Seeing Northern European Fjord and Mountain Agriculture Through Farmers' Eyes: A Critical Step in Promoting Sustainability

Authors: Bernués, Alberto, Clemetsen, Morten, and Eik, Lars Olav

Source: Mountain Research and Development, 36(3) : 276-285

Published By: International Mountain Society

URL: https://doi.org/10.1659/MRD-JOURNAL-D-15-00108.1

Mountain Research and Development (MRD)
An international, peer-reviewed open access journal
published by the International Mountain Society (IMS)
www.mrd-journal.org

MountainResearch
Systems Knowledge

Seeing Northern European Fjord and Mountain Agriculture Through Farmers' Eyes

A Critical Step in Promoting Sustainability

Alberto Bernués[1,2]*, Morten Clemetsen[3], and Lars Olav Eik[4]

** Corresponding author: abernues@aragon.es*

[1] Department of Animal and Aquacultural Sciences, Norwegian University of Life Sciences, P.O. Box 5003, No-1432 Ås, Norway
[2] Centro de Investigación y Tecnología Agroalimentaria de Aragón, Instituto Agroalimentario de Aragón, Universidad de Zaragoza, Zaragoza, Spain
[3] Department of Landscape Architecture and Spatial Planning, Norwegian University of Life Sciences, P.O. Box 5003, No-1432 Ås, Norway
[4] Department of International Environment and Development Studies, Norwegian University of Life Sciences, P.O. Box 5003, No-1432 Ås, Norway

Agriculture is a minor contributor to local economies in European mountain and fjord areas where tourism is predominant; however, it is essential to maintain the agricultural landscape and other important nonmarket functions of mountain agroecosystems. Policy-makers have aimed to support agriculture in these areas, but farmers' perspectives are poorly understood. The purpose of this study was to analyze (1) the main characteristics of livestock farming systems and the recent changes they have undergone, (2) farmers' perceptions of different functions of agriculture, (3) farmers' goals, and (4) the relationships among these elements in order to support more targeted policy-making in fjord and mountain areas in Scandinavian countries. We collected data from 27 farms and conducted univariate and multivariate (principal components and cluster) analyses. Most recent changes in farming have been related to improving working conditions and increasing tourist activity. According to the farmers, the main nonmarket functions of agriculture were (1) maintaining cultural heritage and rural development, (2) delivering environmental services, and (3) promoting traditional agriculture. The farmers' primary goals were (1) innovating for better farming, (2) improving the family's quality of life, and (3) achieving economic objectives. We identified 2 clusters of farmers based on divergent perceptions of rural development and the goal of improving the family's quality of life. These results point to the importance of integrated policies that address agricultural, environmental, and rural development together and take into account farmers' diverse perceptions and goals.

Keywords *Social sustainability; farmers' perceptions; farmers' goals; farming functions; rural development; quality of life; policy design; Norway.*

Peer-reviewed: *April 2016* ***Accepted:*** *May 2016*

Introduction

Agriculture in the northern European mountains has progressively retreated (Staaland et al 1998; Olsson et al 2000) following a general process of abandonment since the mid-20th century (MacDonald et al 2000). Abandonment of less favorable areas and intensification in favorable areas are major drivers of the loss of agricultural landscapes (van Vliet et al 2015) and decreasing biodiversity (EEA 2004). Despite this, animal farming is still important in the mountains and other marginal areas in Europe (Bernués et al 2011).

In Norway, small-ruminant (mainly sheep) production systems are predominant. In 2009, there were approximately 15,000 flocks of sheep, with an average size of 67 breeding ewes. The figures are small compared with the main sheep-producing countries in Europe but are considerably larger than in other Scandinavian countries (Vatn 2009). Lamb meat consumption is comparatively high (5.7 kg person^{-1} year^{-1}) in Norway because it is a traditional product that consumers associate with mountains, fjords, and pastures (Hersleth et al 2012). Animal farming in these areas is considered a multi-output activity that produces food and has other nonmarket functions that are increasingly in demand (Bernués et al 2015).

Multifunctional agriculture is considered a cornerstone of the European Model of Agriculture because it enables the maintenance of characteristic landscapes and social structures in rural areas (Renting et al 2009) together with other public goods, such as farmland biodiversity, water quality, and soil functionality (Cooper et al 2009). A number of biophysical studies have reported that grazing livestock systems are essential to the maintenance of the cultural landscape (eg Staaland et al

1998; Olsson et al 2000), which is a key asset for the tourism industry (Daugstad 2008).

Tourism has developed as a strategy for income diversification in many mountain areas in Europe (Hjalager 1996). In Norway, national and regional government agencies support tourism in remote rural areas (Vik et al 2010). However, there are questions about whether tourism and agriculture are complementary or competitive (Bernués et al 2011). The relationship is not unidirectional, and the border can be vague, depending on the opportunity costs of family labor and the goals and aspirations of household members (Gasson and Errington 1993).

