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Agricultural practices, ecosystem services and sustainability in High Nature Value farmland: Unraveling the perceptions of farmers and nonfarmers

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SUMMARY

Our aim was to examine the perceptions of farmers and nonfarmers regarding the relationships between agriculture and the environment in High Nature Value (HNV) farmland. We performed content analysis of information obtained from five focus groups to derive key items (recording units such as words, phrases and concepts) and classify the derived items into a set of themes: agricultural practices, ecosystem services, and economic and social sustainability. We established the relative importance of each item and the relationships among the items. The farmers were very knowledgeable of ecosystem services (particularly regulation), the interactions among them, and their relationships with agricultural practices, particularly grazing management. Nonfarmers were less knowledgeable of ecosystem services, particularly regulation, and identified fewer relationships with agricultural practices. However, nonfarmers were highly concerned about the provision of quality food products and several cultural ecosystem services, which were discussed in bundles. The provisioning of food with particular quality attributes was revealed to be important for participants and a distinctive feature of HNV farmland. Ecosystem services were frequently interwoven with broad issues of economic and social sustainability. Therefore, a systemic view should be considered when designing agri-environmental policies.

1. Introduction

The concept of High Nature Value (HNV) farmland has been increasingly utilized in European agri-environmental policy in response to rapid declines in farm-related biodiversity and the delivery of other public goods from agriculture. Several features characterize HNV farmland: low-intensity land use, the presence of seminatural vegetation, the existence of a land-use mosaics, and the support of high species and habitat diversity or species of interest (Lomba et al., 2014). HNV farmland is based on a conservation concept that aims to link three separate domains: ecology, farming and public policy (IEEP, 2007). The literature has mainly focused on the ecological domain, whereas the farming (e.g., the perceptions of farmers about their own activity and the environment) and policy (e.g., the views of citizens about agriculture-environment relationships and the agri-food system) domains are less understood. This situation has occurred although public participation is considered essential to the success of conservation policies (Fischer and Young, 2007).

HNV farmland accounts for approximately 30% of the total utilized agricultural area in Europe (mostly seminatural grasslands in the mountains, steppes, *dehesas* or *montados*, wetlands, and permanent and dryland crops) and are mainly located in the marginal areas in eastern, southern and north-western Europe. A variety of HNV farming systems are found in the EU, and grazing livestock systems, which are often located in mountainous areas, are the most common type of HNV farming system (Keenleyside et al., 2014). These systems are characterized by livestock (mostly ruminants) raised on natural and seminatural vegetation that is grazed, browsed, or cut for hay (Bignal and McCracken, 2000). HNV livestock farming systems are multifunctional and deliver a wide

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range of private and public goods. Among these public goods, the conservation of agricultural landscapes, the conservation of farm biodiversity and the resilience of the land to forest fires are intrinsically linked to the existence of low-intensity grazing systems (Cooper et al., 2009). However, the intensification of land use in favorable areas and the abandonment of marginal areas are two primary causes of conflicts between agriculture and the conservation of biodiversity and agricultural landscapes in Europe (EEA, 2004; Henle et al., 2008), undermining the delivery of other ecosystem services (Rodríguez-Ortega et al., 2014).

Agri-environmental schemes that target HNV farmland intend to promote the adoption of environmentally friendly management strategies. These agri-environmental schemes provide payments to farmers who voluntarily subscribe to environmental commitments related to the delivery of public (nonmarket) functions, such as the preservation of biodiversity and the maintenance of the countryside. However, the value of nonmarket functions depends on societal perception and is contextual and diverse (Randall, 2002). In the European Union, agri-environmental schemes are part of the rural development policy known as the "second pillar" of the Common Agricultural Policy (CAP) and are organized around rural development programs that last six years. Specific agri-environmental measures are implemented at the farm level where farmers make decisions. Therefore, for agri-environmental schemes to be effective, it is important to analyze the experiences of farmers and how they understand their own activities and contexts (Boonstra et al., 2011). Thus, we must determine the perceptions of farmers regarding how their farming activities and agricultural practices affect the diverse provisioning and nonprovisioning ecosystem services they manage (Smith and Sullivan, 2014) and must identify the other dimensions of farming that are involved (the economic and social pillars of sustainability).

The concepts of multifunctionality and, more recently, ecosystem services, are human-centered because both human benefits and societal demands are at the core of their definitions (Millennium Ecosystem Assessment, 2005). The ecosystem services framework has helped to systematically classify the different services or functions provided by HNV farmland (Rodríguez-Ortega et al., 2014). However, the embedment of the ecosystem service framework into the wider concept of sustainability is problematic. Norgaard (2010) affirms that the predominance of the ecosystem services framework, which considers nature as a provider of flows of services, is blinding us from the complexity of the challenges (ecological, economic and political) we actually face. Abson et al. (2014) conclude that, despite its increasing acceptance among the scientific community, the ecosystem service framework involves critical challenges (greater focus on normative and transformative knowledge) for use as a management tool. Interdisciplinary knowledge integration and shared vocabularies are necessary for addressing these challenges.

The integration of biological and social knowledge often follows top-down "expert" approaches. However, the economic or socio-cultural benefit (welfare gain) of a particular ecosystem service depends on how different actors in society perceive or attach value to the ecosystem service; thus, these perceptions of value can eventually effect changes in policies (van Oudenhoven et al., 2012). Therefore, if we want public policies to be socially acceptable and transformative, the importance of understanding the different perceptions of society, which ultimately fund these policies, is implicit. To address these demands, social research methods are used to analyze the heterogeneity of the actors, their particular circumstances and their sometimes competing values (Martín-López et al., 2012). In these bottom-up studies, discourse-based deliberative approaches assume that individuals take the role of citizens and act according to social rationality instead of solely as consumers, which involves ethical considerations, social norms and collective utility (Kelemen et al., 2013; Vatn, 2009).

The body of literature available regarding the perceptions of different beneficiaries, particularly farmers and nonfarmers, on biodiversity and sustainability is increasing, but few studies considering ecosystem services have been conducted (Kelemen et al., 2013; Lamarque et al., 2011; Oteros-Rozas et al., 2013; Smith and Sullivan, 2014). Moreover, little research has been directed toward understanding the relevant agricultural practices that mediate between agroecosystems and the delivery of ecosystem services, and few studies have focused on how the perceptions of ecosystem services and environmental attitudes affect farmer behavior (e.g., Reimer et al. (2012), Lamarque et al. (2014)). To the best of our knowledge, studies of the effects of specific agricultural practices and management regimes on ecosystem services and related sustainability issues, as perceived by stakeholders, have not been conducted.

Our objective was to analyze, in depth, the perceptions, understandings and reasoning of farming and nonfarming groups (hereafter, farmers and nonfarmers, respectively) regarding the relationships between animal agriculture in HNV farmland (using the Mediterranean mountains as a case study) and the environment. For this purpose, we focused our analysis on agricultural practices and their mediating effects between agroecosystems and 1. the ecosystem services that they provide, 2. the economic and social issues of sustainability relevant to farmers and nonfarmers, and 3. the relationships among ecosystem services and issues of sustainability.

2. Methodology

2.1. Characteristics of the study area

We circumscribed the study to the Mediterranean mountains in Northeast Spain (the Central Pyrenean and pre-Pyrenean mountain ranges). A large proportion of the Natura 2000 sites are concentrated within this area, covering approximately 30% of the total area in the region. Natura 2000 is the centerpiece of the EU Nature and Biodiversity Policy that established an EU-wide network of protected natural areas in 1992 (Habitats Directive). Habitats such as 6170 (alpine and subalpine calcareous grasslands), 6210 (semi-natural dry grasslands *Festuco-Brometalia*) and 6230 (species-rich *Nardus* grasslands) are dependent on grazing by livestock and mowing by farmers to maintain their HNV status. In the study area, grazing livestock systems (meat sheep and beef cattle) and mixed arable-pastoral (cereals and permanent crops such as almond and olive trees) systems are the most prevalent agricultural systems. These systems are generically considered HNV farming systems despite their very diverse land use, intensity and management regimes (García-Martínez et al., 2009; Riedel et al., 2007).

