (+),

[18] Translation from original intervew: *"si guadagna bene però non devi contare le ore che lavori perché se no magari ti rendi conto che lavori per uno o due eruo l'ora"*

[19] Translation from original interview: *"...non è che ci faccio affidamento. È un qualcosa in più e va bene. Però uno non è che può fare un'aienda e poi dover contare sui sussidi per sopravvivere"*

[20] WWOOF: World-Wide Opportunities on Organic Farms. http://www.wwoof.it/en/

neutral (o) and negative (-). According to the scoring system describes in Table 3 (chapter 5.5) the economic performance of high-pasture dairy farms in the Ossola Protected Areas is reported as well in the table below.

Table 9: Economic performance of high-pasture dairy farms

	Economic satisfaction	Investment capacity	(In)dependence on subsidies	**Economic Performance**
Farm #1	+	o	o	**0**
Farm #2	-	-	-	**- 1**
Farm #3	o	-	-	**- 1**
Farm #4	o	o	-	**0**
Farm #5	+	+	+	**+1**
Farm #6	+	+	+	**+1**
Farm #7	+	+	+	**+1**
Farm #8	+	+	+	**+1**
Farm #9	+	o	o	**0**
Farm #10	-	-	-	**- 1**
Farm #11	o	o	o	**0**
Farm #12*	o	-	n.a.	**- 1**
Farm #13	+	o	o	**0**

*non-profit oriented farm, working on a subsistence base

In summary, the economic performance is rather diverse among all farms. Four farms perform positively, i.e. are profitable and economically strong, while as many perform negatively. These latter, would not be able to eventually continue their activities in lack of external economic support. The economic performance or the remaining five farms has eventually been assessed as neutral. The overall economic dimension of HPDF (i.e. the average of all farms' scores) has been quantified in 0, thus a non-positive and non-negative performance.

6.4 Social dimension of HPDF

6.4.1 Organization of farmers within the OPAs

Farmers are all associated to one of the two farmers' trade unions i.e. Coldiretti and the Italian Confederation of Farmers, CIA by the Italian abbreviation. These are associations that not only represent the farmer' category interests but also provides fiscal and regulatory assistance to farmers (Enzo Vesci, CIA; Bruno Baccaglio, Coldiretti; personal communication, June 2016). Farmers are represented in the OPAs' board by a spokesperson nominated by the two farmers' trade unions (Aree Protette dell'Ossola, 2016).

Overall, there is little cohesion among high-pasture dairy farmers within the Ossola Protected Areas. Despite some farmers live and work relatively close to each other, they are not joint together in any form of association. Only exception is the "Association of the Bettelmatt Producers", which gathers all eight farms entitled to the production of Bettelmatt[21], and includes farmers both within and outside the Ossola Protected Areas.

Farmers of the Ossola Protected Areas reported to meet occasionally during some promotional events organized by the OPAs to promote their own product, but also in these cases they present themselves as different realities and not as a close category.

All farmers also stated that there is little or no cooperation among each other. This, stressed more than one farmer (n=3), does not mean that help is not granted mutually among farmers, but that there is no cooperation on a consistent basis.

> *"I don't really deal with the others* [farmers]. *Of course in case they need help because of any mishaps, I help if I can. But that's about all"*[22] (farmer, 56, Alpe Veglia)

One case of partial cooperation is represented by two farmers bound by family ties who own two different farms but share the same high-pasture area. During high-pasture permanence therefore farming as well as diary production duties are shared. Nevertheless, they sell their share of product separately. Besides this example, collaboration among farmers is limited has not been registered during research.

Two of the oldest farmers highlighted that in the past there was a greater sense of community between farmers that lived in the same area. Collaboration consisted mainly in mutual work for the maintenance of pasturelands e.g. spreading manure on grasslands at the end of each summer season and canalizing water from the rivers in order for pastures to be naturally irrigated.

When talking about maintenance of pastures, these farmers made understand that pastureland was treated like a precious common good, inherited by older generations and whose productivity depended on collective work.

> *"It* [pastureland] *is not so neat as it used to be* [...] *and I regret seeing it like this. Once we all* [farmers] *used to gather one day of work together to spread*

[21] Alpage cheese can be named Bettelmatt only if produced according to a strict procedure and from milk of cows grazing exclusively in seven specific pastures (Bonadonna & Duglio, 2016), within and outside the Ossola Protected Areas.

[22] Translation from original interview: *"Non è che abbia molte relazioni con gli altri. Ovvio che se succede qualcosa e c'è bisogno una mano gliela do se posso, ma non è che facciamo cose assieme"*

manure on pastures. And it was nice, it was a day of feast"[23] *(farmer, 66, Alpe Veglia)*

6.4.2 Reasons for the abandonment of HPDF in the OPAs

Both farmers and the representative of farmers' trade unions were asked about the reasons behind the diminution in the number of people engaged in HPDF within the Ossola Protected Areas.

Abandonment of HPDF activities is due to mainly to the lack of generational change among farmers. Old people would stop their activity while younger generations would not carry on with high-pasture dairy farming.

Economic reasons are, as predictably, also a crucial issue for the abandonment of HPDF. With farmers facing significant practical and bureaucratic difficulties that limit profit margins. Another reason for the abandonment of high-pasture farming is the competition for space with the touristic sector. Particularly, competition occurs for buildings. Many former cowshed and buildings for dairy transformation were renovated into holiday houses or other touristic accommodation. It becomes thus difficult to farmers to establish in the area, as this statement from a farmer exemplifies.

> *"Farmers do not have spaces anymore. We cannot afford to buy or rent houses, we cannot compete with tourism. I have a house that was my father's, and that's why I could continue with the activity. There are houses that could be used by farmers, but prices are too high"*[24] (farmer, 56, Alpe Veglia)

The reduction rate in the number of farmers was not reflected although into a corresponding reduction in the number of cattle. In fact, remaining farms increased in size, thus determining an intensification of HPDF activities.

It is also true that in the last decades, subsidies to high-pasture farming have become more and more appealing, particularly to farms of big dimensions (the amount of the subsidy depends on the number of heads of cattle). This reinforced the competition for pastures even among farmers, particularly between local smaller farms and bigger farms originally from elsewhere.

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[23] Translation oform orifinal interview: *"non c'è più la pulizia che c'era una volta [...] e dispiace vederlo così. Poi una volta si organizzava una giornata in cui si lavorava tutti insieme a stendere il letame sui pascoli. Ed era bello, era un giorno di festa"*

24 Translation from original interview: *"Gli agricoltori non hanno più spazi. Non possiamo competere con il turismo. Io ho la casa che era di mio padre e quindi ho potuto continuare. Ci sono case che potrebero essere usate per agricoltura però coi prezzi che ci sono...!"*

6.4.3 Farmers' satisfaction

As reported in Table 9, farmers are generally very satisfied of their activity, evaluating their gratification with a score of 8/10 or higher (n=11). Satisfaction is often not related to the economic performance of the farm. Only in one case a farmer reported not to be fully satisfied of his activity due to the fact that the negative economic performance was jeopardizing his enjoyment in HPDF. No one reported to be dissatisfied from HPDF, thus assessing their satisfaction as 4/10 or lower.

According to the scoring system for the social performance based on the reported satisfaction of farmers in HPDF (Table 4, chapter 5.5), which is used as indicator for farmers' quality of life, the social performance of high-pasture dairy farms in the OPAs scores as in the following table, reporting a good overall performance.

Table 10: Reported satisfaction on farming activities, social performance of HPDF

	Reported Satisfaction
Farm #1	1
Farm #2	1
Farm #3	0
Farm #4	1
Farm #5	1
Farm #6	1
Farm #7	1
Farm #8	1
Farm #9	1
Farm #10	1
Farm #11	0
Farm #12*	1
Farm #13	1

*non-profit oriented farm

The term "passion" has been very often used by farmers when asked about their satisfaction (n=7). Some farmers (n=3) stated that they couldn't think about doing a different job. Others, who have worked in different fields affirmed they would not go back to the previous jobs (n=3).

Satisfaction of farmers is mostly related to the fact of working in a high mountain environment during the summer months (n=5), to the love for their cattle (n=4) and for the gratification of producing their own product (n=3); three farmers also reported a sense of freedom provided by HPDF activities. Family ties are also a very important aspect in some

farmers' (n=3) evaluation of their activity, as continuation of a family tradition that goes beyond the economic aspect.

> *"I would love that my children would continue with this activity. I made this [family] farm grow and it would be a pity if the family tradition would not continue. Also because all the efforts and passion I put into it could not be recognized on the economic point of view if I sold the farm"*[25] (farmer, 52, Alpe Forno)

On the contrary, farmers' satisfaction appears to be undermined by the long working hours (n=4), the lack of infrastructures (n=3), bureaucracy (n=2), and the growing competition among farmers (n=2), particularly with people coming from elsewhere attracted to the economic benefits of HPDF.

6.5 Protected Areas and high-pasture dairy farming

6.5.1 Impact of OPAs activities on high-pasture dairy farming

The Ossola Protected Areas do not impose particular regulation on grazing activities. According to the pastures' management plan defined in the framework of the LIFE Project, the OPAs have encouraged fenced grazing, i.e. that sections of pastures would be delimitated by fences. (Scalabrini, et al., 2003). Fenced grazing was not imposed, but promoted by subsidies in terms of materials for fences and economic incentives to farmers who would adopt it.

Of the 13 interviewed farmers, almost all (n=9) said that they embraced fenced grazing, also because of the benefits it provided. However, at the end of the project, when funding for fenced grazing were not distributed anymore, five of these farmers stopped fencing their pastures because of the additional amount of work it implied, which was not remunerated. Four farmers instead continued, recognizing a value in fenced grazing both for the maintenance of the pasture and for milk production.

> *"I didn't like it* [fenced grazing] *at the beginning, but then I got convinced* [...] *Cows eat better the pasture, they consume less energy in walking around, and it's good to know that they improve the pasture. If they would be free they*

[25] Translation from original interview: *"mi piacerebbe che i miei figli continuassero l'attività. Anche perché questa azienda è stata fatta crescere con passione e sarebbe un peccato se poi un domani [questa tradizione famigliare] non avesse seguito. Perché il lavoro che c'è dietro non riuscirebbe ad essere riconosciuto dal punto di vista economico se vendessi l'azienda"*

would eat all the best grass the first days and then would be left only with unpalatable grass"[26] (farmer, 45, Alpe Veglia)

As part of the biodiversity conservation policy, the OPAs actively support HPDF. The OPAs recognize in HPDF an essential element for the maintenance of human-modified ecosystem, and the ecological importance of these latter. Many are the OPAs' actions that directly and indirectly support HPDF.

Particularly, in three cases farmers live and work in huts owned by the OPAs. The Ossola Protected Areas take care of these huts in order that they are fully equipped and respect hygiene standards for dairy production, and have access to water connection and treatment system and with electricity (I. De Negri, personal communication, June 2016).

The OPAs' activities include maintenance of trails and roads (I. De Negri, personal communication, June 2016). This on the one hand directly benefits pastures accessibility to farmers. On the other, it favors the accessibility to excursionists, and this might as well indirectly benefit HPDF.

The OPAs are also actively working to tackle and reverse the abandonment of pastures. Particularly, in Alpe Satta (the "pasture zero" of this research, see chapter 5.4 and 6.2.1) the OPAs have completely renewed and equipped an abandoned hut in order to attract farmers to an abandoned pasture. However, by the time of the research this pasture was not utilized for HPDF. In fact, according to the OPAs' Director (personal communication, June 2016) farmers who expressed interest in working in the area eventually renounced due to lack of road access to the pasture.

As part of the OPAs' strategy for the advancement of the territory, there is the touristic promotion of the territory, and of local products, including high-pasture dairies (I. De Negri, personal communication, June 2016). Enhancing tourism marketing, the OPAs also indirectly increase the potential market basin for farmers' HPDF products retails.

It is thus clear that the OPAs do support HPDF. It is therefore important to understand whether these operations are coherent with other conservation-aimed actions. Particularly as it concerns the protection of megafauna.