Most analyses of the sustainability of animal farming focus on ecological and economic components (Bernués et al 2011), and social aspects are often neglected (Boogaard et al 2011). The latter authors define "social sustainability" as the ability of the social system to regenerate; to achieve social goals such as cohesion, equity, and development; and to maintain cultural norms and values. The public has invested in enhancing the social sustainability of farming in rural areas, compensating farmers for the disadvantages they suffer (Bergfjord et al 2011) and for the public goods they deliver. However, farmers' opinions and objectives are often ignored in the design of agri-environmental policies (Haukeland et al 2011), and their motivations to continue farming are poorly understood (Vik and McElwee 2011).

There are a number of reasons for this phenomenon. Farmers' motivations have multiple influences that purely economic models cannot capture (Gasson 1973). The goals and values of farmers help explain their behavior, which can also be influenced by psychological factors (Willock, Deary, Edwards-Jones, et al 1999). These objectives, values, and attitudes are heterogeneous, and so the behavior and management styles of farmers vary as well (Schmitzberger et al 2005; Brodt et al 2006; Karali et al 2013). Other nonfinancial dimensions that can influence farmers' decisions and the adoption of agricultural policies are farm structure, household characteristics, the social milieu, and the specific characteristics of the innovation or policy to be adopted (Edwards-Jones 2006).

The goal of this study was to inform and enable more targeted policy-making in fjord and mountain areas in Scandinavian countries. The specific objectives were (1) to analyze the main characteristics of livestock farming systems and the recent changes they have undergone, (2) to understand farmers' perceptions of the multiple functions of agriculture, (3) to identify farmers' goals, and (4) to establish relationships between these perceptions and goals.

Methodology

Study area

The study was conducted in the commune of Aurland (Sogn and Fjordane County) in southwestern Norway (60°52′05″ N, 07°14′36″ E). The Aurland commune has an area of 1467.86 km^2, of which 205.7 km^2 is forest and 5.54 km^2 is cultivated land; the rest is natural nonforest vegetation, freshwater, seawater, glaciers, and unproductive land (bare rock). The landscape is dominated by mountains, with elevations up to 1800 m above sea level (masl), and fjords, including the Aurlandsfjord and the Nærøyfjord, which are branches of the Sognefjord, the world's longest and deepest fjord. The annual average temperature is 2.6°C, and annual precipitation varies between 700 and 2000 mm. The natural vegetation in the valleys ascends from southern boreal and middle boreal zones with coniferous and deciduous forests to the northern boreal zone located near the climatic treeline (Clemetsen and van Laar 2000). Animals are grazed in the mountains between the northern boreal (approximately 900 masl) and alpine zones.

In 2013, the Aurland commune had a population of 1714. Farms and residents are concentrated in the valleys of Nærøydalen, Flåmsdalen, and Aurlandsdalen. In 2012, there were 70 farms, of which 14 had small-scale horticultural production (mostly berries) and 56 were livestock farms (of which 44 raised sheep for meat, 13 raised goats for milk, and 4 raised dairy cows, with a total (adult animals) of 2290 sheep, 1285 goats, and 49 cows (SSB 2012).

Data collection and analysis

Of the 56 livestock farmers in Aurland, 44 were successfully contacted by phone in the summer of 2012. Twenty-seven farmers (48% of total) agreed to a face-to-face interview. The farms were situated between 5 and 550 masl, and the average distance to a population center with a primary school was 8.8 km (ranging from 0.5 to 27 km).

The interviews lasted between 1.5 and 2 hours. We used a closed questionnaire to collect quantitative data on farm structure and management, farmer and household characteristics, the farm's prospects for continuity, recent and planned changes in farming, farmers' perceptions of different farm functions, and their farming goals.

Variables referring to farm structure and management, farmer characteristics, and household characteristics were continuous. The continuity variable was defined as yes if the farmer was younger than 50 years old, or aged 50 or more with children older than 16 years who were willing to take up farming, as no when the farmer was 50 or older without children willing to take up farming, and as unknown when no data were available. The variables referring to recent or planned farm changes were dichotomous (yes/no). To measure farmers' perceptions of different farm functions and their farming goals, farmers were asked to rate a list of statements on a 5-point Likert scale (1 = completely disagree to 5 = completely agree).

http://dx.doi.org/10.1659/MRD-JOURNAL-D-15-00108.1

TABLE 1 Changes in farm characteristics, 1987–2012.