These HNV livestock systems have the greatest potential to deliver public goods through specific management practices. Some of these public goods, such as the prevention of forest fires, the preservation of biodiversity and the conservation of cultural landscapes, are inherently linked to these types of low-input farming systems (Cooper et al., 2009). However, these areas have experienced profound changes in their demographic and socio-economic characteristics that have threatened the sustainability of these farming systems (Bernués et al., 2011). These changes resulted in a two-fold process: the intensification of farming in the most favorable and easy-to-work areas and the abandonment of the marginal areas, which has led to important transformations of agricultural landscapes characterized by the encroachment of shrub and forest vegetation and the loss of diversified mosaics (Bernués et al., 2005; Lasanta-Martínez et al., 2005; Riedel et al., 2013). Other

changes in economic and social factors that affect sustainability are described in detail by Bernués et al. (2011); among these, we note the enlargement of herd size, the increasing dependence of farmers on subsidies, the lack of succession with a subsequent reduction in the number of farms, and diversification toward nonfarming activities, primarily tourism.

2.2. Focus groups

Focus group (FG) research is a qualitative, open, nondirective technique that involves the use of in-depth group discussions focused on a given topic in which participants are selected because they are "a purposive, although not necessarily representative, sampling of a specific population" (Rabiee, 2004). FG aims to obtain an in-depth understanding of a reduced sample of citizen groups that might show contrasting views (Yin, 2009). Although statistical extrapolation is not possible, FG research can uncover underlying principles and patterns that can be generalized and contribute to scientific development (Flyvbjerg, 2006). Participants in the FGs were recruited based on the criteria that they had something to say on the particular topic under study, had similar socio-cultural characteristics (to avoid differences in experiences and verbal skills) and were comfortable speaking to the interviewer and with each other (Rabiee, 2004). In addition, the use of FGs also provided insight into the words lay people use (Macnaghten, 2004), which may differ among stakeholders and from those used in science.

Because the aim of the study was to understand the reasoning of farmers and the general public, sampling was designed to cover a cross-section of different backgrounds. We organized two FGs with livestock farmers (11 participants) and three FGs with nonfarmers (22 participants). To recruit farmers for participation, we organized the FGs through an association of livestock farmers and an agricultural cooperative located in the study area. One FG consisted of meat-sheep and mixed agriculture-sheep farmers, and the other FG consisted of beef cattle farmers with few or no agricultural crops. All farmers used natural and seminatural vegetation as primary resources to feed their animals. In this manner, we covered all the animal species and the most important farming systems present in the study area. The FGs with nonfarmers were organized with the following aims in mind: i) to collect the diverse views and interests of the general public; ii) to include groups of people with an intermediate level of formal education (due to the complexity of the topic under discussion) and with different degrees of familiarity with the topic (but no expert opinions); and iii) to ensure that the participants within the groups represent a homogeneous sociocultural profile. One FG included laboratory technicians working for a governmental agency for animal health, one FG included primary and secondary education teachers, and one FG included members of a consumers' association. The FGs met between September and December 2012 in cities near the study area.

The objective of the FGs was to generically discuss the relationships between animal agriculture in HNV farmland (considering the mountain grazing livestock systems in the study area as a reference) and the environment using the ecosystem service framework. We aimed to gain an understanding of the spontaneous knowledge held by participants on the topic. At the beginning of the FGs, we introduced the nature and the purpose of the study to the participants. The procedure for the FG sessions was also explained. To facilitate this discussion, the participants were asked to consider five general questions individually for approximately 10 min before the FG discussion and to write their responses and provide examples. The questions were as follows: 1. Do you know the term "ecosystem services"? 2. How do you think livestock production affects the environment? 3. How do these relationships between livestock production and the environment affect you? 4. What geographical areas/places can you identify that show the effects of livestock on the environment? and 5. Should society pay for the delivery of environmental services? Who should pay, and how should they pay? The FG discussions were conducted by a moderator who initiated the session by clarifying the meaning of the ecosystem service concept after collecting the responses of the participants to question 1. In this manner, we avoided insecurity of the participants with respect to technical terminology, which would have hampered the elicitation of individual perceptions (Fischer and Young, 2007). The moderator then proceeded to collect responses to the next questions in the established order. However, discussions often jumped from question to question in a rather random fashion, particularly among questions 2, 3 and 4. When the moderator felt that a topic had been exhausted, he introduced a new topic to maintain the flow of the discussion and to cover all questions (question 5 in particular). Otherwise, the moderator played a passive role, stimulating the participation of all participants without introducing bias or pressures. The FGs continued until no new ideas were elicited (approximately 1.5 h). The sessions were recorded on video, and the transcripts were written to analyze their text.

2.3. Analysis of information

We used the ecosystem services concept to frame the findings obtained during the FG discussions. However, participants often related to key items that did not fit the ecosystem service typology, such as agricultural practices, management regimes or various aspects of sustainability of farming. To gain a complete picture of how farmers and the general public understand ecosystem service-related concepts, all these aspects were included in the analysis.

The text transcripts and video recordings were examined using content analysis. Content analysis is a method that is widely used to describe and quantify a phenomenon through systematic scrutiny of written and visual messages (Robson, 1993). According to Stewart et al. (2007), content analysis is the most rigorous approach for analyzing the data generated by FGs. Content analysis identifies key items (recording units such as words, phrases or concepts) and classifies these items into a set of themes (categories) to describe one or several general phenomena (Elo and Kyngäs, 2008). The interpretation of individual items also included gestures, tone of voice and other nonverbal signs to complement the information in the transcripts (Stewart et al., 2007). Content analysis may be used inductively or deductively depending on previous knowledge of a topic and the purpose of a study (Elo and Kyngäs, 2008). We followed a mixed approach. We conducted a deductive analysis for ecosystem services because we aimed to classify the agriculture-environment relationships based on the typology established by TEEB (The Economics of Ecosystems and Biodiversity) (Kumar, 2010). However, items that did not fit this typology were classified into additional categories that were created and refined in an inductive manner (economic and social issues of sustainability that are discussed below).

Hence, to guide the analytical process and facilitate the presentation of results, the ideas or items of information that appeared in the transcripts were coded into three primary categories: agricultural practices, ecosystem services and economic and social issues of sustainability. A key objective of the analysis was to determine how participants in the FGs described the interactions among the three categories, particularly the effects of the interactions between individual agricultural practices on the delivery of ecosystem services in mountain agroecosystems. Despite the fact that many ecosystem services constitute inputs to the farm (key supporting and regulating services, such as nutrient cycling, or provisioning services, such as forage) (Zhang et al., 2007) and therefore determine the potential practices, participants always discussed agricultural practices as regulators of the ecosystem services obtained from farming. Thus, when participants discussed

environmental aspects related to animal agriculture, we used the ecosystem services framework (Rodríguez-Ortega et al., 2014) to classify the items into four subcategories. We followed the definitions proposed by TEEB, which classify ecosystem services as follows: i) provisioning services (products obtained from ecosystems); ii) regulating services (benefits obtained from the regulation of ecosystem processes); iii) supporting services (necessary for the production of all other ecosystem services); and iv) cultural services (nonmaterial benefits that people obtain from ecosystems through spiritual enrichment, cognitive development, reflection, recreation, and aesthetic experiences). In our analysis, biodiversity was considered as an individual ecosystem service (supporting service: gene pool protection/biodiversity conservation) although biodiversity is a complex phenomenon with multiple roles in the delivery of many other ecosystem services, such as a regulator of ecosystem processes and as a service in itself (Mace et al., 2012).

Despite the focus on environmental issues, the participants often referred to a wide diversity of economic and social aspects regarding mountain farming and agriculture in general. These heterogeneous items were classified into four subcategories: i) farm economics when the participants discussed the profitability of farming and management; ii) social issues at the farm level when the participants discussed, for example, labor, quality of family life and continuity; iii) socio-economic contexts when the participants reflected on, for example, rural development issues and models of agriculture and food chains; and iv) policy/legal contexts when the participants discussed diverse policies such as the CAP, agri-environmental schemes and sanitary regulations, among others.

The content analysis did not aim to differentiate between individuals because an important aspect of FG research is to examine the joint construction of meaning (Bryman, 2012). Therefore, video recordings and text transcripts were analyzed separately for the two main population targets, farmers and nonfarmers. The results were partly presented as transcripts, citations or quotations to better illustrate the results and report how people construct and refer to the topic under study (Boogaard, 2009). We also created four diagrams that represent collective mental constructs, i.e., aggregated models of the views of the participants on the importance of and the relationships among agricultural practices and subcategories, either ecosystem services or sustainability issues. Each agricultural practice and subcategory was represented by a specific color, and the size was proportional to the total amount of time that the participants discussed the practice or subcategory. There were no points of disagreement or negotiation within the FGs; participants mostly shared their personal opinions, concerns and experiences. Therefore, we presumed that people spent more time discussing, i.e., attached greater importance to, issues that they knew and understood (see the discussion times for each category in Tables A1–A3 included in Appendix A).