At present, deers commonly frequent high-mountain pastures. They generally do not interfere with farming activities, even though two exceptions were reported during interviews with farmers. The presence of predators instead, principally wolves, is not so important within the OPAs at the moment and does not concerns farmers (n=13). Moreover, cattle are less vulnerable to predators than for instance goats or sheep. Wild boars affect

[26] Translation from original interview: *"All'inizio non mi piaceva, poi mi sono convinta [...] Le mucche mangiano meglio il pascolo, sprecano meno energia a camminare in giro, e poi è bello sapere che migliorano il pascolo. Se fossero libero i primi giorni mangerebbero tutta l'erba più buona e rimarrebbere solo quella inappetibile"*

most greatly farming activities because of their disruptive effect on land. Their presence does not concern the OPAs but some farmers (n=5) fear that conservation policies might be very detrimental in case of their arrival, particularly in Alpe Veglia.

> *"Now there are many more* [deers] *than once. Sometimes they make some damage to the fences but it's not a big deal. Wolves did not arrive here yet, but if they will settle here, well... I don't know what is going to be like. For sure it will be a problem for those who have the goats here.* [...] *the real problem are wild boars because they turn the land upside down. Now they arrived at lower altitudes, and people can kill them, but if they will arrive here in the* Park [the OPAs], *it will be a proliferation!"*[27] (farmer, 56, Alpe Veglia)

Overall, the OPAs are supporting HPDF directly and indirectly while conservation actions do not interfere with farming activities. The director of the Ossola Protected Areas though stressed during interview (June 2016) that the OPAs are experiencing a severe reduction of budget and staff, which could lead to a limited capacity to continue supporting HPDF in the future.

6.5.2 A Park's products brand to enhance conservation and livelihoods?

During interview the Director of the OPAs revealed that the Protected Areas are currently working at a regional project on the development of a Park Brands to support productions from Piedmonts' protected area. The idea of an OPAs' products' brand follows a national and international trend (Naviglio, 2011). Such branding scheme would consist not only in a certification of origin, but also a proof that a certain product is produced according to natural methods which also play a role in environmental conservation (I. De Negri, personal communication, June 2016).

The expectancy is that a "Product of the Park" brand could be an instrument to persuade producers to adopt producing techniques that actively contribute to environmental (including biodiversity) conservation. At the same time the brand aims to become a marketing instrument that attracts a growing niche of customers who are attracted by natural, local and traditional products.

When expressing their opinion of the possibility of developing a "Product of the Park" brand, some farmers (n=6) recognized that it could have a positive impact on their activity. Three of them already promote their products as produced in the Ossola Protected Areas.

[27] Translation from original interview: *"Adesso ce ne sono* [cervidi] *molti più che una volta. A volte fanno qualche danno, tirano giù un recinto, ma non è un porblema. Il lupo non è ancora arrivato qui, però se diventa stanziale...non so cosa potrebbe succedere. Di sicuro sarebbe un problema per quelli che hanno le capre. [...] il problema vero è il cinghiale, perché rivoltano il terreno. Adesso sono già arrivati in basso, se arriveranno anche in Veglia dove non potrenno essere cacciati, diventerà un vivaio!"*

These farmers are aware that a label that links their product to the protected area could differentiate their product from others, and that it might attract (gastronomic) tourism.

The idea of a Park's products brand however, arouses some concern among farmers in terms of bureaucratic implications (n=4). Also, two farmers said themselves not to be willing to change their farming methods in order to adopt the brands' label.

> "[the Park's products brand] *would of course be something more* [to promote the product]. *But I should really consider what it would entail from the production point view. We already respect the environment and if we should modify the way we work then I don't agree with it."*[28] (farmer, 34, Alpe Forno)

In one case, a farmer disagreed with the idea of a Park's product brand. His major concern was that a common label would equate all different products from different farmers of the OPAs and this would create confusion among consumers be detrimental in the long run.

Overall, the idea for a Park's product brand promoted by the Ossola Protected Areas seems to be appealing to farmers for enhancing HPDF socio-economic outcome. Nevertheless, some pitfalls have been highlighted, which could make the brand not be adopted by farmers.

6.5.3 Farmers' perception of and involvement in OPAs' activities

A good share of the interviewed farmers recognized the direct and indirect benefits (Figure 14) that being located within the protected areas entails for their activity (n=7). The most reported benefit is connected to the OPAs' touristic appeal that boosts farms' sales (n=5), particularly for those farmers who have a retail point direct on site. The contribution of the OPAs to the maintenance of buildings and farming equipment has also been reported by four farmers. Others stressed on the active promotion products from within the Park, e.g. on the website or during specific fairs (n=2), the maintenance of roads and trails (n=2), the support to fenced grazing with subsidies and equipment (n=2) and the limitation of the expansion of mass tourism (n=2).

[28] Translation from original interview: *"Sicuramente sarebe una cosa in più, poi bisogna considerare bene di cosa si tratta, anche dal punto di vista della produzione. Noi lo rispettiamo già l'ambinete, se c'è da cmbiare la nostra produzione allora no."*

> *"You see that*? [pointing at an under-construction big touristic complex] *If it wouldn't be for the Park, they would have built here as well. And we* [farmers] *should have left."*[29] (farmer, 49, Alpe Veglia)

No farmer recognized in the OPAs an obstacle to HPDF activities. However, some limitations due to the fact of being in the protected areas have been highlighted (Figure 15). First of all, the lack of road access to pasturelands represents for three farmers a remarkable impediment to their activity (n=3). Other negative aspect that farmers tie to the fact of being located within the OPAs are the excessive presence of tourism, the increasing competition for subsidies and excessive bureaucratic procedure, all being reported twice in the interviews.

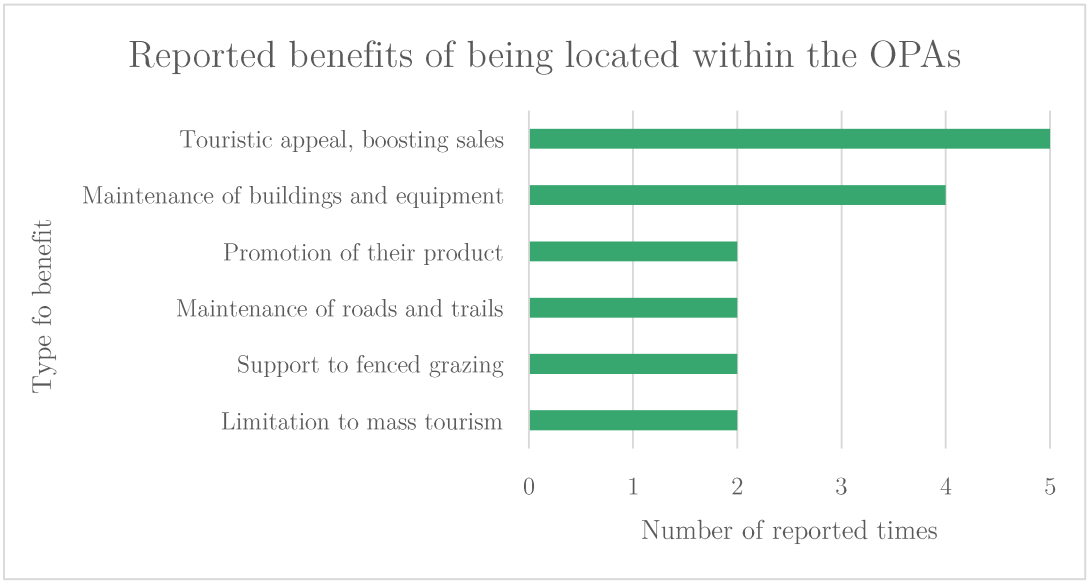

Figure 15: Benefits to HPDF of being located within a protected area, according to farmers

[29] Translation from original interview: *"Lo vedi quello? Se non fosse stato per il Parco quelli avrebber costruito qui. E noi ce ne saremmo dovuti andare"*

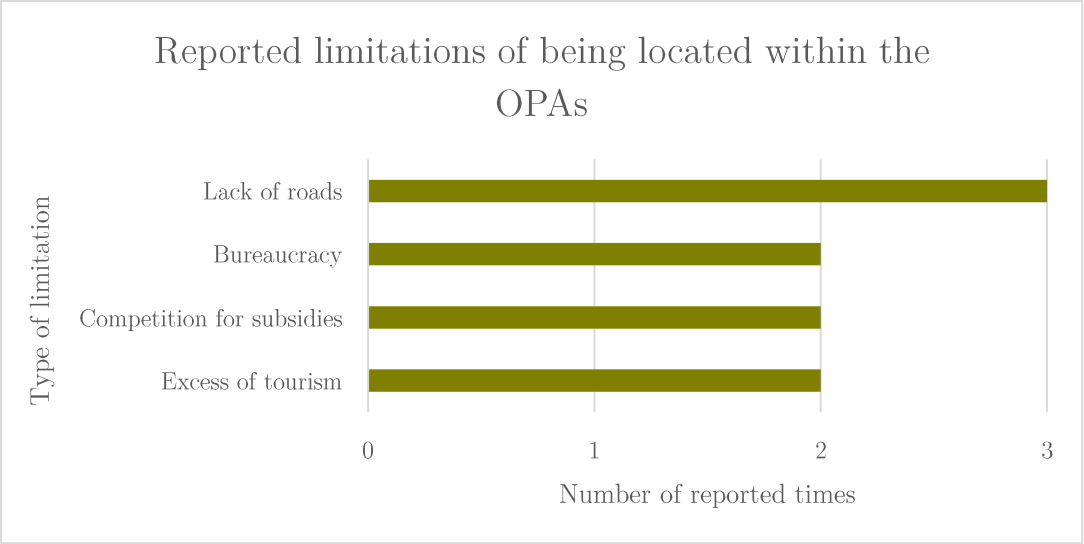

Figure 16: Limitations to HPDF of being located within a protected area, according to farmers

As it concerns conservation efforts, farmers are mostly aware only of the regulations to HPDF which directly involved them. Almost all farmers recognize the importance that a pristine environment (including a biodiversity-rich pasture) has on their final products (n=11). Some farmers (n=3) even use the fact of being within the OPAs as a marketing strategy, which implies that this is considered an added value. Nevertheless, not everyone comprehends the importance the OPAs give to biodiversity conservation strategies (n=6).

> *"There has always been biodiversity here, and cows have always been grazing everywhere. So sometimes it makes me laughs when they* [the OPAs] *say that we have to fence the bogs to prevent the cows to go in. Because cows have always drunk in there. I will do it, but I cannot give an explanation to this"*[30] (farmer, 29, Alpe Colbernas)

The case of fenced grazing is a good example of that. Many farmers participated in the initial implementation of the pastures' management plan. However, after a few years when this was not subsidized, almost all farmers stopped fencing pastures: they did not see the reason for additional work if they did not receive any contribution for it.

Overall relations between the OPAs and the farmers are good (Figure 25, Annex 6) and six farmers define their relation with the OPAs as collaborative[31] and one as synergic[32]. No

[30] Translation from original interview: *"La biodiversità c'è sempre stata qui. E le mucche hanno sempre pascolato qui. Quindi a volte mi viene da sorridere quando dicono che dobbiamo recintare le torbiere per non farci andare dentro le mucche. Perché le mucche ci hanno sempre bevuto lì. Per carità lo faccio, però non mi do una spiegazione logica"*

[31] According to the definition adopted during interviews: it is almost always possible to come to accordance and pursue common stakes

[32] According to the definition adopted during interviews: there are very good relations and strict collaboration to reach mutual stakes

conflict was identified during research, with the exception of one farmer who is struggling with the parks to improve the access to his pasture. However, there is little interaction between the protected areas and farmers. Moreover, in many cases (n=7) collaboration is seen by farmers as unidirectional. It is very meaningful this statement of a farmer who was asked to specify his answer about the collaborative relation between farmers and protected areas:

> *"We always try to collaborate. Certainly, in the last years the Park has much less funds, and therefore it doesn't comply with tasks it used to do. There is much to be done, but the Park does much fewer interventions. Sometimes we have accessibility problems with the road that runs to the pasture and we need to intervene directly to fix it."*[33] (farmer, 34, Alpe Forno)

Synergies between farmers and the OPAs, have been reported in one case at individual scale. It is the case of a farmer's family who, in lack of an own hut, was granted the possibility to use the OPAs' guest house and information center. In exchange, the farmer's partner (who is also an environmental and tourist guide) assures that the OPAs' information center remains open. This way, the OPA's are able to grant a service to visitors that would otherwise be limited by a lack of staff. At the same time the farm got accommodation and a retail point, next to the information center.