	2012				2007	1987	% change	
	Minimum	Maximum	Coefficient of variation	Average	Average	Average	2007–2012	1987–2012
Land area (ha/farm)								
Agricultural land	3.5	34.4	0.57	13.2	12.9	9.5	2.1	38.4
Cultivated pastures	2.5	17.5	0.39	9.2	9.1	6.1	0.3	49.6
Grazing-only pasture	0.0	20.0	1.11	4.0	3.8	3.4	6.3	18.2
Uncultivated land	5.0	600.0	1.56	105.9	105.7	105.0	0.1	0.8
Mountain pasture (communal)	200.0	3700.0	0.68	1608.0	1608.0	1590.4	0.0	1.1
Number of adult animals per farm								
Meat sheep (16 farms)	6	200	0.76	60	65	60	−7.7	0.0
Dairy goats (9 farms)	73	150	0.27	95	97	76	−2.1	25.0
Dairy cows (2 farms)	11	16	0.26	14	12	8	16.7	75.0

We used univariate analysis to characterize agricultural systems and farm evolution. A *t*-test was performed to check for differences between farms with and without continuity. We used multivariate analysis to explore the multiple relations that can exist within and between perceptions and goals Because we did not consider perceptions and goals as either dependent or independent variables, we used interdependence techniques.

First, 2 principal component analyses (PCAs) allowed us to identify relationships among perceptions and among goals (Willock, Deary, Edwards-Jones, et al 1999). PCA identifies the relationship between variables and reduces the original dimension of the data matrix through the identification of new groups of variables (factors), which retain as much variance as possible. Factors are a linear combination of the original variables and represent the underlying dimension that summarizes the original set of observed variables. Only factors with eigenvalues greater than 1 were retained for further analysis.

Second, the prior factors (by definition noncorrelated) were used in a subsequent PCA to establish relationships between perceptions and goals. Third, a K-means cluster analysis was conducted to segment the study sample according the factors obtained in the last PCA. Finally, we analyzed the differences between farmer profiles with a *t*-test for parametric variables (farmer, household, and farm structure) and a chi-square test for nonparametric variables (continuity and changes in farming).

Results

Characterization of the farming systems

Farm structure: Generally, farms had small agricultural land areas (13.2 ha on average) that had increased considerably (38%) in the past 25 years (Table 1). All of the land was dedicated to animal production except small vegetable gardens for family consumption. Cultivated pastures for summer hay and silage production constituted 69.7% of farmland area, which was an increase of 50% since 1987. The rest of the agricultural land was grazing-only pasture. Much larger areas of uncultivated land (mainly forest) and mountain communal pastures have remained constant over the past 25 years. The fragmentation of agricultural land was rather high; households had an average of 8 plots within 2 km of the home and 5 plots located more than 2 km away.

Of the 27 farms under study, 16 primarily raised sheep for their meat, 9 raised goats for milk, and 2 raised cows for milk. Average herd size was small and had remained constant over the past 5 years.

Household characteristics: Livestock farming was the main activity on 70% of the farms, but off-farm work was very common, especially for farmers' cohabitants. Despite the small size of the operations, nearly 2 working units (annual full-time worker equivalents) were devoted to farming on average. There was very little contracted labor (Table 2).

Continuity: The continuity of farming activities within the family for the next 15 years was ensured in 70% of the farms. We found one significant difference between farms with and without continuity: farmer age (50 and 59, respectively, $P = 0.045$). Working units outside farming approached significance (0.74 and 0.24, respectively, $P = 0.08$).

Recent and projected changes in farming

The main 2 changes that had occurred in the past 10 years were related to the increase or improvement of

http://dx.doi.org/10.1659/MRD-JOURNAL-D-15-00108.1

TABLE 2 Farm and household characteristics.

	Average	Minimum	Maximum	Coefficient of variation
Farmer age	52.8	30	83	0.21
Family size	3.1	1.0	7.0	0.50
Working units[a)]				
On the farm, total	1.8	0.5	3.4	0.39
On the farm, family members	1.6	0.3	3.4	0.43
On the farm, contracted labor	0.2	0	1.5	1.8
Outside the farm, family members	0.6	0	2.1	1.1
	Number of farms		Percentage of farms	
Households with agriculture as main occupation for ...				
... farmer	19		70.4%	
... farmer's partner	12		44.4%	
Farmers with children ...				
... younger than 12 years	7		25.9%	
... between age 12 and 18 years	10		37.0%	
... older than age 18 years	14		51.9%	
Continuity in next 15 years?				
Yes	19		70.4%	
No	4		14.8%	
Unknown (no data)	4		14.8%	

[a)] One working unit is the equivalent of one person working full-time for one year (1845 hours in Norway). Continuity in the next 15 years was assumed if the farmer was younger than 50 years old, or was 50 or older but had children older than 16 years who were willing to take up farming.

mechanization and buildings (Figure 1A). Other changes—such as to the feeding system, grazing management (increased length of the grazing season and more fencing), or farmed species (for example, from sheep to goats)—were also frequent. Of the farms in the study, 40% had started tourism-related activities (such as the construction of cabins for rental), and 30% had started processing local food products (such as sheep meat and goat cheese).

The main change forecast for the next 10 years was the increase in or start-up of tourism-related activity (Figure 1B). Increasing herd size and increasing or improving mechanization and production facilities were also mentioned by a high percentage of farmers, followed by other changes relating to land, grazing, and feeding management.