The diagrams were designed based on additional assumptions. In the FG discussions, the participants always expressed the importance of the provision of quality and safe food, and these items were always classified as a provisioning ecosystem service rather than as an issue of sustainably (socio-economic context). Additionally, people often discussed several items in bundles, i.e., corresponding to different subcategories in the same debate; in these cases, time was assigned to each subcategory proportionally and separately. Similarly, time was assigned proportionally when a particular agricultural practice affected several ecosystem services and/or issues of sustainability. The analytical framework is summarized in Fig. 1.

3. Results

None of the participants in the FG discussions knew of or were familiar with the term “ecosystem services.” Several of the participants had a good intuitive understanding of the concept of ecosystem services and used phrases such as “goods that nature provides to society,” “utility of diverse natural environments” or “economic benefits from nature”. However, other participants interpreted “ecosystem services” as the responsibility that humans have to preserve nature. Despite the initial questions that focused on the relationships between animal agriculture and the environment, other social and economic sustainability issues were recurrent during discussions.

3.1. Ecosystem services discussed by farmers

The farmers discussed several ecosystem services (14) and associated agricultural practices (15) (Fig. 2) and established many relationships among practices and various economic and social sustainability issues.

One of the most important ecosystem services discussed was the provision of “quality foods”, which always involved general aspects concerning food safety and the quality of food production. The production of quality foods on HNV farmland was enhanced by feeding the animals “well” and by practicing “ethical production”. The farmers believed that natural and healthy animal diets involved the limited use of medicines and additives to produce safe food and avoid the bioaccumulation of drugs in products. Ethical production referred to the rearing of animals outdoors, a method that was considered better than rearing indoors.

> *I do not believe that the calf reared indoors is the same as the calf that lives in the field quietly; it is not the same to be in the middle of a muddy paddock than in the clean countryside* [FG beef farmers, Participant 1].

> *Consumers prefer lambs that they know are well reared. They have seen the lambs, and they know the activity, the farmer, the territory* [FG sheep farmers, P3]. *In intensive livestock farming, they abuse antibiotics, and people say that the antibiotics get to us through the products we eat* [FG sheep farmers, P5].

Simultaneously, quality foods were related to the cultural service “culture/art” through gastronomy and local production. Another provisioning service that was considered by farmers was the provision of “raw materials”, which was associated with self-sufficiency practices to obtain fodder, nuts and fruits from trees located near the farm. Clean water was also considered an essential provisioning service but was not connected to any particular practice; instead, clean water was always linked to pollution problems arising from intensive farming.

The farmers noted and discussed several regulating ecosystem services in detail. The prevention of wild forest fires was a recurrent subject during the discussions. The prevention of forest fires was discussed in connection with five different practices related to forest and shrub clearing (forestry regulations and management) and to appropriate grazing management (winter use of pastures to force animals to graze marginal areas and fencing, among others).

> *To clean the forest, you need to use it in winter; animals in the spring only eat the fresh parts, but in the winter, they are forced to eat everything. There are big differences between fenced areas that become open for grazing and the surrounding areas* [FG beef farmers, P2].

The incremental encroachment of shrub biomass was an important concern among farmers because it resulted in the loss of forage resources, limited access and increased the risk of wildfires. The optimal grazing pressure also affected other regulating services, such as “soil fertility” (natural fertilization with manure), “waste management” (prevention of water pollution), and “erosion prevention” (avoidance of excessive trampling and maintenance of

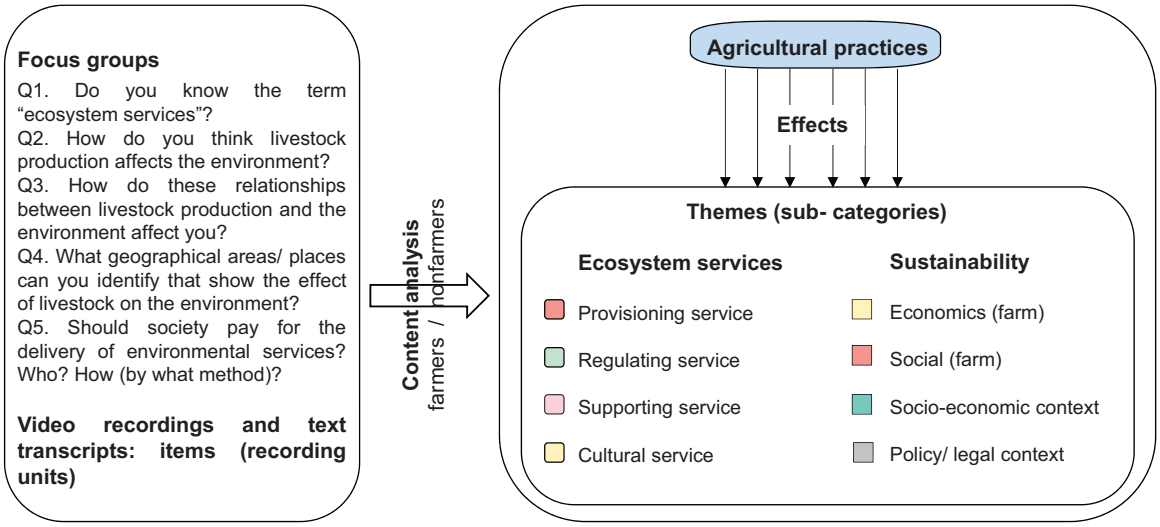

Fig. 1. Analytical framework.