At last, as it concerns farmers' direct involvement in OPAs' initiatives and decision making, this is very limited. The fact that farmers are not (n=4) or little aware (n=9) of the OPAs' activity is symptomatic of that. A more concrete example consists in the process of definition and adoption of the pastures' management plan. In fact, this was not initially discussed with farmers, but it was presented to them once defined by a scientific commission.

Overall, the management model of the Ossola Protected Areas, despite farmers are formally represented in the board, appears to be little participative and not inclusive (Quick & Feldman, 2011).

[33] Translation from original interview: *"si cerca sempre di collaborare, è ovvio che ultimamente avendo meno disponibilità il parco in termini di fondi, viene un po' meno in cose che potrebbe fare secondo me, proprio materialmente all interno de parco. Interventi che fa li fa molto meno. A volta abbiamo problemi di viabilità all'interno del parco e dobbiamo intervenire noi direttamente mentre una volta lo faceva subito il parco"*

Chapter 7: Discussion

7.1 Limitations of the research and sources of bias

This research underwent some limitations both in terms of methodology and in terms of gathering of data. As it concerns the first point, since the research sample included only farmers at the head of farms, it is possible that data collected from interviews do not reflect the point of view of all people working in high-pasture dairy farming, particularly those in a subordinate position. This might be relevant for data concerning the socio-economic dimension of HPDF and particularly on the rate of satisfaction among farmers. However, it is considered that this was not a limitation to the analysis of the relation with protected areas regime and to an even lesser extent to the environmental analysis.

For the same reason, the research sample suffers from a considerable gender bias, despite women being effectively active in high-pasture dairy farming. Nevertheless, neither this bias was expected to represent a major limitation to the research outcome.

Also the environmental analysis might have been suffering from some bias due to involuntary measurement error. As it concerns the count of pastures' biodiversity, this has been carried out in the most scrupulous way according to the guidelines provided by an agronomist who has experience in biodiversity count of pastures in the same area. However, not having a background in botany and any previous experience in biodiversity measurements, might have been cause of error. At last, there could be some error in the calculation of the net pasture area from the interpretation of aerial photographs of pastures by the agronomists working in the farmers' trade unions.

The presence of these errors yet, is stable because the method used in counting biodiversity and in photointerpretation is consistent throughout all measurements. For this reason, such errors are not considered to represent a major limitation for the overall environmental analysis.

At last, the values attributed in the integration phase to the different dimension of sustainability of HPDF are arbitrary. Therefore, attributing different weights to the single values or different ranges of values to the different dimensions could modify the final outcome.

Despite these pitfalls, this research represents an in-depth, interdisciplinary research embracing almost all cases of HPDF in the Protected Area. It provides therefore a good representativeness of the context. The results of this research therefore could be thus taken into consideration in similar contexts of HPDF in protected areas. Moreover, the insights

that this research provides on farmers' perspectives and their relation with the Protected Areas Management Authority could be useful for the OPAs in view of present and future initiatives concerning HPDF.

7.2 Considerations on the environmental dimension of HPDF

According to the score of farms (Table 7, chapter 6.2.2) the overall environmental performance of HPDF scores 0.5. This value, which is included in a range going from -1 to +1 shows that cattle pressure on high-mountain pastures has, as a whole, a rather good impact. This result is in line with previous studies on the environmental impact of HPDF on grasslands' plant biodiversity (Avondo et al., 2013; Metera et al., 2010), and with the OPAs' rationale for supporting HPDF (I. De Negri, personal communication, June 2016).

It is important to stress however that both abandoned areas of pastures and areas that bare a constant strong pressure of cattle present a lower plant diversity. This result, in line with the pasture management plan adopted by the OPAs (Scalabrini et al., 2003), suggests how both abandonment and intensification of HPDF activities can be detrimental for pastures' biodiversity. Considering that both abandonment and intensification are ongoing phenomena, a solid plan for the preservation of Alpine grasslands' biodiversity should take into consideration this fact and address these phenomena. From this research emerged that the OPAs are working in this sense, mainly by limiting or reversing the abandonment of pastures. It did not appear instead any measure to limit or manage intensification of HPDF.

In conclusion, the result of the environmental analysis of this case study shows that when it is adequately managed, a land sharing approach to biodiversity conservation can be successful. Very importantly, in some cases land sharing can even be necessary for the conservation of habitats whose existence is linked to centuries-old human activities.

7.3 Economic performance, intensification and abandonment of HPDF

Overall economic performance of the farms that were included in this research cannot be defined neither bright nor bad. In fact, the average of all economic performance of farms (Table 8, chapter 6.3.3) scores exactly 0 out of a range from -1 to +1.

The four farmers that perform the best from the economic point of view are the youngest, only one farmer being older than 40, and with a higher education level. Three of these four are produce Bettelmatt, confirming the economic importance that such product has in the sector (Bonadonna & Duglio, 2016). In two cases farms adopted expedients not to be dependent from single one source of income. These consist in diversifying production (both dairies and meat, including shifting to dual-purposes cattle breeds) and selling channels and undertaking agritouristic activities. It is not so surprising that such expedients have

been adopted by younger and better educated farmers, who might be more keen to novelties. At last, it is important to notice that these are all farms of big dimensions.

On the contrary, the four farms that are the least economically viable, belong to older farmers, only one of whom completed secondary education. Three of these farms are not engaged in any other income generating activity. These are also smaller farms.

The fact that economic performance is linked to farms' dimension and farmers' age, raises some considerations about future trends of abandonment and intensification of HPDF. Being bigger farms more economically performant, it seems that intensification of HPDF is economically rewarding. At the same time, HPDF abandonment is likely to continue, like in past trends (e.g. Penati et al., 2011), in the case that older farmers will eventually stop with their (little economically viable) farming activities and that their farm will not be taken over.

Overall, the economic dimension of HPDF seems to be tightly linked to intensification and abandonment of farming activities. Future scenarios of HPDF in the OPAs will then depend on both the environmental performance of farms and on external subsidies to farming activities in high-mountain and in protected areas. These latter would on the one hand allow economically weak farms to continue to break even and on the other attract potential newcomers.

7.4 Farmers' quality of life and economic outcome

Chapter 6.4.3 shows that almost all farmers report a high satisfaction in HPDF activities. Indeed, within the range of the sustainability indicator, the social dimension scores 0.85. Such a high value contrasts with the economic performance score, which is the lowest in the three dimensions of the sustainability of HPDF.

Comparing economic and social performance scores of the single farms (Tables 8 and 9) it is possible to notice that reported satisfaction is not linked to economic performance of farms, i.e. the satisfaction that HPDF provide to farmers is greater than its economic pitfalls. Even in three of the four cases where the economic performance was assessed as negative, farmers reported a high level of satisfaction.

This result is in line with theories that challenge the traditional economic doctrine stating that to higher income corresponds higher satisfaction (Bruni & Porta, 2005). Nevertheless, it is necessary to focus on the negative economic viability of some farm, which would not be able to continue their activities without external economic support, as stressed in chapter 6.3.3. Such negative economic performance, is cause of reflection on whether a future reduction or lack of external support to HPDF would not cause farms to stop their activities. Consequently, farmers would lose their source of satisfaction and their quality of life would be likely to drop. For this reason, the economic dimension of farms does have

an impact on the social dimension of HPDF, although in an indirect way and only up to a certain extent. After all, as reported in chapter 3, quality of life depends both on non-economic and economic variables (Layard, 2005).

7.5 The intricate relationship between HPDF and tourism in the OPAs

Throughout this thesis, tourism emerged several times as a key element. The Ossola Protected Areas have a remarkable touristic attraction and this has an impact on high-pasture dairy farms that are active within them.

The most evident positive impact of tourism on HPDF is on revenues. In fact, direct retail of dairies to tourists and excursionists represent a relevant share of farms' income, as highlighted in chapter 6.3.2. Also, agritouristic activities represent a profitable side activity for farms. HPDF also has a positive impact on the touristic sector, attracting gastronomic tourists particularly for the most renown *alpage* cheeses (Bonadonna & Duglio, 2016).

Despite positive these interrelations between HPDF and tourism, it was reported during research that tourism entails also downsides for HPDF. The first problem is that tourism competes for space with HPDF. Limitations in constructions imposed by the OPAs in fact creates a sort of contention for mountain huts between vacation housing and HPDF purposes. Also, some farmers consider mass tourism an annoyance (Table 13).

The role that the OPAs play with regard to this relation is mainly to promote tourism within the protected areas. Nevertheless, OPAs environmental regulations limit an excessive growth of massive tourism in favor of a smaller scale and more conscious type of tourism. Overall, the promotion of such kind of tourism in the OPAs can be an asset for HPDF, enhancing revenues and minimizing the downsides that tourism was reported to have on HPDF.

7.6 Social capital, participation and conservation of Alpine biodiversity

The fact that there is little or no cohesion among farmers can get implications also on what concerns the management of pastures.

Pasture areas are rented out to farmers from the municipal authorities and are not considered (anymore) as a common resource whose maintenance is entrusted communally to the people who base their livelihood on it (chapter 2.1).

Conservation of pasturelands is delegated to the OPAs management authority, but two shortcomings could be pinpointed in this respect. First of all, there is an overlapping of

authorities: the municipality, which owns the land and gives it to farmers, and the OPAs, which are entrusted to the conservation of grassland environments. This situation reduces the OPAs power to make sure that farmers comply to maintenance duties and do not overexploit pastures, and this fact is also clear to farmers (see end of chapter 4.2).

The OPAs capacity in ensuring conservation of pasturelands is also undermined by its little participative management model. Literature indeed suggests that in order for conservation policies to be effective and to overcome potential conflicts between conservation strategies and local livelihoods, involvement and participation of the people who live in and/or base their livelihood on the protected areas is indispensable (Brandon et al., 2005; Sayer et al., 2013). Similarly, the IUCN guidelines, stress on involvement of local communities for effective management of category V protected areas (Phillips, 2002).

The facts that people do not perceive the conservation of the natural environment as an issue concerning them as a collectivity and that they are not involved in the development and implementation of conservation strategies, represent noteworthy (potential) weaknesses in the Protected Areas' conservation plan.

7.7 Trade-offs and synergies between OPAs' objectives and farmers' interests

The positive impact that cattle grazing has on pastures' biodiversity (chapter 6.2.1) constitutes the main rationale beyond the remarkable support that the OPAs grant to HPDF activities (chapter 6.5.1). The OPAs deliberately pursue farmers' interests in order to avoid the abandonment of HPDF, which would have negative consequences in terms of loss of grasslands' biodiversity and eventually of transition of the habitat into forest. As reported in other case studies (Liebrand et al., 2012), farmers are aware of their importance and stress to keep their image of environmental stewards clear (chapter 6.2.3).

Nevertheless, the results of this research are in line with other studies that affirm that if grazing is not regulated it can have a negative impact on pastures (Galvánek & Janák, 2008; Metera et al., 2010). Regulation is particularly necessary in view of current and future intensification of HPDF, as discussed previously in this chapter. However, regulation of farming activities often does not correspond to the interests of farmers, who see their amount of work increasing. Similarly, environmental limitations (e.g. for constructions) imposed by the OPAs in some cases clash with farmers' interests.