Perceptions of the functions of agriculture and farming goals

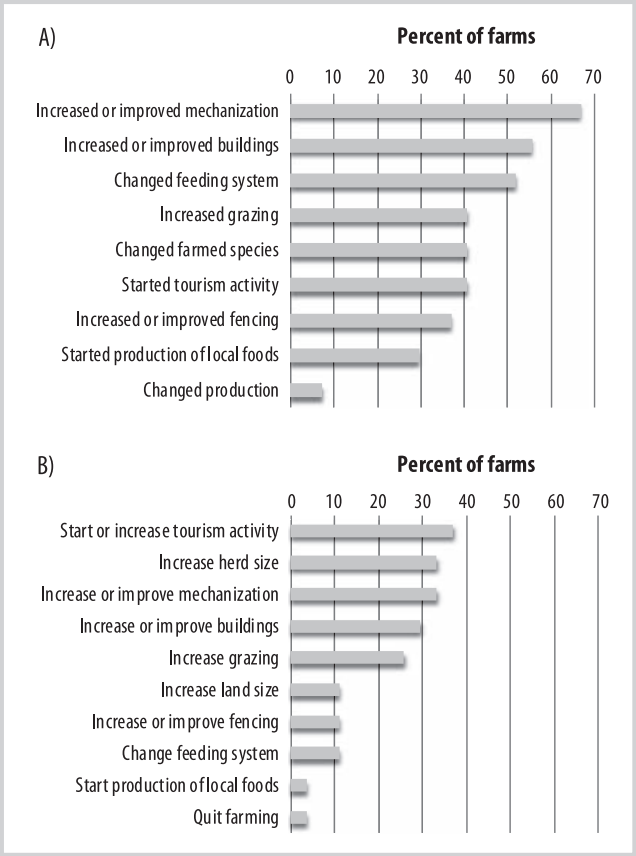
Perceptions of the functions of agriculture: The top 3 functions of agriculture, as perceived by the farmers, were directly related to the farming activity itself: producing high-quality food, maintaining soil fertility, and improving animal welfare (Figure 2). Maintaining rural life and economic activity and controlling forest encroachment were next in importance. The possibility of using local resources to produce food was also highly appreciated. The other cultural and environmental functions of farming were, in general, highly rated.

Three factors related to these perceptions were identified in the PCA (Table 3). Factor 1, *cultural heritage and rural development*, included perceptions of cultural aspects (heritage and high-quality local food), rural activity, and attractiveness for tourism. Factor 2, *environmental services*, included perceptions of landscape, vegetation, and biodiversity. Factor 3, *traditional agriculture*, included perceptions of animal welfare and the utilization of local resources.

Farming goals: The main farming goals referred to social issues: increasing the quality of life or having good

http://dx.doi.org/10.1659/MRD-JOURNAL-D-15-00108.1

FIGURE 1 Changes in farming (A) experienced in 2002–2012; (B) projected for 2012–2022.



relations with neighbors (Figure 3). Important technical and economic goals were improving product quality, improving buildings and machinery, and minimizing production costs. Being more environmentally friendly, reducing workload, adopting new technologies, maximizing production, and increasing the size of the farm followed in importance.

Three factors related to farming goals were identified in the PCA (Table 4). Factor 1, *innovations for better farming*, included goals related to the adoption of new technologies, improvement of buildings and machinery, improvement of product quality, and reduction of the workload. Factor 2, *quality of life*, included goals related to the family's quality of life and relationships with neighbors and with the environment. Factor 3, *economic objectives*, included goals related to increasing farm size, maximizing production, and reducing costs.

FIGURE 2 Importance given by farmers to different farming functions.

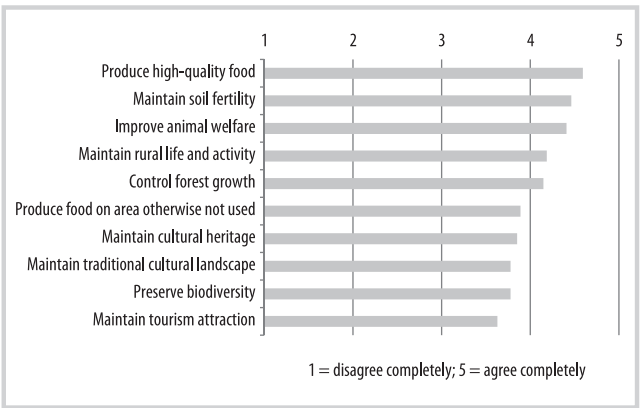


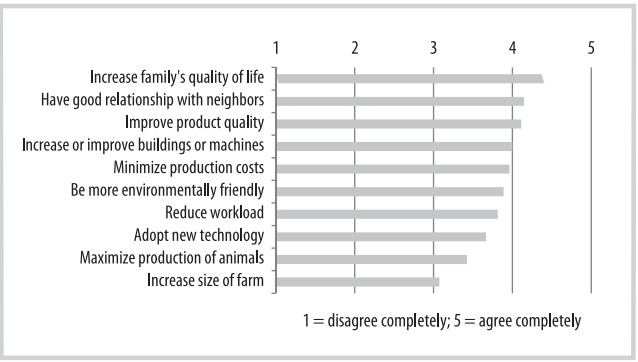
TABLE 3 Factors obtained in the PCA of farmers' perception of different functions of agriculture.[a]