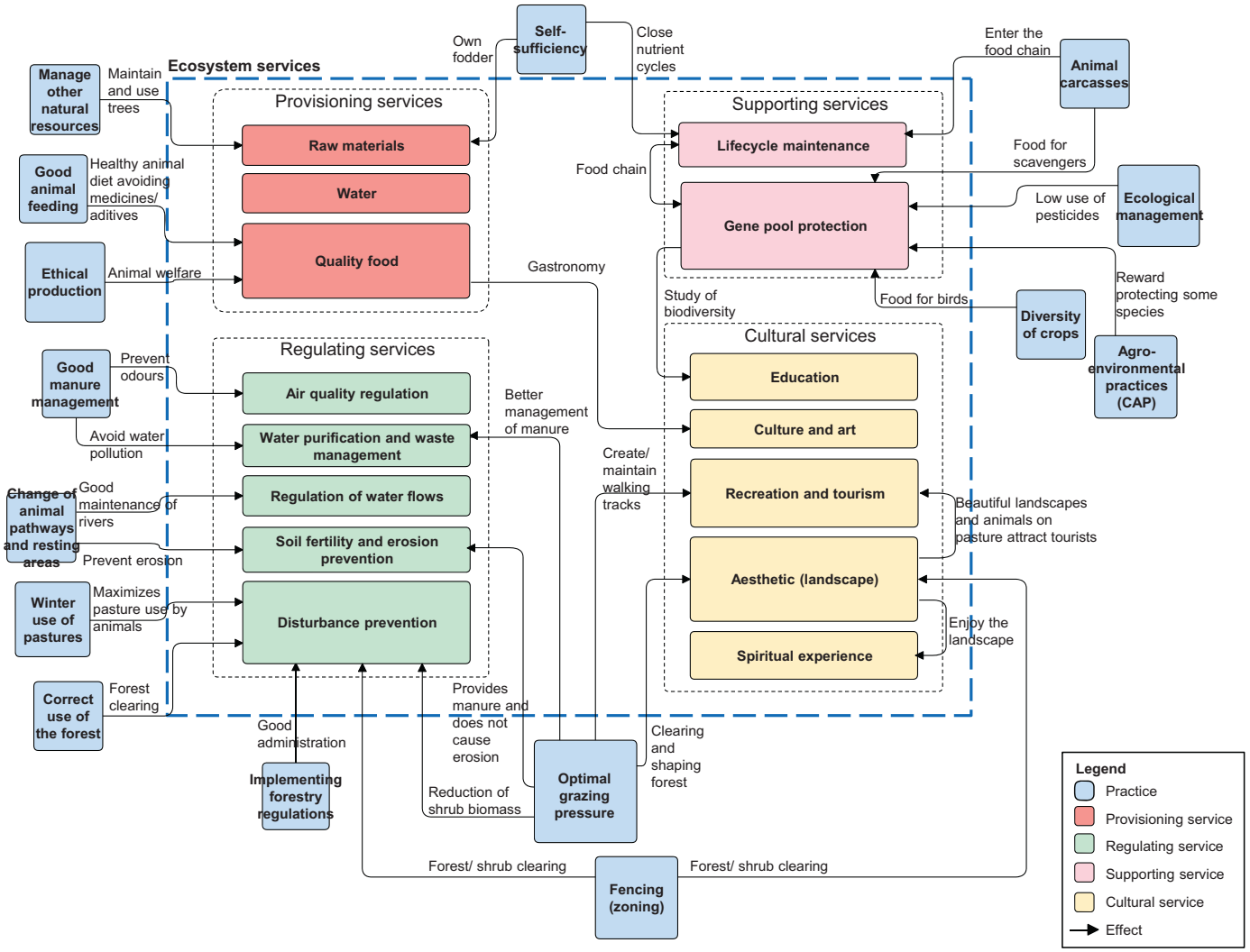

Fig. 2. Graphical abstract of discussions of farmers (two focus groups) on the relationships between agricultural practices and ecosystem services. The size of the figures is proportional to the time that each item was discussed during the focus groups. The arrows indicate effects between agricultural practices and ecosystem services, or between different ecosystem services, as expressed by the focus group participants.

slopes). Changing the pathways and resting areas of animals was noted as an important practice for managing soil fertility, preventing erosion, maintaining the quality status of rivers (avoidance of pollution and preservation of riparian vegetation). "Air quality" was affected by the proper processing of manure to prevent odors, which also affected "waste management" by preventing the pollution of water by manure.

"Gene pool protection" (biodiversity) was a widely discussed supporting ecosystem service. According to the farmers, biodiversity was affected by several practices: ecological management (avoidance of pesticide use, which benefits floral diversity and insects); diversity of crops used to feed livestock (favors the presence of birds, which feed on grains and insects); specific agri-environmental programs that support farmers in protecting endangered species; and dead animals left in the pasture to feed scavengers (mostly vultures). These practices were better integrated in the food chain and therefore contributed to the maintenance of the cycle of life.

> *Livestock, if rationally managed, is going to favor biodiversity. Livestock helps close the circle in trophic chains because it becomes feed for wild animals that otherwise would not have other ways to survive* [FG sheep farmers, P5].

> *Where you see grazing cows, there are always starlings below, and red kites appear when you cut the grass.* [FG beef farmers, P2]. *Insects also benefit. It is all part of the trophic chain* [FG beef farmers, P1].

For the farmers, "gene pool protection" and "life cycle maintenance" were connected and dependent on each other. "Gene pool protection" also affected the cultural service "education", which was related to the study of biodiversity.

The "aesthetic" property of the landscape was the most widely recognized cultural ecosystem service. For the farmers, the cultural landscape was created by the livestock, and the farmers could intervene by modifying the landscape with fencing and by providing optimal grazing pressure, clearing forests and maintaining meadows. This "aesthetic" property of the landscape was connected to "recreation/tourism" because beautiful cultural landscapes and animals in pastures attract rural tourism.

> *Tourists appreciate landscapes where animals have been grazing, but they do not know why. They get emotionally moved when they go to the countryside and see a goat. It is like a fish bowl with or without fish; if there are no animals, it is a bit disappointing* [FG beef farmers, P1].

Another direct effect of grazing animals on the attraction of tourism was related to the maintenance of open forests and the creation of walking trails for hiking. The "spiritual experience" realized by both farmers and visitors due to the enjoyment of landscapes was also noted.

3.2. Economic and social sustainability issues discussed by farmers

The farmers discussed approximately 12 highly interrelated sustainability issues and associated some of them with only five practices (Fig. 3). In general, farmers were more concerned about the policy/legal context than about other practices. The most discussed item was "agri-environmental schemes"; however, these schemes were mainly discussed in connection with the "quality of life" of the farmer and his/her family because subsidies improved the profitability of farming and contributed to the welfare of the household.

> *Agri-environmental measures have been a big help for livestock in the last six years; without them, we would not be here* [FG sheep farmer, P2].

> *Thanks to the subsidies, we could invest in machinery, and we could progress* [FG beef farmer, P2]. *In the last 20 years, all prices went up except our products, which is why we depend on subsidies; without them, it would be impossible* [FG beef farmer, P5].

The farmers also had several concerns about the way in which agri-environmental schemes were designed; they heavily criticized the horizontal distribution of premiums among farmers, independent of the handicaps or marginal character of each farming system.

> *Agri-environmental subsidies should compensate our environmental work; there are people who do nothing and still get them. The same policy for all does not work* [FG beef farmer, P5].

> *It is necessary to differentiate according to the characteristics of the activity and the area* [FG sheep farmer, P2]. *Initially, the subsidies were targeted towards less-favored areas, but in fact they are distributed equally for all farmers, so less-favored areas will remain the same* [FG sheep farmer, P3].

The "legal framework" was discussed in relation to two issues. First, "wildlife conflicts" were discussed in reference to hunting regulations and conservation policies; for example, the prohibition of wild boar hunting out of season increases crop damage and economic losses caused by the growth of the boar population. Second, the farmers discussed how the rights to use some "communal grasslands" were badly managed (short-term rights and prohibited areas), with negative effects on the availability and maintenance of grazing infrastructures.

Zoning and fencing of pastures was discussed for a long time. Zoning helped avoid problems with other farmers using "communal grasslands", but the farmers demanded access to larger grazing areas and further regulation (long-term rights) to facilitate grazing management and increase profitability. Fencing was also discussed with respect to economic and quality-of-life issues (see below).

"Profitability" was the most important item regarding farm economics and was discussed relative to the "self-sufficiency" of a farm (low dependence on external factors), "mechanization" (facilitated and optimized labor), "fencing" (easier and more profitable management), and "grazing in mountains" (low feeding costs). Another issue that was important to farmers was the "use and price of inputs". For example, higher fuel consumption caused by mechanization decreased farm self-sufficiency, but farmers felt that mechanization reduced waste and improved the management system. Self-sufficiency was also associated with "farm structure and size" because the farmers thought that the size of the operation and the stocking rate should be based on the area of land.

Regarding social issues, the farmers were highly concerned with "wildlife conflicts", which were affected by "diversity of crops" (the diversity attracted wild boars and increased damage) and "animals grazing in mountains", which were occasionally hunted by feral dogs. Other relevant social issues were the "quality of life" (mentioned many times during discussions) and "labor conditions" of farmers relative to fencing, mechanization, animal grazing in mountains, and crop diversity; these practices involve lower demands for labor and easier labor organization.

In the socio-economic context, "rural development" was positively associated with self-sufficient farms because self-sufficient farmers were considered profitable and resilient.

Additionally, the farmers discussed different issues of sustainability, such as the effects of the CAP", "price of outputs", "diversification of production", "farm continuity" and some "ethical aspects of food production". However, the farmers did not connect these issues to other items.