Overall there is an important synergy between the OPAs' aim to preserve Alpine grasslands' biodiversity and farmers interest in supporting HPDF. This synergy however loses strength when measures for the preservation of biodiversity from supporting HPDF. This however does not always happen and the results of this research show that in some cases

farmers embrace the rationale beyond conservation measures, and appreciate their value (chapter 6.5.1).

7.8 The future of HPDF in the OPAs

The assessment of the socio-economic dimension of HPDF highlighted that the economic performance of farms is the most critical aspect for the future of farming and the one that benefitted the most (directly and indirectly) from the OPAs. However, interviews' results show that the OPAs are facing a considerable reduction in resources, which could undermine their capacity to support farms.

In view that (controlled) HPDF will continue being considered by the OPAs an asset for the conservation of Alpine grasslands' biodiversity, it will be necessary that the OPAs identify and adopt less resource-demanding strategies to support HPDF.

Future initiatives will not only need to go in support of the economic outcome of farms, but they will also likely need to promote adequate farming methods in order to address both HPDF abandonment and intensification. To face OPAs' reduced means, such initiatives will need to support HPDF by enhancing farmers' revenues instead of subsidizing farming activities. The creation of a "brand of the Park" label of environmentally responsible products hailing from within the protected areas could go in this direction.

Regardless of what kind of activity the OPAs will undertake to promote sustainable HPDF, in order to be effective it will need to be embraced by farmers. It is essential therefore that farmers are involved in the process of ideation and implementation of any initiative concerning them. This is particularly important for farmers that showed being most reluctant to accept environmental regulation. The risk is otherwise that farmers will not collaborate with the OPAs initiatives if they will not see a direct advantage, as it happened in the past (chapter 6.5.3).

Chapter 8: Conclusion

The objective of this thesis was to investigate whether high-pasture dairy farming carried out in protected areas of the Ossola could constitute the basis of a sustainable livelihood. To do so, the environmental impact of HPDF on pastures' biodiversity, the economic outcome of farms and the quality of life of farmers were assessed. Moreover, it was analyzed the influence that the protected areas have on HPDF activities and sustainability performance.

High-pasture dairy farming in the Ossola Protected Areas was assessed as a fairly sustainable livelihood. The overall sustainability performance of HPDF in the OPAs was evaluated with a score of 0.41 within a range going from a minimum negative value of -1 to a maximum positive value of +1.

On the whole, HPDF has a positive impact of Alpine pastures' biodiversity. Not only in fact humans shaped Alpine grasslands habitats (also) for animal farming purposes, but also the conservation of such habitats depends on animal grazing, which avoid the advance of the forest, and maintain herbaceous plants diversity. Nevertheless, an excessive animal pressure could have the opposite impact of and be detrimental to Alpine pastures biodiversity. For this reason, it is necessary to manage adequately HPDF in order to maximize its positive environmental impact.

From the socio-economic point of view, HPDF has a more multifaceted outcome. While on the one hand it is related to high satisfaction of farmers, its economic performance is less good. Many farms are effectively profitable or at least self-sustaining due to good sales of their dairy production and in some cases other side activities. However, almost one third of the farms reported to need support of subsidies to carry on.

Farmers adopt in some cases particular stratagems to enhance their livelihoods (e.g. innovative recruit of workforce and diversification of production). However, contrarily to what expected, no collective action finalized to enhance farmers' livelihood was detected. This is symptomatic of the little cohesion that exists among farmers.

HPDF represents an asset for the OPAs strategy of conservation of Alpine grasslands' biodiversity. For this reason, the protected areas policies pay much emphasis on supporting farmers' livelihoods in order to avoid abandonment of HPDF. Farmers recognize the benefits that being in the OPAs entail for them. However, when it comes to regulation of grazing, not all farmers appreciate the OPAs' policies and are less likely to accept regulatory measures if they are not compensated economically.

Overall, the park is very much supportive to the economic outcome of HPDF both in a direct indirect way and this is a key point in the sustainability of many farms whose economic performance is rather weak.

To conclude, when adequately managed, high-pasture dairy farming in protected areas can be considered a sustainable livelihood. Indeed, it contributes to the conservation of Alpine pastures' biodiversity and provide a satisfactory quality of life to farmers engaged in it, despite its economic outcome is not always satisfactory. The Ossola Protected Areas play an important role in supporting this latter dimension of HPDF but also in incentivizing adequate management of farming activities in order to improve the environmental impact. Such role makes the OPAs a catalyst for the sustainability of high-pasture dairy farming.

Chapter 9: Policy Recommendations

In order to maximize the sustainability performance of HPDF and to enhance the synergies between biodiversity conservation and enhancement of livelihoods based on high-pasture dairy farming, the following recommendations directed to the Ossola Protected Areas are suggested.

1) For a more effective control of environmental regulations concerning farming activities on pastures, avoid juxtaposition between municipal authorities which owns pasturelands and that set regulations that farmers have to respect during farming activities and the Protected Areas who are entrusted for monitoring for the respect of such policies.
2) Enhance involvement of farmers in the decision making processes of the Ossola Protected Areas: Involvement needs to be effective and go beyond the current formal representation of farmers in the OPAs' board. This could be a first step to increase participation of farmers in the OPAs' actions for conservation of Alpine habitats.
3) Think about innovative ways to support HPDF that take in consideration future reduced budget of the OPAs. Among these strategies could be the improvement of the synergies between tourism and HPDF, for instance promoting forms of tourism that combine hiking with rural experience of HPDF.
4) The development of the "product of the Park" brand could be included in the before mentioned strategies. It is suggested though that the OPAs take into consideration the shortcomings that have been highlighted by farmers and reported in chapter 6.5.2 in order to maximize the potential benefits of this instrument.

References

Adams, W. M., Aveling, R., Brockington, D., Dickson, B., Elliott, J., Roe, D., … Wolmer, W. (2015). Biodiversity Conservation and the Eradication of Poverty. *Science (New York, N.Y.)*, *306*(5699), 1146–1149.

Agrawal, A. (2003). Sustainable Governance of Common-Pool Resources: Context, Methods, and Politics. *Annual Review of Anthropology*, *32*(1), 243–262. http://doi.org/10.1146/annurev.anthro.32.061002.093112

Alpine Convention. (1991). Framework Convention. Salzburg. Retrieved from http://www.alpconv.org/en/convention/framework/Documents/Framework_en.pdf

Altieri, M. A., & Toledo, V. M. (2011). The agroecological revolution in Latin America: rescuing nature, ensuring food sovereignty and empowering peasants.

Aree Protette dell'Ossola. Delibera di Consiglio Direttivo n° 1 del 30.01.2016 "Insediamento del Presidente e del Consiglio Direttivo" (2016). Varzo. Retrieved from http://www.areeprotetteossola.it/it/organizzazione/organi-di-indirizzo-politico-amministrativo/item/download/777_5b502fd3a782a8d72f32aba55f92db70

Areeprotetteossola.it. (n.d.). Parco Naturale Veglia e Devero. Il Parco. Retrieved February 19, 2016, from http://www.areeprotetteossola.it/it/parco-naturale-veglia-e-devero/presentazione/il-parco

Avondo, M., Secchiari, P., Battaglini, L. M., Bonanno, A., & Pulina, G. (2013). Soil, pasture and animal product quality. *Italian Journal of Agronomy*, *8*(3), 19. http://doi.org/10.4081/ija.2013.e19

Barbaglia, D., Cresta, R., & Monti, C. (2009). *Alpi, alpigiani e formaggi: dal Mottarone alla Formazza*. Verbania: Alberti Libraio.

Bonadonna, A., & Duglio, S. (2016). A Mountain Niche Production: The Case of Bettelmatt Cheese in the Antigorio and Formazza Valleys (Piedmont - Italy). *Food Safety Management2*, *17*(150), 80–86.

Brandon, K., Gorenflo, L. J., Rodrigues, A. S. L., & Waller, R. W. (2005). Reconciling biodiversity conservation, people, protected areas, and agricultural suitability in Mexico. *World Development*, *33*(9 SPEC. ISS.), 1403–1418. http://doi.org/10.1016/j.worlddev.2004.10.005

Brundtland, G. H. (1985). World Commission on environment and development. *Environmental Policy and Law*, *14*(1), 26–30.

Bruni, L., & Porta, P. L. (2005). *Economics and Happiness. Framing the Analysis*. New York: Oxford University Press.

Calpini, S. (1880). *Memoria sulle condizioni dell'agricoltura e della classe agricola nel circondario dell'Ossola*. Domodossola: Tipografia Porta.

Casale, F., & Pirocchi, P. (2005). *La conservazione degli ambienti alpini nel Parco Veglia-Devero*. Varzo: Ente Parco Alpe Veglia e Alpe Devero.

CCIAA-VCO. (2012). *L'economia del Verbano Cusio Ossola*. Retrieved from http://www.lanuovaimpresa.it/pub/progetto.php

Commission of the European Communities. (2006). Proposal for a Council decision on the conclusion, on behalf of the European Community, of the Protocol on Mountain Farming attached to the Alpine Convention (Vol. 250059). Retrieved from http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52006PC0170&from=it

Corrado, F., Dematteis, G., & Di Gioia, A. (2014). *Nuovi Montanari. Abitare le Alpi nel XXI secolo*. Milan: Franco Angeli.

Corti, M. (2011). Formaggio d'alpeggio. In *La cucina delle Alpi tra tradizione e rivoluzione* (pp. 179–188). Retrieved from https://www.academia.edu/7924108/Formaggio_dalpeggio

Corti, M. (2012). The contradictory relationship between man, animals and wilderness in the late modernity. The case of large carnivore reintroduction in the Alps: between wilderness ideology, biopolitics and social conflict. *Studi Trenitini Di Scienze Naturali*, *91*, 83–113. Retrieved from https://www.academia.edu/7896786/The_contradictory_relationship_between_man_animals_and_wilderness_in_the_late_modernity

de Koning, J. (2014). Unpredictable Outcomes in Forestry-Governance Institutions in Practice. *Society & Natural Resources*, *27*(4), 358–371. http://doi.org/10.1080/08941920.2013.861557

de Vries, B. (2013). *Sustainability science*. Cambridge University Press.

Dudley, N. (2008). Guidelines for Applying Protected Area Management Categories. *Best Practice Protected Area Guidelines Series*. Gland, Switzerland.

EEA. (2012). *Protected areas in Europe — an overview*. Copenhagen. Retrieved from http://www.eea.europa.eu/publications/protected-areas-in-europe-2012

Ente di Gestione delle Aree Protette dell'Ossola. Statuto (2009). Varzo. Retrieved from http://www.areeprotetteossola.it/images/docs/statuto2012.pdf

Ente di Gestione delle Aree Protette dell'Ossola. (2012). Dichiarazione ambientale EMAS 2010-2013, 1–34. Retrieved from http://www.areeprotetteossola.it/it/ente-parco/certificazione-ambientale-emas/item/download/205_4cd91b7cfd04bf6d10fd62fa723237f1

EuroNatur Foundation. (2012). *Maintain Alpine diversity. Demands of the Alliance for Agriculture and Nature Conservation in the Alps for viable and sustainable mountain farming*. Retrieved from http://www.euronatur.org/fileadmin/docs/umweltpolitik/Alpen-GAP/GAP_Englisch_web_Juli_2012_ks.pdf

European Commission. (2014). Rural development 2014-2020 - Agriculture and rural development. Retrieved from http://ec.europa.eu/agriculture/rural-development-2014-2020/index_en.htm

European Parliament. (2013). *EU report on maintaining milk prduction in mountain areas, disadvantaged areas and outermost regions after the expiry of the milk quotas*. Retrieved from http://www.europarl.europa.eu/sides/getDoc.do?pubRef=-//EP//NONSGML+REPORT+A7-2013-0383+0+DOC+PDF+V0//EN

European Union. (1996). Convention on the protection of the Alps. Retrieved from http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=URISERV%3Al28161

FAO. (2015). *A review of indicators and methods to assess biodiversity. Application to livestock production at global scale*. Rome. Retrieved from http://www.fao.org/3/a-av151e.pdf

Fassio, G., & Zanini, R. (2014). Ossola. In F. Corrado, G. Dematteis, & A. Di Goia (Eds.), *Nuovi montanari. Abitare le Alpi nel XXI secolo* (pp. 119–135). Milan: FrancoAngeli.