	Factor 1[b]	Factor 2[c]	Factor 3[d]
Control forest growth	−0.023	**0.656**	0.006
Maintain traditional cultural landscape	0.106	**0.815**	−0.067
Preserve biodiversity	0.316	**0.794**	0.074
Preserve soil fertility	0.420	0.490	0.452
Maintain cultural heritage	**0.738**	0.350	0.137
Maintain rural life and activity	**0.660**	0.406	−0.157
Maintain tourism attraction	**0.842**	0.125	0.075
Produce high-quality food	**0.829**	−0.176	0.116
Produce food in area otherwise not used	−0.065	0.146	**0.802**
Improve animal welfare	0.178	−0.210	**0.799**
Eigenvalue	3.61	1.68	1.33
Variance (%)	36.11	16.83	13.29
Cumulative variance (%)	36.11	52.94	66.23

[a] Boldfaced and underlined values indicate factor loadings above 0.6.
[b] Factor 1 = cultural heritage and rural development.
[c] Factor 2 = environmental services.
[d] Factor 3 = traditional agriculture.

Relationships between perceptions and goals: Another PCA (Table 5) combined the 6 factors described previously. A direct relationship was observed between positive perceptions of the role of agriculture in maintaining cultural heritage and rural development and the goals of improving the family's quality of life, having good relationships with neighbors, and becoming more environmentally friendly (Factor 1). An inverse relationship was observed between positive perceptions of the role of agriculture in maintaining the cultural landscape, vegetation, and biodiversity, and the goals of increasing farm size and achieving economic objectives (Factor 2). An inverse relationship was also observed between positive perceptions of the role of agriculture in

FIGURE 3 Importance given by farmers to different farming goals.



utilizing local resources and improving animal welfare and the goals of using new technologies, improving product quality, and reducing the workload (Factor 3).

The 3 new factors that associated perceptions and goals were used to segment our sample into 2 clusters (Figure 4). Cluster 1 grouped 13 farmers with positive loading in Factor 1 and negative loading in Factors 2 and 3. In other words, these farmers showed positive perceptions of the role of agriculture in preserving cultural heritage and rural development but also showed positive perceptions toward environmental services and traditional agriculture. Their farming goals were related to improving the quality of life of their families, whereas innovation and economic objectives were not important. Cluster 2 grouped 14 farmers with a negative loading in Factor 1 and positive loadings in Factors 2 and 3; in other words, their perceptions and goals were the reverse of those expressed by farmers in Cluster 1.

We then analyzed the differences between the 2 clusters in terms of farmer characteristics, household structure, and continuity. Only age was significant: farmers in Cluster 1 tended to be older than farmers in Cluster 2 (57 versus 48 years, $P = 0.043$). Finally, we analyzed differences between the 2 clusters in terms of farmer behavior (observed or forecasted changes in farming), but we did not find any significant differences. Figure 5 illustrates the relationships identified between farmers' perceptions and goals.

TABLE 4 Factors obtained in the PCA of farming goals.[a)]

	Factor 1[b)]	Factor 2[c)]	Factor 3[d)]
Minimize production costs	0.045	0.034	**0.804**
Maximize production of animals	0.253	−0.032	**0.738**
Increase size of farm	0.168	−0.079	**0.816**
Increase or improve buildings or machines	0.572	0.462	0.381
Adopt new technology	**0.873**	0.181	0.125
Improve product quality	**0.845**	0.121	0.116
Reduce workload	**0.858**	0.032	0.203
Increase family's quality of life	0.110	**0.829**	−0.070
Be more environmentally friendly	0.226	**0.737**	−0.037
Have good relationship with neighbors	0.008	**0.771**	0.014
Eigenvalue	3.69	2.01	1.17
Variance (%)	36.95	20.08	11.70
Cumulative variance (%)	36.95	57.04	68.74

a) Boldfaced and underlined values indicate factor loadings above 0.6.
b) Factor 1 = innovations for better farming.
d) Factor 2 = quality of life.
d) Factor 3 = economic objectives.