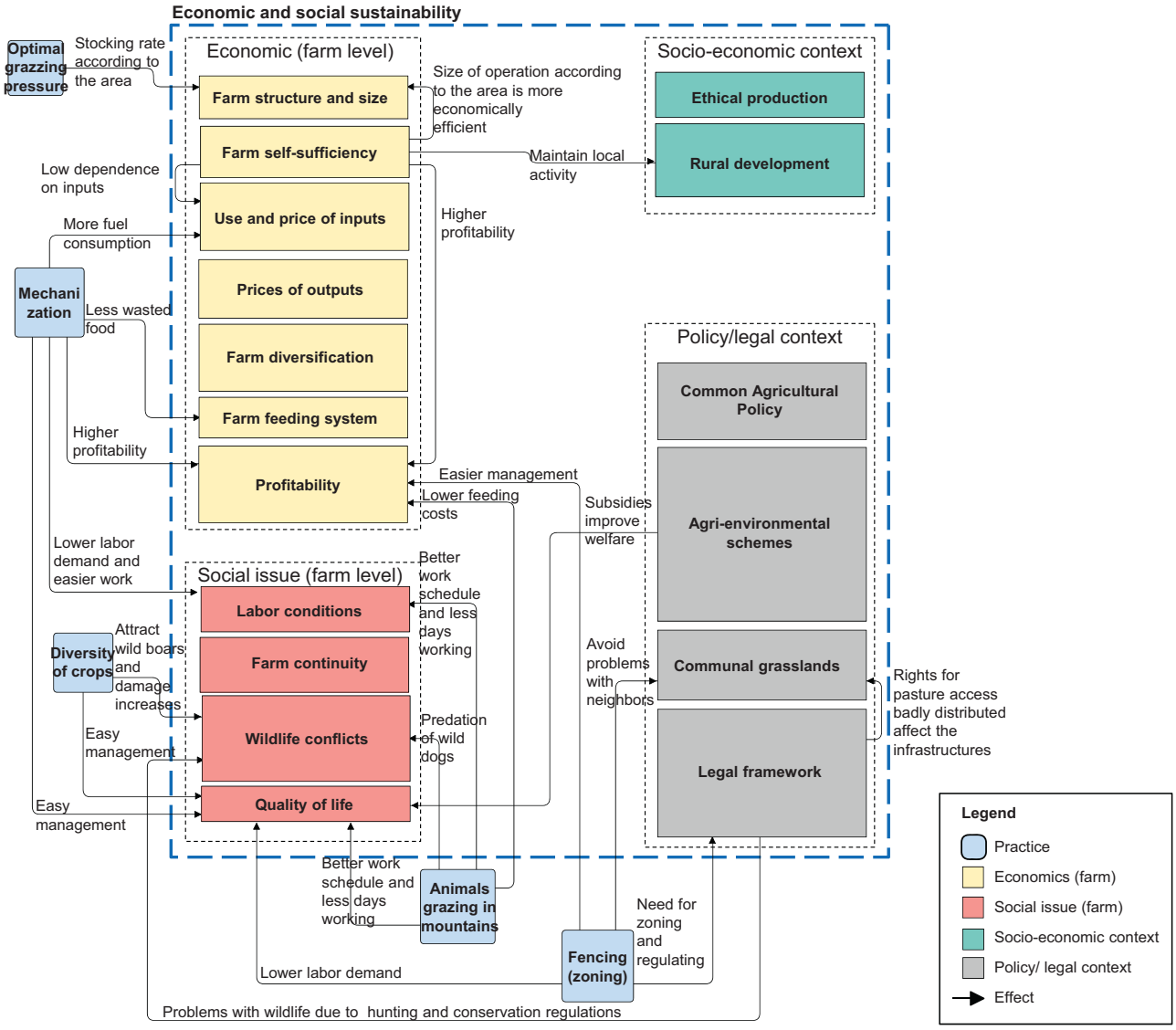

Fig. 3. Graphical abstract of discussions of farmers (two focus groups) on the relationships between agricultural practices and economic/social sustainability. The size of the figures is proportional to the time that each item was discussed during the focus groups. The arrows indicate effects between agricultural practices and sustainability issues, or between different sustainability issues, as expressed by the focus group participants.

3.3. Ecosystem services discussed by nonfarmers

The nonfarmers also discussed several ecosystem services (13) associated with agricultural practices (13), but the duration of the discussions varied among items, with much more time dedicated to discussions of food quality, the aesthetic value of the landscape and other cultural services. In contrast to the farmers, the nonfarmers associated particular practices with only one (rarely two) ecosystem service (Fig. 4) or sustainability issue.

The most discussed item was the provision of "quality foods", which nonfarmers considered to be affected by three practices: reduction in the use of drugs, proper (natural) feeding of animals, and ethical production with concern for animal welfare (animals living outdoors, grazing and walking around).

> *The quality of meat is correlated with the quality of the animal's life. The quality of the feed is different* [FG consumer association, P2]. *A mountain lamb is different from one that is cramped in the feedlot and that has never eaten grass but just concentrates and is given a lot of medicines* [FG consumer association, P4].

Another provisioning service that was discussed for a shorter duration was "genetic resources", particularly with respect to the importance of the use of and preservation of native species and varieties. The nonfarmers briefly discussed the provision of "medicinal resources" but did not connect "medicinal resources" to any particular practice or other ecosystem service.

The regulating services were not discussed in depth by the nonfarmers. The most important service was the prevention of forest fires, which was connected to grazing in the mountains and using communal pastures. The nonfarmers discussed that allowing animals to eat shrub biomass was a more cost-effective prevention tool than the mechanical clearing of shrubs and that communal pastures were easier to manage and guaranteed that all pastures are grazed. Optimal grazing pressure also affected "waste management" because manure was integrated into the local environment, affecting "soil fertility" through natural composting.

> *In farms where the stocking rate is in accordance with the environment, there is an equilibrium by which animals feed on pasture and give composted fertilizer back to nature in the form of manure* [FG teachers, P2].

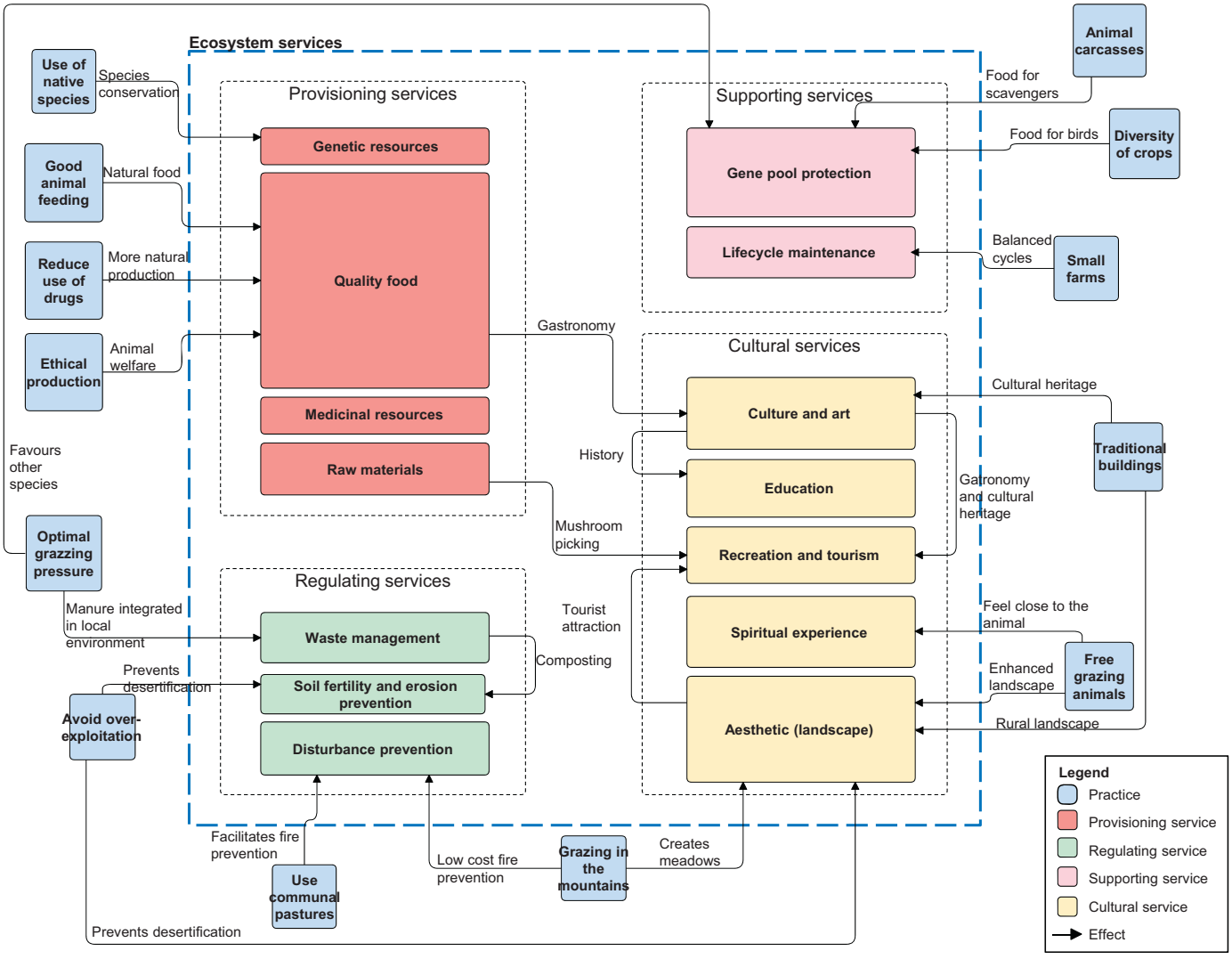

Fig. 4. Graphical abstract of discussions of nonfarmers (three focus groups) on the relationships between agricultural practices and ecosystem services. The size of the figures is proportional to the time that each item was discussed during the focus groups. The arrows indicate effects between agricultural practices and ecosystem services, or between different ecosystem services, as expressed by the focus group participants.