Fischer, J., Brosi, B., Daily, G. C., Ehrlich, P. R., Goldman, R., Goldstein, J., … Tallis, H. (2008). Should agricultural policies encourage land sparing or wildlife-friendly farming? *Frontiers in Ecology and the Environment*, *6*(7), 380–385. http://doi.org/10.1890/070019

Fletcher, R. (2012). Using the Master's Tools? Neoliberal Conservation and the Evasion of Inequality. *Development and Change*, *43*(1), 295–317. http://doi.org/10.1111/j.1467-7660.2011.01751.x

Galvánek, D., & Janák, M. (2008). Management of Natura 2000 habitats. 6230 Species-rich Nardus grasslands. European Commission.

Gazzola, E., & Rizzi, P. (2004). Il posizionamento competitivo del VCO. In P. Rizzi & L. Quinatavalle (Eds.), *La competitività territoriale tra sviluppo endogeno e apertura*

del sistema locale: linee guida per il piano strategico del Verbano Cusio Ossola (p. 240). Milan: FrancoAngeli.

Grandi, C., & Triantafyllidis, A. (2010). *Organic Agriculture in Protected Areas. The Italian Experience. FAO - Food and Agricultre organization of the United Nations.* Retrieved from http://www.fao.org/3/a-al412e.pdf

Grasseni, C. (1998). *Those Who Don't Work Don't Make Love*. UK: University of Manchester.

Grasseni, C. (2011). Re-inventing food: Alpine cheese in the age of global heritage. *Anthropology of food*, (8). Retrieved from http://aof.revues.org/6819

Grasseni, C. (2014). Seeds of Trust. Italy's Gruppi di Acquisto Solidale (Solidarity Purchase Groups). *Journal of Political Ecology*, *21*, 178–192.

Hardin, G. (1968). The Tragedy of the Commons. *Science*, *162*(3859).

Honey, M. (1999). *Ecotourism and Sustainable Development. Who owns Paradise?* Washington DC: Island Press.

Horton, L. R. (2009). Buying Up Nature: Economic and Social Impacts of Costa Rica's Ecotourism Boom. *Latin American Perspectives*, *36*(3), 93–107. http://doi.org/10.1177/0094582X09334299

Hughes, R., & Flintan, F. (2001). *INTEGRATING CONSERVATION AND DEVELOPMENT EXPERIENCE: A REVIEW AND BIBLIOGRAPHY OF THE ICDP LITERATURE*. London: International Institute for Environment and Development.

Hunt, C. a., Durham, W. H., Driscoll, L., & Honey, M. (2014). Can ecotourism deliver real economic, social, and environmental benefits? A study of the Osa Peninsula, Costa Rica. *Journal of Sustainable Tourism*, *23*(3), 339–357. http://doi.org/10.1080/09669582.2014.965176

IMELS. Charter of Rome on Natural and Cultural Capital (2014). Retrieved from http://www.minambiente.it/sites/default/files/archivio/allegati/biodiversita/conference_ncc_charter_rome_24october.pdf

IUCN. (n.d.). IUCN Protected Area Categories System. Retrieved March 1, 2016, from http://www.iucn.org/about/work/programmes/gpap_home/gpap_quality/gpap_pacategories/

Larson, P., Freudenberger, M., & Wyckoff-Baird, B. (1997). *Lessons from the field: A review of World Wildlife Fund's experience with Integrated Conservation and Development Projects, 1985-1996*. Washington DC.

Layard, R. (2005). *Happiness: Lessons from a new science*. Penguin Books/Penguin Group (USA).

LCIE. (2013). A manifesto for large carnivore conservation in Europe. Retrieved from http://www1.nina.no/lcie_new/pdf/635253308262465095_LCIE manifesto for large carnivore conservation in Europe 2013.pdf

Levett, R. (1998). Sustainability indicators-integrating quality of life and environmental protection. *Journal of the Royal Statistical Society: Series A (Statistics in Society)*, *161*(3), 291–302. http://doi.org/10.1111/1467-985X.00109

Liebrand, J., Zwarteveen, M. Z., Wester, P., & van Koppen, B. (2012). The deep waters of land reform: land, water and conservation area claims in Limpopo Province, Olifants Basin, South Africa. *Water International*, *37*(7), 773–787. http://doi.org/10.1080/02508060.2012.740613

Mack, G., Walter, T., & Flury, C. (2013). Seasonal Alpine grazing trends in Switzerland: Economic importance and impact on biotic communities. *Environmental Science & Policy*, *32*, 48–57. http://doi.org/10.1016/j.envsci.2013.01.019

Marazzi, S. (2005). *Atlante orografico delle Alpi. SOIUSA: suddivisione orografica internazionale unificata del sistema alpino*. Scarmagno (TO): Priuli & Verlucca.

Maurer, K., Weyand, A., Fischer, M., & Stöcklin, J. (2006). Old cultural traditions, in addition to land use and topography, are shaping plant diversity of grasslands in the Alps. *Biological Conservation*, *130*(3), 438–446. http://doi.org/10.1016/j.biocon.2006.01.005

McMorran, R., Santini, F., Guri, F., Gomez-y-Paloma, S., Price, M., Beucherie, O., … Cloye, G. (2015). A mountain food label for Europe? *Revue de Géographie Alpine*, (103–4). http://doi.org/10.4000/rga.2654

McShane, T. O., Hirsch, P. D., Trung, T. C., Songorwa, A. N., Kinzig, A., Monteferri, B., … O'Connor, S. (2011). Hard choices: Making trade-offs between biodiversity conservation and human well-being. *Biological Conservation*, *144*(3), 966–972. http://doi.org/10.1016/j.biocon.2010.04.038

Metera, E., Sakowski, T., Słoniewski, K., & Romanowicz, B. (2010). Grazing as a tool to maintain biodiversity of grassland - a review. *Animal Science Papers and Reports*, *28*(4), 315–334.

Naughton-Treves, L., Holland, M. B., & Brandon, K. (2005). the Role of Protected Areas in Conserving Biodiversity and Sustaining Local Livelihoods. *Annual Review of Environment and Resources*, *30*(1), 219–252. http://doi.org/10.1146/annurev.energy.30.050504.164507

Naviglio, L. (2011). *L'utilizzo del "Marchio del Parco" nel sistema nazionale delle aree protette e nella Regione Lombardia*. Retrieved from http://www.lagodidro.regione.lombardia.it/shared/ccurl/658/87/Indagine_utilizzo_marchio del parco.pdf

Nepal, S. K., & Weber, K. E. (1995). The quandary of local people-park relations in Nepal's Royal Chitwan National Park. *Environmental Management*, *19*(6), 853–866. http://doi.org/10.1007/BF02471937

NORDREGIO. (2014). *Mountain Areas in Europe: Analysis of mountain areas in EU member states, acceding and other European countries*. Retrieved from http://ec.europa.eu/regional_policy/sources/docgener/studies/pdf/montagne/mount1.pdf

Ostrom, E. (1990). *Governing the Commons. The Evolution of Institutions for Collective Actions*. Cambridge: Cambridge University Press.

Paltani, G. (2010). *Dati dal IV° censimento dell' agricolatura nel Verbano-Cusio-Ossola*. Retrieved from http://www.regione.piemonte.it/agri/area_statistica/6censimento/dwd/calendario/2012_10_18PresentazionePaltaniVerbania.pdf

Parcovalgrande.it. (n.d.). Parco Nazionale Val Grande | Visitare il Parco | Mappa. Retrieved February 19, 2016, from http://www.parcovalgrande.it/mappa.php

Pearce, F. (2013). Sharing or sparing land for nature? *CGIAR Research Program on Water, Land and Ecosystems*. Retrieved from https://wle.cgiar.org/thrive/2013/05/15/sharing-or-sparing-land-nature

Penati, C., Berentsen, P. B. ., Tamburini, A., Sandrucci, A., & de Boer, I. J. . (2011). Effect of abandoning highland grazing on nutrient balances and economic performance of Italian Alpine dairy farms. *Livestock Science*, *139*(1–2), 142–149. http://doi.org/10.1016/j.livsci.2011.03.008

Phillips, A. (2002). *Management Guidelines for IUCN Category V Protected Areas. Protected Landscapes/Seascapes*. Gland, Switzerland.

Piazza, D. (2011). *Rete Natura 2000 in Val d'Ossola. Il Sic e Zps "Alpi Veglia e Devero - Monte Giove."* Varzo: Ente di Gestione delle Aree Protette dell'Ossola.

Plieninger, T., Gaertner, M., Hui, C., Huntsinger, L., Foley, J., DeFries, R., … Wilson, D. (2013). Does land abandonment decrease species richness and abundance of plants and animals in Mediterranean pastures, arable lands and permanent croplands? *Environmental Evidence*, *2*(1), 3. http://doi.org/10.1186/2047-2382-2-3

Quick, K. S., & Feldman, M. S. (2011). Constituting Communities through Public Engagement. *Journal of Planning Education and Research*, *31*(3), 272–290. http://doi.org/10.1177/0739456X11410979

Redford, K. H., & Richter, B. D. (1999). Conservation of Biodiversity in a World of Use. *Conservation Biology*, *13*(6), 1246–1256. http://doi.org/10.1046/j.1523-1739.1999.97463.x

Regione Piemonte. L.R. 19/2009. Testo unico sulla tutela delle aree naturali e della biodiversità (2009).

Regione Piemonte. (2012). PSR - Programma di Sviluppo Rurale 2014-2020. Retrieved from http://www.regione.piemonte.it/agri/psr2014_20/misure_interventi.htm

Renting, H., Rossing, W. A. H., Groot, J. C. J., Van der Ploeg, J. D., Laurent, C., Perraud, D., … Van Ittersum, M. K. (2009). Exploring multifunctional agriculture. A review of conceptual approaches and prospects for an integrative transitional framework. *Journal of Environmental Management*, *90 Suppl 2*, S112-23. http://doi.org/10.1016/j.jenvman.2008.11.014

Robinson, J. G. (1993). The Limits to Caring: Sustainable Living and the Loss of Biodiversity. *Conservation Biology*, *7*(1), 20–28. http://doi.org/10.1046/j.1523-1739.1993.07010020.x

Ruralpini. (2008). Alpeggi. Retrieved from http://www.ruralpini.it/Alpeggi.htm

Ruralpini. (2009). Gli alpeggi del Verbano Cusio Ossola destano un grande interesse. Ma i problemi sono tanti. Retrieved February 19, 2016, from http://www.ruralpini.it/Inforegioni10.10.09.htm

Ruralpini. (2010). Ticino e VCO: un grande patrimonio di alpeggi. Retrieved February 19, 2016, from http://www.ruralpini.it/Inforegioni05.11.2010Alpeggi_del_VCO_e_del_Ticino.htm

Ruralpini. (2016). Una settimana di proteste anti lupi degli allevatori della Lessinia. Retrieved October 24, 2016, from http://www.ruralpini.it/Lessinia_settimana_di_proteste_antilupo.html

Russo, D. (2006). *Effects of land abandonment on animal species in Europe: conservation and management implications*.

Salafsky, N. (2011). Integrating development with conservation. *Biological Conservation*, *144*(3), 973–978. http://doi.org/10.1016/j.biocon.2010.06.003

Sayer, J., Sunderland, T., Ghazoul, J., Pfund, J.-L., Sheil, D., Meijaard, E., … Buck, L. E. (2013). Ten principles for a landscape approach to reconciling agriculture,

conservation, and other competing land uses. *Proceedings of the National Academy of Sciences of the United States of America*, *110*(21), 8349–56. http://doi.org/10.1073/pnas.1210595110

Scalabrini, C., Locatelli, G., Ravicini, E., & Siniscalco, C. (2003). Piano di pascolamento relativo all'habitat prioritario "formazioni erbose a nardus, ricche di specie, su substrato siliceo delle zone monane" nel PSIC e ZPS "Alpi Veglia e Devero." Varzo: Progetto LIFE Nature, Ente Parco Alpe Veglia e Alpe Devero.