TABLE 5 Factors obtained in the PCA combining farmers' perceptions of different functions of agriculture and their farming goals.[a)]

	Factor 1[b)]	Factor 2[c)]	Factor 3[d)]
Cultural heritage and rural development	**0.848**	0.034	0.320
Environmental services	−0.093	−**0.713**	0.285
Traditional agriculture	0.396	−0.314	−**0.620**
Innovations for better farming	0.239	−0.185	**0.707**
Quality of life	**0.909**	0.042	−0.181
Economic objectives	−0.031	**0.756**	0.187
Eigenvalue	1.77	1.21	1.13
Variance (%)	29.58	20.16	18.91
Cumulative variance (%)	29.58	49.74	68.65

a) Boldfaced and underlined values indicate factor loadings above 0.6.
b) Factor 1 = direct relationship between positive perceptions of the role of agriculture in maintaining cultural heritage and rural development and the goals of improving the family's quality of life, having good relationships with neighbors, and becoming more environmentally friendly.
c) Factor 2 = inverse relationship between positive perceptions of the role of agriculture in maintaining the cultural landscape, vegetation, and biodiversity and the goals of increasing farm size and achieving economic objectives.
d) Factor 3 = inverse relationship between positive perceptions of the role of agriculture in utilizing local resources and improving animal welfare and the goals of using new technologies, improving product quality, and reducing the workload.

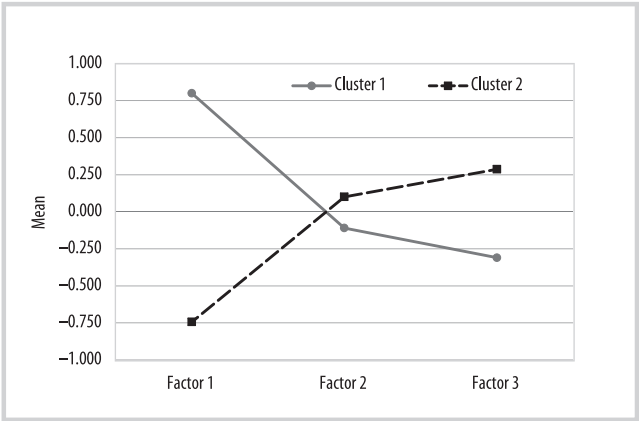
Discussion

Farming changes and farm continuity

The farms participating in the study have undergone very limited structural change since 2007, despite the decline

http://dx.doi.org/10.1659/MRD-JOURNAL-D-15-00108.1

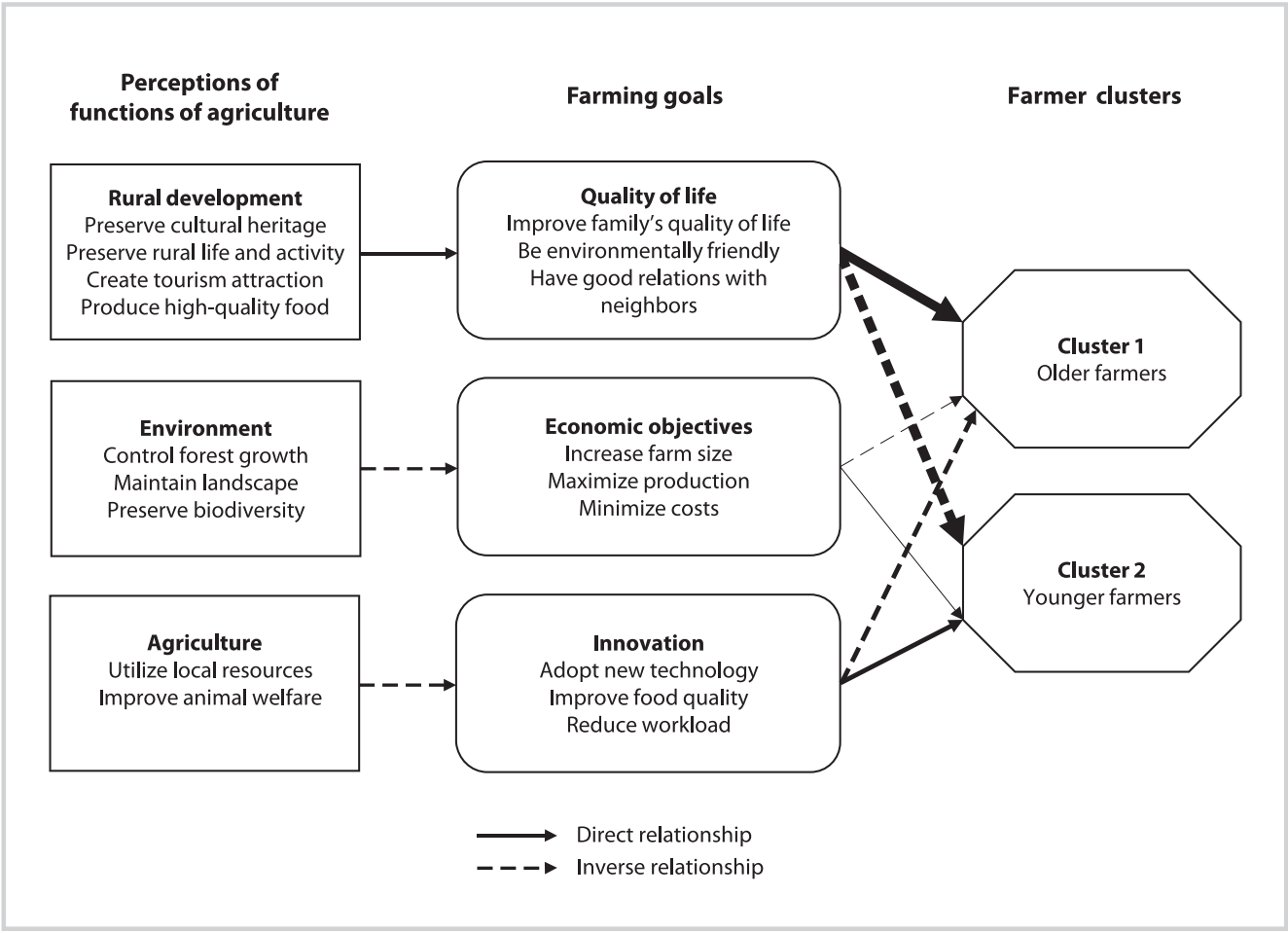
FIGURE 4 Mean values for the 2 clusters resulting from the final PCA, which related perceptions of the importance of different farming functions and farming goals.