"Soil fertility and erosion prevention" could also be affected by the overexploitation of resources, which could eventually lead to desertification.

"Gene pool protection" was the most discussed supporting service among nonfarmers and was affected by three different practices: optimal grazing pressure that favored the coexistence of species; carcasses of dead animals left in the pastures to feed scavengers; and a high diversity of crops to provide feed for birds. "Life cycle maintenance" was discussed in connection to small-scale farming because the nonfarmers thought that small farms maintained more balanced nutrient cycles.

> *It is very important to close cycles; a small number of animals in a small territory can do so with the help of the local biodiversity* [FG consumer association, P1].

For extended periods, the nonfarmers discussed cultural ecosystem services in bundles. Among these services, the most important one was the "aesthetic" value of landscapes. According to the nonfarmers, this service was affected by four practices: avoiding the overexploitation of pastures (to prevent desertification); grazing in the mountains (to create and maintain meadows); maintaining traditional buildings (to provide shelters, water points, and popular architecture, among others); and freely grazing animals (to enhance the quality of the landscape and to make it more beautiful with animals). The freely grazing animals evoked a type of "spiritual experience" for some nonfarmers who valued close contact with the animals.

> *Finding animals in the countryside is a primary contact with other mammals that helps you to know yourself and makes you think. There is not a single child who does not get excited in front of an ewe, pig, or goat* [FG teachers, P7]. *Seeing animals in the countryside makes you think differently; they do not go with an engine, but they go on their own with a movement you do not control, and that is striking to us* [FG teachers, P8].

The "aesthetic" landscape affects "recreation and tourism" because tourists are attracted to beautiful landscapes. This service was also connected to the provisioning service of "raw materials" for mushroom picking, which is very popular in this area, and to "culture and art" through local gastronomy. Gastronomy was also related to food quality and occupied a central role in the local cultural heritage.

> *Extensive livestock encompasses higher quality differentiated products. When I travel, the first thing I look for is gastronomy and local*

quality products, and it is better if they come from a small farmer [FG consumer association, P3]. *The best is to know how they make it and that they tell you face to face; quality labels do not guarantee anything* [FG consumer association, P7].

"Culture and art" was also related to "education" through local history.

3.4. Economic and social sustainability issues discussed by nonfarmers

The nonfarmers discussed approximately eight issues of sustainability and five related practices (Fig. 5). The nonfarmers cared more about general socio-economic issues centered on farming, particularly "rural development", than farmers did. The nonfarmers believed that direct marketing helped avoid intermediaries, benefited farmers and consumers and promoted rural activities. Other issues of sustainability, such as "legal framework" (referring to rural development regulations), "agro-environmental schemes" (affected the "prices of outputs" because subsidies contributed to cheap food products) and economic "diversification" (other jobs increased village activity and wealth), were also related to rural development. "Ethical production" was discussed in terms of the general model of agriculture and how food is produced and was very important, but the nonfarmers did not connect "ethical production" to any other factor affecting sustainability.

Regarding social issues at the farm level, nonfarmers had different views of "wildlife conflicts" and were concerned that the prohibition of leaving carcasses in pastures was the primary reason why scavengers suffered from hunger. Another difference in opinion occurred for the installation of fences that impeded wildlife movement. The nonfarmers noted that a greater number of species, including foxes, birds of prey, wolves and bears were affected than the farmers. In general, the nonfarmers supported greater wildlife conservation efforts. The nonfarmers also thought that the "labor conditions" of farmers were worse than the farmers themselves thought; thus, they defended the development of cooperatives to optimize labor, create spare time for weekends and holidays, and increase the use of portable electric fences to facilitate livestock management.

Regarding economics, farm "profitability" was noted many times but was not discussed in detail. Typically, in relation to market prices, the need to diversify the economic activities of farms affected profitability. To the nonfarmers, crop diversity, the creation of cooperatives and the use of native species all contributed to higher incomes. Simultaneously, low agricultural income affected "farm diversification" because low profitability promoted off-farm activities and eventual farm abandonment.

Some issues were discussed without any connections to other items. Particularly relevant was the CAP because although some nonfarmers thought that subsidies were too high, most nonfarmers expressed their support. All participants were critical of the implementation and monitoring of the policy because of multiple frauds and scandals and a lack of accountability.

Premiums can be dangerous. The CAP has done good things but also has failed considerably. There is too much fraud that we need to prevent [FG technicians, P7].

Who should pay the subsidies? We all should. But we are tired of how public money is distributed [FG teachers, P8]. *The subsidies should result in improvement of production while respecting the environment* [FG teachers, P6]. *They should be given to those who do the right thing. Controls exist, but they are not effective* [FG teachers, P4].

4. Discussion and concluding remarks

The number of FGs and stakeholders in this study was limited; however, statistical inference was not our intention. By properly selecting cases to study, our goal was to uncover underlying principles and patterns in the perceptions and reasonings of stakeholders and to contribute to scientific knowledge and development with the generalization of results, *sensu* Flyvbjerg (2006). With the FGs we gained an in-depth understanding of the range of ideas and feelings of individuals regarding agricultural practices, environmental effects and related issues of sustainability in HNV farmland and illuminated differences in perspective between the groups of individuals (Rabiee, 2004). Two contrasting types of individuals were considered in our study: nonfarming citizens who predominantly fund agri-environmental policies and farmers who receive subsidies and are responsible for implementing agricultural practices. We did not find many differences between the two FGs of farmers; however, some differences related to degree of familiarity and certain concerns and interests were observed among the FGs of nonfarmers. The representatives of the consumer association were more concerned about the quality of food products and were particularly critical of the agri-food system. The participants working in education showed greater interest in the cultural ecosystem services of agriculture, i.e., education, culture and art.

The use of different samples of farmers (e.g., those working in industrial farming systems located in favored areas) would likely have rendered different results, particularly in terms of policy design and implementation. In addition, the groups of nonfarmers that were involved in the FGs were limited and were not representative of the general population. The selection of the groups was based on level of formal education and degree of familiarity with the topic to assure the usefulness of the exercise. We recognize that the "average" citizen probably knows very little about farming. However, we believe that the main findings of this study may be relevant in similar regions in Europe. For example, Morgan-Davies and Waterhouse (2010) demonstrated that, despite differences between interest groups, people in Scotland preferred local economics linked to the land, and recommended policies that focused on biodiversity and tourism rather than on forestry and wild land. In addition, Lamarque et al. (2011) analyzed the perceptions of different stakeholders (experts and farmers) on ecosystem services and related farming practices in three mountain areas and found differences (importance of market services for farmers and nonmarket for experts) and common views (importance of aesthetics).

The classification of subcategories during content analysis was another limitation that could mask the multiple interrelations among the subcategories. The items of different subcategories were frequently discussed in bundles, i.e., mixed with discussions of agricultural practices, environmental effects and diverse socio-economic issues at various spatial scales. Additionally, we represented the weights of the different items as proportional to the times of discussion. In certain FG settings this assumption might not be appropriate, e.g., confused points and disagreements or negotiations, which could be discussed at length. Nevertheless, our FG was exploratory, and it was clear that participants largely discussed topics they were familiar with and gave importance to. Therefore, we are confident that the graphic representation reflected the primary links among items and the relative importance according to participants. In this section, we focus on the findings that have the greatest importance to ecosystem service valuation and policy design for HNV farmland areas.