Schmidtz, D. (1997). When preservationism doesn't preserve. *Environmental Values*, *6*(3), 327–339.

Silva, J. P., Toland, J., Jones, W., Eldridge, J., Thorpe, E., & O'Hara, E. (2008). *LIFE and Europe's grasslands. Restoring a forgotten habitat*. Louxembourg.

Spellerberg, I. F., & Fedor, P. J. (2003). A tribute to Claude Shannon (1916-2001) and a plea for more rigorous use of species richness, species diversity and the "Shannon-Wiener" Index. *Global Ecology and Biogeography*, *12*(3), 177–179. http://doi.org/10.1046/j.1466-822X.2003.00015.x

Tessaro, M. (2003). *Relzione sullo stato dell'ambiente nlle aree naturali protette del vco* (Quaderni d). Verbania: Provincia del Verbano Cusio Ossola.

Urbistat. (2012). Classifica e Mappa tematica del "TASSO MIGRATORIO" Provincia di VERBANO-CUSIO-OSSOLA per Comune. Retrieved February 17, 2016, from http://www.urbistat.it/AdminStat/it/it/classifiche/tasso-migratorio/comuni/verbano-cusio-ossola/103/3#linknote_1_note

Van Laerhoven, F. (2010). Governing community forests and the challenge of solving two-level collective action dilemmas—A large-N perspective. *Global Environmental Change*, *20*(3), 539–546. http://doi.org/10.1016/j.gloenvcha.2010.04.005

Veenhoven, R. (1991). Is happiness relative? *Social Indicators Research*, *24*(1), 1–34. http://doi.org/10.1007/BF00292648

Verzijl, A., & Quispe, S. G. (2013). The System Nobody Sees : Irrigated Wetland Management and Alpaca Herding in the Peruvian Andes The System Nobody Sees : Irrigated Wetland Management and Alpaca Herding in the Peruvian Andes. *Mountain Research*, *33*(3), 280–293. http://doi.org/10.1659/MRD-JOURNAL-D-12-00123.1

Wiederwald, D., & Chodziesner-Bonne, M. (2000). Le tourisme dans les espaces protégés alpins. Recensement de l'infrastructure et de la fréquentation touristiques afin d'évaluer les retombées sur l'économie régionale. *Les Dossiers Du Réseau Alpin*, *2*. Retrieved from http://www.alparc.org/en/resources/our-

publications/dossiers/item/download/46_f920a4515060bd5fab510205221f6366

Wilshusen, P. R., Brechin, S. R., Fortwangler, C. L., & West, P. C. (2002). Reinventing a Square Wheel: Critique of a Resurgent "Protection Paradigm" in International Biodiversity Conservation. *Society & Natural Resources*, *15*(1), 17–40. http://doi.org/10.1080/089419202317174002

WWF. (2012). *The European Alpine Programme: Joint Action for Nature in the European Alps*. Retrieved from http://wwf.panda.org/wwf_news/?204615/theeuropeanAlpineprogramme#

Zerbini, G. (2005). L'agrcoltura, l'allevamento, i prodotti tipici. In A. Pagani, P. Caretti, R. Frassetti, A. Grossi, S. Lucchini, & G. Prola (Eds.), *Terra d'Ossola* (pp. 297–304). Domodossola: Edizioni Grossi. http://doi.org/10.1017/CBO9781107415324.004

Appendixes

Appendix 1: IUCN protected areas' management categories system

IUCN Category	Description of management type
Ia Strict Nature Reserve	Strictly protected areas set aside to protect biodiversity and also possibly geological/geomorphologic features, where human visitation, use and impacts are strictly controlled and limited to ensure protection of the conservation values. Such protected areas can serve as indispensable reference areas for scientific research and monitoring
Ib Wilderness Area	Usually large unmodified or slightly modified areas, retaining their natural character and influence without permanent or significant human habitation, which are protected and managed so as to preserve their natural condition.
II National Park	Large natural or near natural areas set aside to protect large-scale ecological processes, along with the complement of species and ecosystems characteristic of the area, which also provide a foundation for environmentally and culturally compatible, spiritual, scientific, educational, recreational, and visitor opportunities
III Natural Monument or Feature	Protected areas set aside to protect a specific natural monument, which can be a landform, sea mount, submarine cavern, geological feature such as a cave, or even a living feature such as an ancient grove. They are generally quite small protected areas and often have high visitor value.
IV Habitat/Species Management Area	Protected areas aiming to protect particular species or habitats, their management reflects this priority. Many Category IV protected areas will need regular, active interventions to address the requirements of particular species or to maintain habitats, but this is not a requirement of the category
V Protected Landscape/Seascape	A protected area where the interaction of people and nature over time has produced an area of distinct character with significant, ecological, biological, cultural and scenic value: and where safeguarding the integrity of this interaction is vital to protecting and sustaining the area and its associated nature conservation and other values.
VI Protected Area with sustainable use of natural resources	Protected areas that conserve ecosystems and habitats together with associated cultural values and traditional natural resource management systems. They are generally large, with most of the area in a natural condition, where a proportion is under sustainable natural resource management and where low-level non-industrial use of natural resources compatible with nature conservation is seen as one of the main aims of the area

Source: IUCN (www.iucn.org)

Appendix 2: Questions to Park Manager - Ivano De Negri, Director of the Ossola Protected Areas.

1) What are the main objectives of the Ossola Protected Areas (OPAs)?
2) How are the Ossola Protected Areas' management structured and organized?
3) What is and has been the extent of the anthropic presence in the OPAs(seasonal/permanent)?
4) What are and have been the major human (economic) activities within the OPAs?
5) Do the OPAs provide active support to human income-generating activities within its area? If so, to what activities? And how?

<u>As it concerns high-pasture dairy farming:</u>

6) What is and has been the number of farms that are active within the OPA's area?
7) What is and has been the number dairy cows (head of livestock) that graze within the OPAs?
8) Where are and have been located dairy farming activities within the OPAs?
9) What is the extent of the abandonment of high-pasture dairy farming within the OPAs? What are its causes? And its consequences?
10) What are the regulations that dairy farmers have to comply with during their activities within the OPAs?
11) How have these regulations evolved over time, including considering the just mentioned changes?
12) How are these regulations determined, and by whom?
13) Are farmers (associations) involved in the definition of such regulations?
14) What is farmers' response to the park's regulations affecting their activities?
15) Who owns pastureland and the buildings where milk transformation occurs? If public land: How does land allocation work?
16) Does land (private) property have any effect on OPAs' regulations over farming activities?

<u>About biodiversity conservation:</u>

17) What is the relation between grazing activities and biodiversity richness?
18) How is biodiversity conservation of pasturelands assured?
19) Are there areas that suffer from overgrazing, or else rom abandonment?
20) Did you perform any biodiversity monitoring on abandoned pastureland?
21) How has pasture biodiversity changed following abandonment?
22) As it concerns biodiversity conservation of wild areas and of human-tailored environment: is there any priority of action reserved to the conservation of one of the two areas?

23) What is the relation between high-pasture dairy farming activities and wild fauna?

About the relations between the OPAs and farmers:

24) How would you define the quality of the relation between the OPAs and farmers?

- Non existent
- Conflictual and static (impossible to find accordance)
- Conflictual but proactive (it is possible to find accordance/compromise)
- Cooperative (almost always possible to find accordance and common stakes)
- Synergic (very good relations and strict collaboration to reach mutual stakes)

25) What kind of benefit would you say high-pasture dairy farming brings to OPAs?

26) What kind of obstacles would you say high-pasture dairy farming entail to OPAs' objectives?

27) What kind of strategies are adopted to minimize such negative impacts?

28) What kind of benefit would you say the OPAs bring to high-pasture dairy farming?

29) What kind of obstacles would you say the OPAs entail to high-pasture dairy farming?

30) What kind of strategies are adopted to minimize such negative impacts?

Appendix 3: Questions to Farmers Trade Unions

1) What does your association's activities consist in in? And specifically as it concerns high-pasture dairy farming?

2) What is the entity of high-pasture dairy production within the Ossola Protected Areas?

3) How has high-pasture dairy farming evolved over time in terms of number of farms and of people involved?
   And in terms of heads of livestock?
   And in terms of profitability and income generation?

4) Is any other (formal or informal) income generating activities carried out by farmers in order to boost their revenue?

5) To what extent does the environmental conservation regime of protected areas affect agricultural activities? And specifically as it concerns high-pasture dairy farming?

6) What are the major problems of being located in a protected area for high-pasture dairy farmers?
   And what are the major benefits?

7) Is there any kind of subsidy for high-pasture dairy farming activities?
   Where do these subsidies come from?
   What is the specific reason for this economic support?
   What is the economic relevance of such subsidies?

8) What is the position of your association as it concerns environmental conservation?
   … as it concerns conservation of biodiversity conservation in mountain pastures?
   … as it concerns restrictions to farming activities in protected areas?
   … as it concerns coexistence of farming activities with megafauna (ungulates and predators)?

9) What is your specific activities to bring forward your associates' positions?

10) What kind of relationship exists between your association and the Protected Areas?

11) How would you define the quality of the relation between the OPAs and farmers?

- Non existent
- Conflictual and static (impossible to find accordance)
- Conflictual but proactive (it is possible to find accordance/compromise)
- Cooperative (almost always possible to find accordance and common stakes)
- Synergic (very good relations and strict collaboration to reach mutual stakes)

12) Could you define the relation between protected areas and farmers?

13) Could you identify (if they have not been already identified) any possible synergy between protected areas and high-pasture dairy farmers? Have such ideas been already proposed and/or discussed?

Appendix 4: Questions to Farmers

The activity

1) How old are you? Where are you from? How long have you been doing this activity?
2) How did you start this activity? For what reason?
3) Where do you undertake your farming activity throughout the year?
4) How many heads of livestock do you have? What race is your livestock?
5) What does your dairy production consist in?
6) Could you describe high-pasture farming activities?
    a. Transhumance of live stock
    b. Grazing
    c. Milking
    d. Dairy production
    e. Selling

7) Where do you sell your products in summer/winter? To whom?
8) Are you satisfied by the price you get for your products?
9) How has high-pasture dairy farming activity evolved over time?
10) How have farms changed over time, including yours (in terms of number of heads of livestock, kind of work, production and sales of dairies, profitability)?
11) As it concerns the abandonment of high-pasture dairy farming: what do you think are the reasons for such abandonment? And why did you decide to continue with this activity?

High-pasture dairy farming in Protected Areas:

12) Are there any specific rules dictated from the Park that you have to comply with during high-pasture farming activity?
13) What are the major problems with working within a protected area?
14) Do you address to anyone to improve your situation with respects of (one of) these problems?
15) What are the major benefits of working within a protected area?
16) (How) Does the Park support your activity?
17) How would you define the quality of the relation with the OPAs?
    - Non existent
    - Conflictual and static (impossible to find accordance)
    - Conflictual but proactive (it is possible to find accordance/compromise)
    - Cooperative (almost always possible to find accordance and common stakes)
    - Synergic (very good relations and strict collaboration to reach mutual stakes)

18) Whose is the property of buildings and pasturelands? In case of public property: how are they allocated? What does it change for your activity between private or public property?

Biodiversity:

19) What is the environmental impact of high-pasture dairy farming?
20) To what extent the quality of your dairy production depends on the environment where it is produced?
21) Do you think that the environmental conservation regime of the Park represents a burden or a gain for your activity?
22) To what extent does wild megafauna (ungulates and predators) affect your activity?

Income, Desirability and Synergies:

23) Are you satisfied by the profitability of your activity?
24) (How much) Do you receive any subsidies in support of your activity? From whom? For what specific reason?
25) What do you think should be done in order to improve the profitability of high-pasture dairy farming?
26) Are you engaged in any other income generating activity in order to improve your income?
27) From 1 to 10, how much would you say you are satisfied from your activity? Could you justify your answer?
28) What are the aspects of your activity that make you the most satisfied? And the least?
29) Would you like that your son/daughter would do this same job?