in the number of agricultural holdings and the subsequent increase in farmland and herd sizes in Norway (SSB 2012). This may be because land is becoming scarce and expensive (cultivated land is only 0.37% of total land area in Aurland). Commitment to agriculture seemed to remain strong among agricultural households, as previously described by Lobley and Potter (2004) for the United Kingdom. However, in many mountain regions, the medium- to long-term continuity of farming is uncertain (López-i-Gelats et al 2011), especially in southern Europe; this is often related to the lack of a successor (Riedel et al 2007).

The 2 biggest changes noted by farmers in Aurland were improvements to machinery and buildings. In terms of grazing management, many farmers reported increases in grazing duration, often accompanied by additional fencing of grazing areas. All these changes seemed to be associated with either improving working conditions or reducing the workload (Hostiou and Dedieu 2012), which were probably related to the need to allocate labor to other activities (Bergfjord et al 2011; Lien et al 2010), such as tourism. Approximately 40% of the farmers had started or expanded a tourism-related activity or planned to do

FIGURE 5 Differences between the 2 farmer clusters in perceptions of farming functions and farming goals. Thickness of arrows denotes the power of perceptions and goals to differentiate farmers.



http://dx.doi.org/10.1659/MRD-JOURNAL-D-15-00108.1

so. However, the results showed a positive association between diversification toward tourism and farm maintenance (farms with continuity had more labor dedicated to off-farm activities). In Norway, Lien et al (2010) found that off-farm work had a positive effect on farm outputs and was not detrimental to efficiency. However, other scholars have suggested that the development of farm tourism is an employment issue rather than a diversification option because tourism and farming are separate businesses (Sharpley and Vass 2006).

The recent development of differentiated food products based on extrinsic quality characteristics—that is, those characteristics that depend on the production process rather than on the product itself (Bernués et al 2003)—is another form of farm diversification. Local foods have the potential to enhance the visitor experience and expand marketing possibilities by connecting consumers to the region and its perceived culture and heritage (Sims 2009; Olsson et al 2011). The rising interest of consumers in "stories" linked to physical products to create consumption experiences helps explain current food demands (Grunert 2006). Additionally, the development of new high-quality products can fulfill farmers' creative urges in addition to addressing their need for additional income (Vik and McElwee 2011).

Farmers' perceptions and goals

Contrary to other recent studies (Willock, Deary, Edwards-Jones, et al 1999; Birge and Herzon 2014), we could not find consistent associations between farmer perceptions, goals, and past or planned behavior; some trends were observed, but our sample was too small to reach definitive conclusions. However, we did identify 3 relationships between farmers' perceptions of the multiple functions of agriculture and their farming goals. These were analogous to 3 dimensions of animal farming's meaning for society that were identified by Boogaard et al (2011): tradition, modernity, and "naturality" (harmony with nature).

There was a direct relationship between farmers' perceptions of the role of agriculture in rural development and cultural heritage and the goals of improving the family's quality of life, maintaining the environment, and having good neighbor relations. Karali et al (2014) affirmed that lifestyle and quality of life had not been adequately discussed in the literature and were strongly related to farmers' willingness to continue farming. This relationship, which could be identified within the "tradition" dimension of Boogaard et al (2011), was the characteristic that most differentiated farmers. Using a similar methodological approach, Maybery et al (2005) also found that the lifestyle factor had the strongest power to differentiate farmers according to their values and goals. Other studies in Nordic rural areas found that the lifestyle orientations and the social motivations of farmers were keys to understanding the trajectory of the farm in terms of off-farm work (Lien et al 2010), migration (Bergfjord et al 2011), and diversification of activities and entrepreneurship (Vik and McElwee 2011).

The "naturality" dimension showed an inverse relationship between positive perceptions of the role of agriculture in improving the environment (prevention of forest encroachment, maintenance of landscape and biodiversity) and the economic objectives of maximizing production and profit. This dimension, which places environmental and economic values in opposition, has been widely reported (eg Schmitzberger et al 2005, Brodt et al 2006).