A first consideration is the gap that appears to exist concerning the term "ecosystem service", with academia on one side and farmers and general society on the other. Despite the increasing use of the concept to link the functions of ecosystems to human wellbeing, the final beneficiary, the lay citizen, is not yet aware of

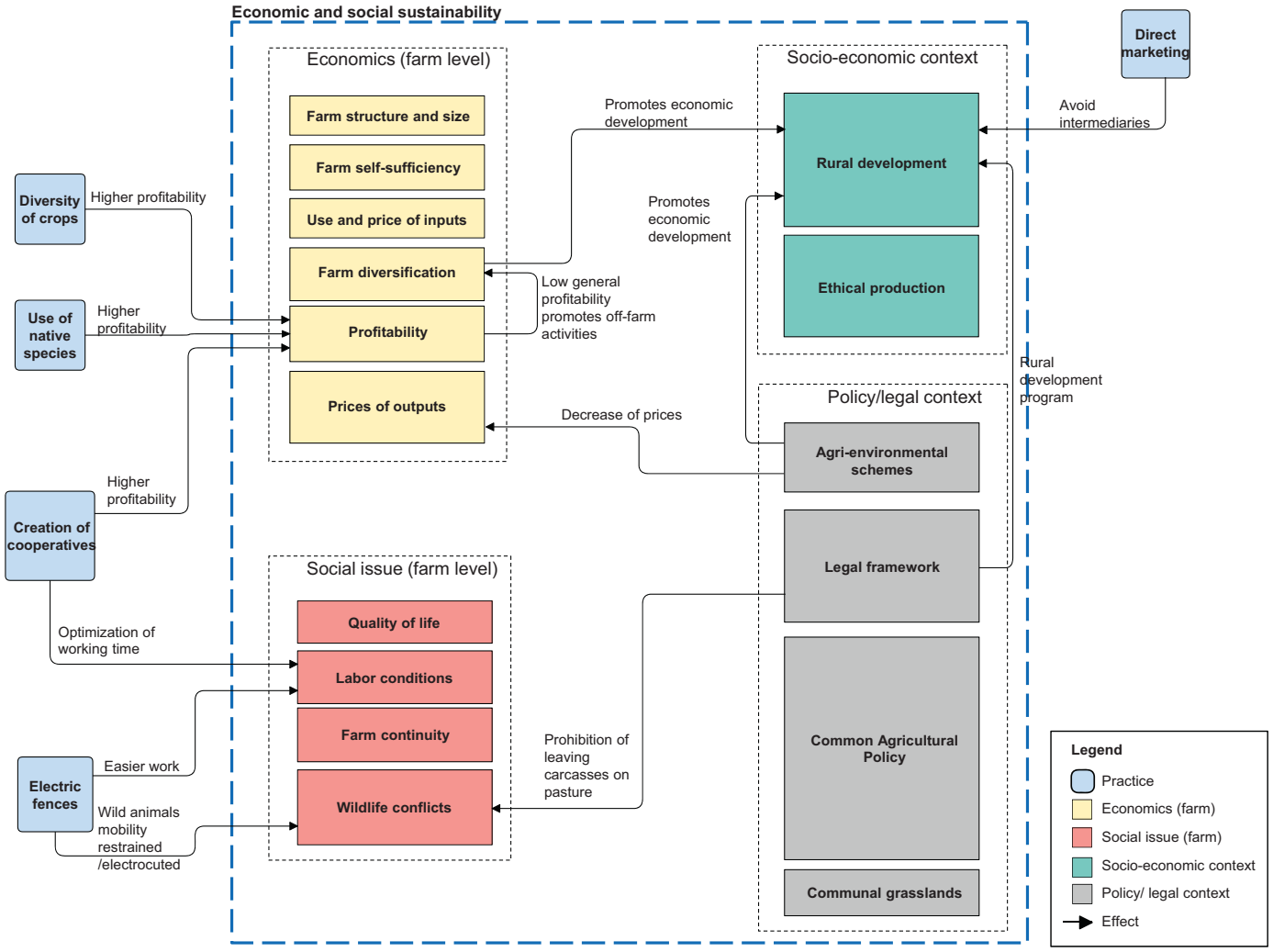

Fig. 5. Graphical abstract of discussions of nonfarmers (three focus groups) on the relationships between agricultural practices and economic/social sustainability. The size of the figures is proportional to the time that each item was discussed during the focus groups. The arrows indicate effects between agricultural practices and sustainability issues, or between different sustainability issues, as expressed by the focus group participants.

this new term or its meaning. As Fisher et al. (2009) state, there is an obvious need to communicate scientific information to the public; the use of the concept of ecosystem services requires a clear definition and understanding by the public. Most participants in the FGs demonstrated an implicit and intuitive recognition of the ecosystem services derived from HNV agriculture, but the concept of ecosystem services must be assimilated by society with an understanding of the different perspectives held by stakeholders to be useful in policy design (Hauck et al., 2013). Combining the ecosystem services concept with other related concepts that are more easily understood, such as the concept of multifunctional agriculture, which places the farm and agricultural activity at the center of its definition, could facilitate this assimilation process (Bernués et al., 2015).

Second, a rigid top-down ecosystem service classification might not be helpful because of multiple interactions among components, the diversity of management regimes, and perceptions of beneficiaries (Fisher et al., 2009), which could place value on the additional features of agroecosystems. For example, for food quality, society (in our case, farmers and nonfarmers) clearly perceived differences in food quality characteristics as a distinct result of the European HNV areas. This key provisioning service is currently missing in the ecosystem service framework. The provision of quality food was the most frequently discussed issue during the discussions with nonfarmers in relation to practices such as the "natural" feeding of animals, the absence or reduction in drug use, and ethical production, including animal welfare and wider ethical considerations of the agriculture model and the food chain. The extrinsic attributes of food products, those that do not depend on the physical and chemical characteristics of the product but on the production system, could also satisfy the expectations of consumers regarding health and safety, knowledge of the origin and the production method or ethical considerations (Bernués et al., 2003; Fernqvist and Ekelund, 2014). Moreover, people intrinsically link food quality to HNV agriculture; therefore, the concept of HNV farmland could be defined in terms of physical characteristics and importance in conservation of biodiversity and in terms of the different qualities of market goods that HNV farmland provides to society.

Third, although farmers did not demonstrate spontaneous knowledge of the ecosystem service concept, they showed a great understanding of multiple ecosystem services and the agricultural practices that influenced their delivery. In other words, farmers hold rich mental concepts of ecosystem services although they are not familiar with the formal terminology (Fischer and Young, 2007). The farmers also established various interactions among these concepts, which indicated a large capacity to recognize the complexity of ecological processes in agroecosystems (Kelemen et al., 2013; Martín-López et al., 2012). The most relevant agricultural practice

was grazing pressure, which influenced key regulating services, such as waste management, soil fertility, erosion prevention, and specifically disturbance prevention (wild forest fires). In combination with other land use practices (correct use of forests, winter use of pastures, and zoning of pastures), grazing affected key cultural services, such as the aesthetic value of the landscape and the possible use of the landscape for recreation and tourism. The farmers intuitively understood that an intermediate intensity level of use of land could improve the delivery of multiple ecosystem services (Huston, 1979), including biodiversity. Biodiversity was enhanced with the ecological management of land (i.e., low use of pesticides and fertilizers, as also observed by Smith and Sullivan (2014)), the diversification of crops, allowing the remains of animal carcasses to remain in grazing areas (key for the conservation of avian scavengers (Margalida et al., 2011)), and the adherence to specific rules for implementing agri-environmental schemes that contribute to the protection of wild species. Notably, biodiversity was indirectly related to farm self-sufficiency because farm self-sufficiency resulted in a greater capacity to close nutrient cycles, in accordance with one of the principles of agroecology (Dumont et al., 2013).

A fourth consideration is the different perceptions of the farmers and nonfarmers concerning the relationships among HNV agriculture, agricultural practices, ecosystem services and sustainability. The farmers focused more on regulating ecosystem services (disturbance prevention and soil fertility, among others), sustainability at the farm level (mostly economic) and agri-environmental policy and other regulatory frameworks that directly affected their activities. Generally, previous studies (Kelemen et al., 2013; Smith and Sullivan, 2014) have shown that the perceptions of farmers are more closely related to their daily lives, particular interests and farming practices. The nonfarmers had less general knowledge about ecosystem services and related practices; however, they dedicated a large amount of time to discussing a small number of ecosystem services, such as the provision of quality food products (discussed above) and diverse cultural ecosystem services. These services were always discussed in bundles (Martín-López et al., 2012), e.g., recreation and tourism were favored by the aesthetic properties of the landscape and by cultural and artistic values. Relative to wider economic and social sustainability issues, the nonfarmers showed more general socio-economic concerns than the farmers, e.g., concerning rural development, the abandonment of agriculture, and the development of agri-food systems. A clear divergence between farmers and nonfarmers was apparent in discussions of the relationships between farming and the conservation of specific endangered species. The farmers were skeptical or against conservation policies for conflicting species (predators) and favored the fencing of grazing areas; whereas, the nonfarmers generally had a favorable opinion of wildlife conservation and were critical of efforts to fence grazing areas.