At last:

Have you ever heard about a "Product of the Park" label? [explanation if needed] What is your opinion about it?

Appendix 5: Example of calculation of Shannon Diversity Index (Alpe Veglia, P8)

	Relative abundance per species per subplot #																									Per entire Plot		
	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12	#13	#14	#15	#16	#17	#18	#19	#20	#21	#22	#23	#24	#25	average	ln	abund*ln
Species 1	0.10	0.13	0.11	0.13	0.11	0.11	0.11	0.09	0.13	0.09	0.09	0.09	0.09	0.08	0.08	0.11	0.08	0.11	0.10	0.11	0.09	0.14	0.13	0.10	0.09	0.10	-2.27	-0.23
Species 2	0.10	0.13	0.11	0.13	0.00	0.12	0.00	0.10	0.13	0.09	0.09	0.09	0.09	0.08	0.08	0.11	0.08	0.11	0.10	0.11	0.00	0.00	0.13	0.10	0.09	0.09	-2.45	-0.21
Species 3	0.10	0.13	0.11	0.13	0.11	0.11	0.11	0.10	0.13	0.09	0.09	0.09	0.09	0.08	0.08	0.11	0.08	0.11	0.10	0.11	0.09	0.14	0.13	0.10	0.09	0.10	-2.26	-0.24
Species 4	0.10	0.13	0.11	0.13	0.11	0.11	0.11	0.10	0.13	0.09	0.09	0.09	0.09	0.08	0.08	0.11	0.08	0.11	0.10	0.11	0.09	0.14	0.13	0.10	0.09	0.10	-2.26	-0.24
Species 5	0.10	0.13	0.11	0.13	0.11	0.11	0.11	0.10	0.13	0.09	0.09	0.09	0.09	0.08	0.08	0.11	0.08	0.11	0.10	0.11	0.09	0.00	0.13	0.10	0.09	0.10	-2.32	-0.23
Species 6	0.10	0.00	0.00	0.00	0.10	0.11	0.11	0.10	0.00	0.09	0.09	0.09	0.09	0.08	0.08	0.11	0.08	0.11	0.10	0.00	0.09	0.00	0.13	0.10	0.09	0.07	-2.60	-0.19
Species 7	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.09	0.09	0.00	0.00	0.08	0.08	0.00	0.00	0.11	0.10	0.11	0.00	0.00	0.00	0.00	0.00	0.03	-3.38	-0.12
Species 8	0.10	0.13	0.11	0.13	0.10	0.12	0.11	0.09	0.13	0.09	0.09	0.09	0.09	0.08	0.08	0.11	0.08	0.11	0.00	0.11	0.09	0.14	0.13	0.10	0.09	0.10	-2.31	-0.23
Species 9	0.10	0.13	0.11	0.13	0.03	0.03	0.00	0.03	0.00	0.00	0.09	0.00	0.09	0.08	0.08	0.11	0.08	0.00	0.00	0.00	0.09	0.14	0.00	0.10	0.09	0.06	-2.81	-0.17
Species 10	0.10	0.13	0.10	0.00	0.11	0.00	0.11	0.00	0.00	0.09	0.00	0.09	0.09	0.00	0.08	0.00	0.08	0.00	0.00	0.00	0.09	0.00	0.00	0.00	0.00	0.04	-3.15	-0.13
Species 11	0.00	0.00	0.03	0.00	0.00	0.03	0.00	0.00	0.13	0.00	0.00	0.09	0.09	0.00	0.00	0.00	0.08	0.11	0.00	0.00	0.09	0.14	0.00	0.10	0.00	0.04	-3.34	-0.12
Species 12	0.00	0.00	0.10	0.13	0.11	0.12	0.11	0.10	0.00	0.00	0.09	0.00	0.00	0.00	0.00	0.11	0.08	0.00	0.10	0.11	0.09	0.14	0.13	0.00	0.00	0.06	-2.80	-0.17
Species 13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.08	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.01	-4.31	-0.06
Species 14	0.00	0.00	0.00	0.00	0.11	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.00	0.08	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.09	0.02	-3.82	-0.08
Species 15	0.00	0.00	0.00	0.00	0.00	0.03	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.01	-4.36	-0.06
Species 16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.13	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	-4.40	-0.05
Species 17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.09	0.09	0.09	0.08	0.08	0.00	0.00	0.00	0.10	0.11	0.09	0.00	0.00	0.00	0.09	0.04	-3.31	-0.12
TOTAL	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		

Shannon Diversity Index: the OPPOSITE of the SUM of the RELATIVE ABUNDANCE * the NATURAL LOG of the relative abundance	2.648

Appendix 6: Descriptive figures and tables about HPDF in the OPAs

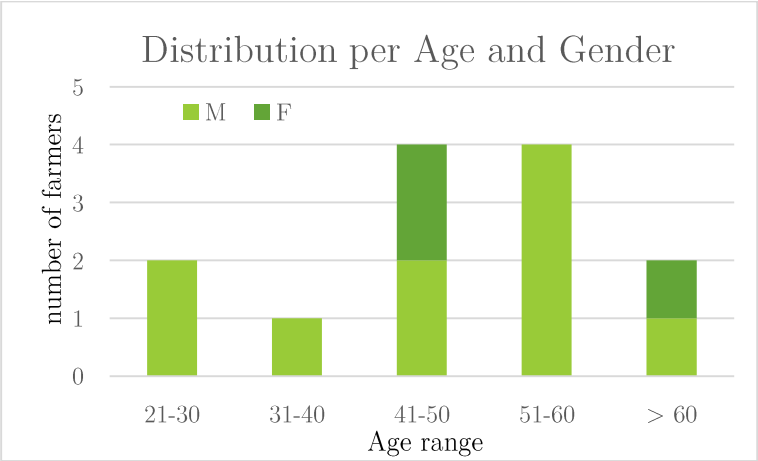

Figure 17: Distribution of interviewee population per age and gender

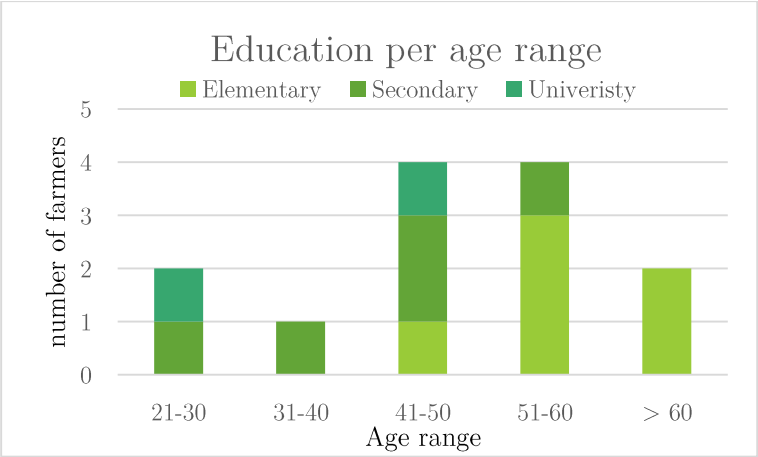

Figure 18: Education level of farmers, according to age range

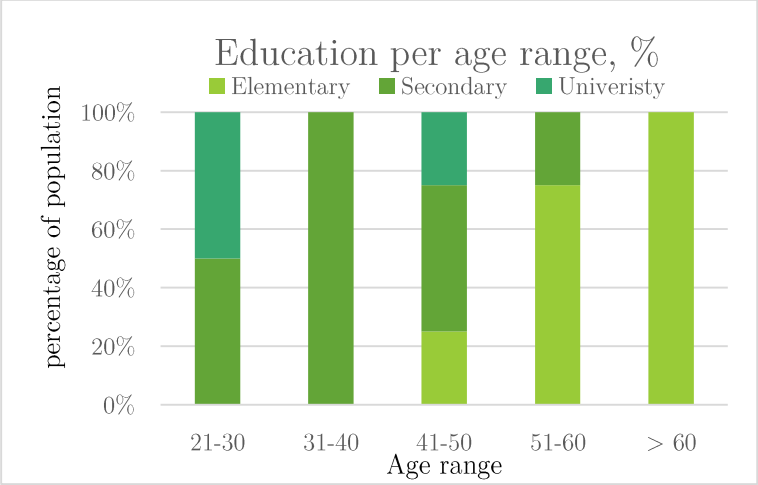

Figure 19: Education level of farmers, expressed in percentage, according to age range