Finally, we highlight some implications for policy design. Despite their differences, the farmers and nonfarmers both recognized the importance and necessity of social recognition of the public goods delivered by HNV farmland. Both groups also agreed that farmers should be paid for providing ecosystem services through the enactment of agri-environmental policies; however, the farmers and nonfarmers were highly critical of the current implementation and monitoring of these policies within the CAP. The distribution of budgetary resources, the design and implementation of policy measures and the choice of instruments are among the main factors explaining the failure of the CAP for delivering public goods (Cooper et al., 2009). Previous research has indicated a need to regionalize and, if possible, individualize agri-environmental schemes at the farm level (Rodríguez-Ortega et al., 2014). The participants in the FGs agreed that the disadvantages incurred in HNV farming should be compensated for according to location. The farmers agreed that compensation should occur according to a gradient of "marginality" defined by physical disadvantages, such as difficult climate, altitude, slope and remoteness. Furthermore, outcome-oriented schemes based on region-specific environmental targets were preferred by participants; this results-based approach might increase efficiency and ensure that the targeted ecosystem services are provided (Plieninger et al., 2012). Currently, the agri-environmental schemes implemented in the region are intricate and support farmers in a rather horizontal manner, independent of location, and are based on numerous agricultural practices that are sometimes difficult to monitor (e.g., grazing periods and number of grazing animals in remote areas) or are questionable in terms of results (e.g., subsidies given to particular breeds without considering the grazing management of the farm). The ability of farmers to understand the effects of agricultural practices on ecological processes and the provision of ecosystem services would guarantee that outcome-oriented policies can be implemented and monitored.

During the discussions, ecosystem services were clearly interwoven with the wider and more recognizable issues of sustainability that referred to social and economic issues at various (farm, local, and global) scales. The contributions of the ecosystem service concept to sustainability is currently under debate. Some authors claim that the concept of ecosystem services must integrate normative and transformative knowledge before it can play a significant role in human-nature relations (Abson et al., 2014) or that the concept of ecosystem services cannot encompass the complexity of the multiple biophysical, socioeconomic and political challenges we face (Norgaard, 2010). More pragmatic approaches point to major research gaps, among which understanding the diversity of stakeholders and their benefits and preferences for ecosystem services should be a priority (Bennett et al., 2015). In this study, individuals were able to express opinions toward various ecosystem services and the relationships among them and with agricultural practices that were well grounded in complex mental models, independent of scientific terminology, as described by Fischer and Young (2007). Therefore, systemic approaches applied to policy design and implementation can have environmental and economic and socio-cultural benefits, for example, enforcing the concept of HNV farmland (Plieninger et al., 2012). Managing ecosystem services in an integrated manner could also help minimize trade-offs among them (de Groot et al., 2010; Raudsepp-Hearne et al., 2010), notably between provisioning services (i.e., agricultural production) and biodiversity. In summary, when applied to agroecosystems, the ecosystem service framework should be embedded into wider assessments of sustainability to increase the acceptance, adoption and efficacy of agri-environmental policies.

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Appendix A. Percentage of time and total time spent by participants discussing each category of ecosystem services, agricultural practices and sustainability

Table A1
Percentage of time and time in minutes spent by participants discussing each category of ecosystem services (two focus groups with farmers and three with citizens).

	Farmers n = 11	Citizens n = 22	Total n = 33
Provisioning	16,3	40,7	32,7
Food (meat and milk)	14,6	36,8	29,6
Water	0,7	0,0	0,2
Raw materials (firewood, forage, mushrooms)	1,0	3,3	2,6
Genetic resources	0,0	0,3	0,2
Medicinal resources	0,0	0,2	0,1
Ornamental resources	0,0	0,0	0,0
Regulating	24,2	7,5	12,9
Air quality regulation	1,1	0,0	0,4
Climate regulation (incl. C seq.)	0,0	0,0	0,0
Disturbance prevention (forest fires)	17,5	3,6	8,2
Regulation of water flows	0,9	0,0	0,3
Water purification/waste management	1,6	3,1	2,6
Soil fertility/erosion prevention	3,0	0,8	1,5
Pollination	0,0	0,0	0,0
Biological control (pests)	0,0	0,0	0,0
Supporting	21,9	14,2	16,7
Lifecycle maintenance (nutrient cycling, photosynthesis)	2,5	3,2	3,0
Gene pool protection (biodiversity maintenance)	19,4	10,9	13,7
Cultural	37,6	37,6	37,6
Aesthetic (landscape/vegetation)	18,3	14,3	15,6
Recreation/tourism	11,7	4,2	6,7
Culture/art	0,1	7,4	5,0
Spiritual experience	3,9	7,2	6,1
Education/cognitive dev.	3,6	4,4	4,2
Total%	100,0	100,0	100,0
Time in minutes	26.55	54.42	80.97

Table A2
Percentage of time and time in minutes spent by participants discussing each category of agricultural practices (two focus groups with farmers and three with citizens).

	Farmers n = 11	Citizens n = 22	Total n = 33
Agricultural practices (ecosystem services)	57,6	73,1	64,1
Agro-environmental practices (CAP)	7,1	0,0	4,1
Animal carcasses	1,0	7,3	3,6
Avoid over-exploitation	0,0	2,5	1,1
Change of animal pathways and resting areas	1,2	0,0	0,7
Correct use of the forest	2,1	0,0	1,2
Diversity of crops	2,2	5,5	3,6
Ecological management	3,4	0,0	2,0
Ethical production	6,4	11,2	8,4
Fencing (zoning)	7,8	0,0	4,5
Free grazing animals	0,0	4,1	1,7
Good animal feeding	0,6	11,5	5,2
Good manure management	0,8	0,0	0,5
Grazing in the mountains	0,0	1,7	0,7
Implementing forestry regulations	0,1	0,0	0,0
Manage other natural resources	1,8	0,0	1,1
Optimal grazing pressure	17,9	9,6	14,4
Reduce use of drugs	0,0	11,2	4,7
Self-sufficiency	1,1	0,0	0,6
Small farms	0,0	1,7	0,7
Traditional buildings	0,0	4,4	1,9
Use of communal pastures	0,0	1,2	0,5
Use of native species	0,0	1,2	0,5
Winter use of pastures	4,1	0,0	2,4
Agricultural practices (sustainability)	42,4	26,9	35,9
Animals grazing in mountains	14,1	0,0	8,2
Creation of cooperatives	0,0	15,7	6,6
Direct marketing	0,0	1,0	0,4
Diversity of crops	4,3	2,2	3,4
Electric fences	0,0	5,8	2,4
Fencing (zoning)	12,0	0,0	7,0
Mechanization	10,6	0,0	6,2
Optimal grazing pressure	1,5	0,0	0,9
Use of native species	0,0	2,2	0,9
Total%	100,0	100,0	100,0
Time in minutes	20.97	15.07	36.03

Table A3
Percentage of time and time in minutes spent by participants discussing each category of sustainability issues (two focus groups with farmers and three with citizens).

	Farmers n = 11	Citizens n = 22	Total n = 33
Economics (farm level)	27,4	9,6	19,0
Profitability	6,8	2,2	4,6
Use and price of inputs	5,5	0,2	3,0
Prices of outputs	4,1	4,3	4,2
Farm structure and size	1,9	0,2	1,1
Farm management: self-sufficiency	3,1	0,9	2,1
Farm management: diversification	4,3	1,9	3,2
Farm management: feeding system	1,6	0,0	0,8
Social (farm level)	14,7	9,0	12,0
Labor/working conditions	2,2	1,9	2,1
Quality of life/satisfaction	0,8	0,5	0,7
Farm continuity (ageing pop./succession)	3,6	2,0	2,8
Wildlife (and other) conflicts	8,1	4,7	6,5
Socio-economic context	12,5	44,1	27,4
Rural development/abandonment	6,2	12,1	9,0
Quality of food products	3,0	13,4	7,9
Food safety	0,0	10,0	4,7
Food security	1,1	0,7	0,9
Ethical aspects of food production (industrialization, animal welfare, etc.)	2,2	8,0	4,9
Policy/legal context	45,4	37,2	41,5
CAP	6,7	23,3	14,5
Agri-environmental schemes	18,9	4,0	11,8
Communal grasslands (access, infrastructure, etc.)	5,7	0,6	3,3
Legal framework (sanitary regulations/abattoirs)	14,1	9,4	11,9
Total%	100,0	100,0	100,0
Time in minutes	92.45	82.70	175.15

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