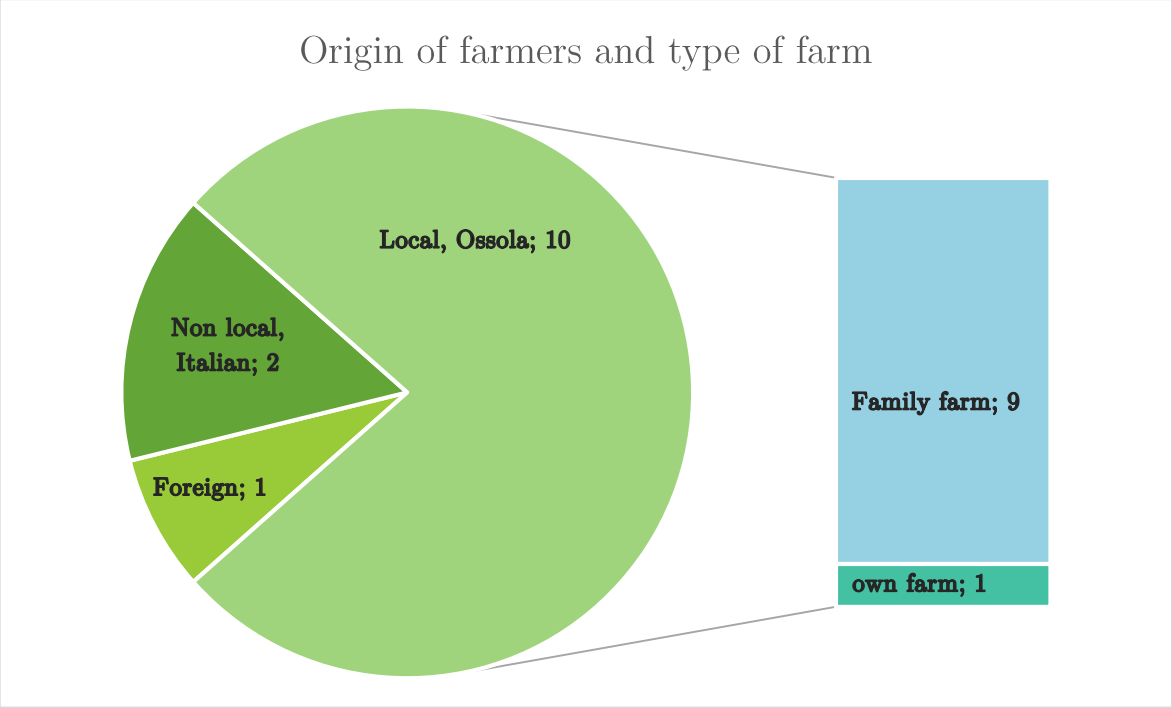

Figure 20: origin of farmers and type of farms

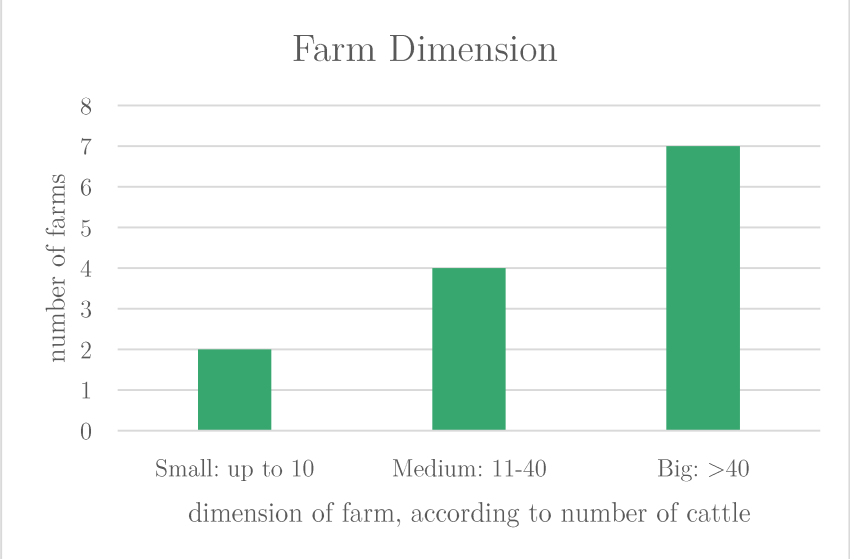

Figure 21: Dimension of farms, according to number of cattle

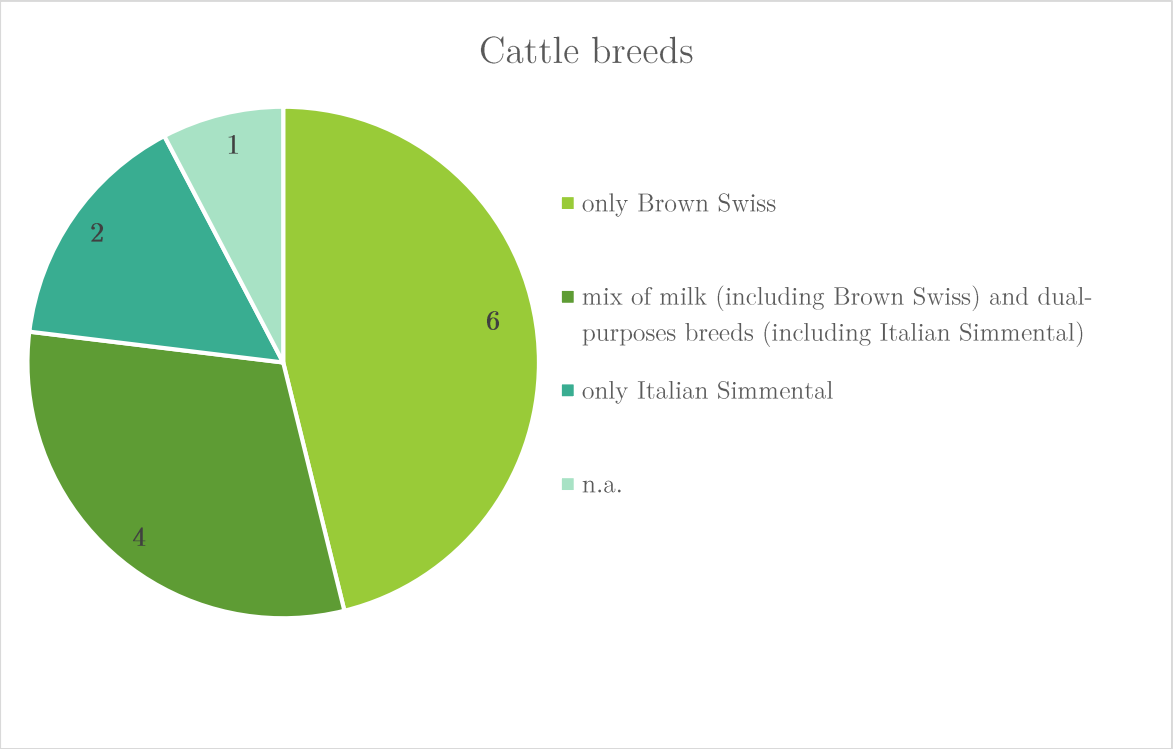

Figure 22: Farms' cattle according to breed

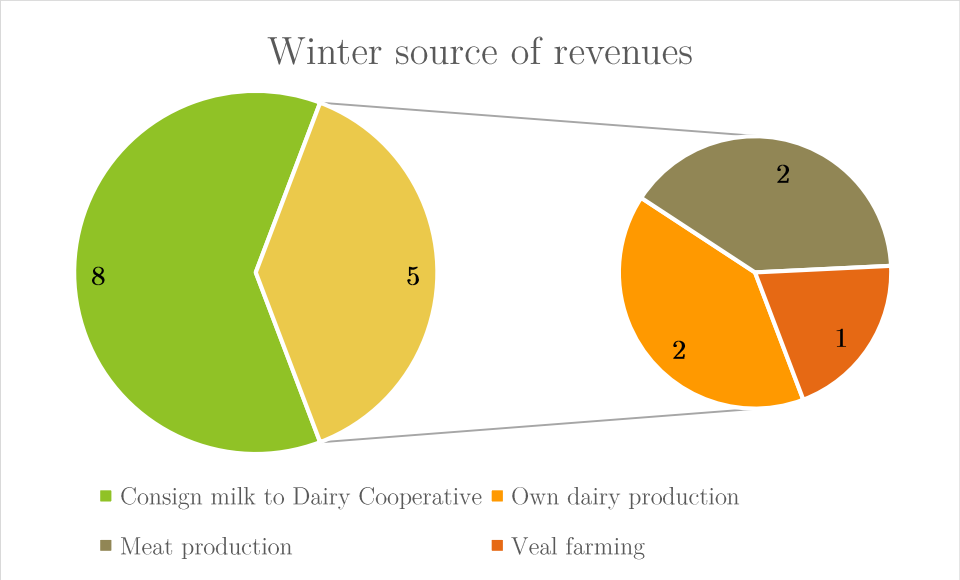

Figure 23: Sources of revenues of farms durimng winter months

Table 10: Characteristics of farmers and farms

	Gender	Age	Education	Origin	Type of farm	Heads of cattle	Cattle breed	Side activities
Farm #1	M	> 60	Elementary	Non local, Italian	Own farm	50 + 15	Brown Swiss, Italian Simmental, Holstein Friesian	Other job
Farm #2	M	51-60	Elementary	Local	Family farm	30+13	Brown Swiss, Italian Simmental	Pig farming
Farm #3	M	41-50	Elementary	Local	Family farm	30	Brown Swiss	No side activities
Farm #4	F	41-50	University	Foreign	Other farm	30	Brown Swiss	Excursionistic guide
Farm #5	M	41-50	Secondary	Local	Family farm	85	Brown Swiss	No side activities
Farm #6	M	31-40	Secondary	Local	Family farm	80	Brown Swiss	No side activities
Farm #7	M	21-30	University	Local	Family farm	60	Brown Swiss, Italian Simmental	Agritourism, meat production
Farm #8	M	21-30	Secondary	Local	Family farm	40	Italian Simmental	Meat production
Farm #9	M	51-60	Elementary	Local	Family farm	27	Italian Simmental	Meat production
Farm #10	F	41-50	Secondary	Local	Own farm	10	n.a.	No side activities
Farm #11	M	51-60	Secondary	Non local, Italian	Own farm	20	Brows Swiss, dual purposes cattle crossbreed	Meat production, pig farming, Agritourism
Farm #12	F	> 60	Elementary	Local	Family farm	8	Brown Swiss	No side activities
Farm #13	M	51-60	Elementary	Local	Family farm	55	Brown Swiss	No side activities

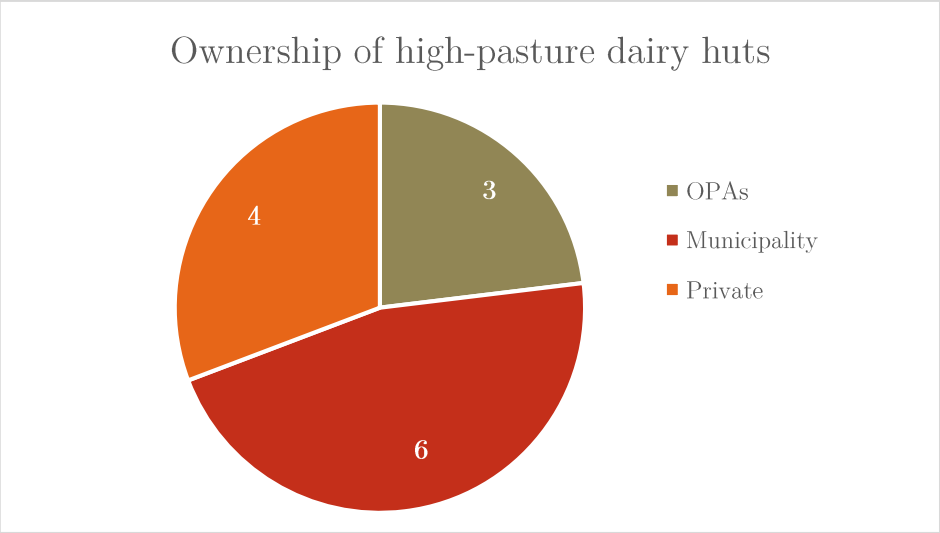

Figure 24: Ownership of high-pasture dairy huts where farmers live and work during summer months

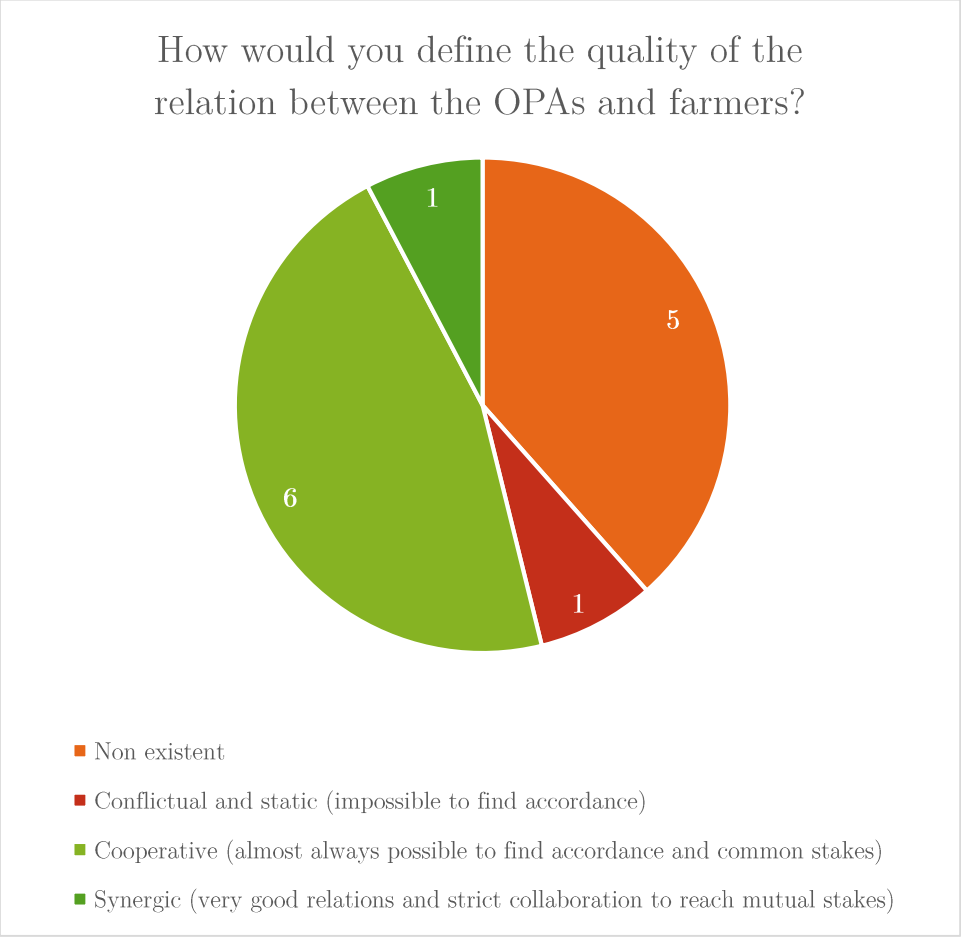

Figure 25: Relation between the OPAs and farmers, according to these latter

Acknowledgments

This thesis would not have been the same without the support of many people, to whom I would like here to express my gratitude.

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