Similarly, an inverse association was observed between positive perceptions of traditional agriculture that uses local resources and maintains animal welfare standards and the goal of innovating in agriculture to improve food quality and reduce workload (the "modernity" dimension). "Traditionalist" (Karali et al 2013) and "innovative" (Schmitzberger et al 2005) farming styles have also been identified to explain different farm management practices.

In our study, the naturality and modernity dimensions were less important in differentiating the clusters of farmers; however, our sample was too small to rule out their importance altogether or to conclude that the tradition dimension is most appropriate when segregating farmers. These 3 dimensions should be considered dynamic (Karali et al 2013), nonhierarchical, and complementary parts that can be equally important (Boogaard et al 2011) and that indicate the complexity of farmers' visions and behaviors.

Implications for policy design

The success of any policy promoting the sustainable development of agriculture will depend on its acceptance by farmers (Edwards-Jones 2006), and there is therefore great interest in understanding how farmers respond to policies. This is particularly challenging when farmers are largely concerned about nonfinancial issues. Farmers' perceptions and goals can relate to environmental (Beedell and Rehman 1999), ethical (de Rooij et al 2010), or sociocultural (Vik and McElwee 2011) concerns.

Few studies characterize farmers according to their perceptions and goals (defined as "attitudes" and "objectives" by Willock, Deary, McGregor, et al [1999]); however, several authors in Norway have noted a dichotomy between farmers' social and lifestyle-oriented motivations and their economic motivations (Bergfjord et al 2011; Vik and McElwee 2011). Studies outside Norway have also found a distinction between farmers with mainly environmental versus economic goals in mountain areas (eg Willock, Deary, Edwards-Jones, et al 1999 in Scotland; García-Martínez et al 2007 in the Spanish Pyrenees). This dichotomy was confirmed in our study, in which 2 clusters

http://dx.doi.org/10.1659/MRD-JOURNAL-D-15-00108.1

of farmers were identified based on different perceptions of rural development and the importance of maintaining the family's quality of life.

The results suggest a need to establish different policy instruments to target different farmer profiles (O'Rourke et al 2012; Karali et al 2013). Some examples have been suggested: standard food production versus niche productions, such as tourism and cultural or national identity (Daugstad et al 2006); or production support versus improving living conditions in affected communities (Bergfjord et al 2011), for example, by increasing off-farm job opportunities for farmers and their partners (Lien et al 2010).

However, as mentioned previously, the diverse perceptions and goals of farmers are context dependent, are not mutually exclusive, and can all contribute to explaining the acceptance of policy measures. We argue that integrated policy design dealing with agricultural, environmental, and rural development schemes would yield better results if the 3 dimensions were addressed together. For example, policies promoting employment in rural areas and improving social (education, health, and cultural) services could be combined with voluntary schemes to promote grazing and compensate famers for the environmental services they provide, such as cultural landscape and biodiversity (Rodríguez-Ortega et al 2014), and with programs promoting individual or collective processing, branding, and certification of distinctive regional products and services (Olaizola et al 2012).

Conclusions

The farming changes most frequently reported by study participants related to improving working conditions, reducing workloads, and starting a tourism-related activity. Diversification in favor of tourism did not impair farming; rather, there seemed to be a positive relationship between the 2 activities. The prospects for farm continuity in this area were relatively high.

The 3 dimensions that were associated with farmers' perceptions of the functions of agriculture and farming goals were (1) importance of rural development and the family's quality of life (a direct relationship), (2) importance of the environment and economic objectives (an inverse relationship), and (3) importance of traditional agriculture and innovation (an inverse relationship). Two clusters of farmers were identified, mainly based on perceptions of the role of agriculture in cultural heritage and rural development and the goal of improving the family's quality of life.

ACKNOWLEDGMENTS

This work was supported by the European Commission under the FP7 Marie Curie IEF program, contract no. 299794. We thank Britt Lilly Hylland for the survey work.

REFERENCES

Beedell JDC, Rehman T. 1999. Explaining farmers' conservation behaviour: Why do farmers behave the way they do? *Journal of Environmental Management* 57(3):165–176.

Bergfjord OJ, Lien G, Hoveid Ø. 2011. Factors influencing farmer migration in Norway: A study based on survey results linked to financial data. *Food Economics—Acta Agriculturae Scandinavica, Section C* 8(2):92–104.

Bernués A, Olaizola A, Corcoran K. 2003. Extrinsic attributes of red meat as indicators of quality in Europe: An application for market segmentation. *Food Quality and Preference* 14(4):265–276.

Bernués A, Rodríguez-Ortega T, Alfnes F, Clemetsen M, Eik LO. 2015. Quantifying the multifunctionality of fjord and mountain agriculture by means of sociocultural and economic valuation of ecosystem services. *Land Use Policy* 48:170–178.

Bernués A, Ruiz R, Olaizola A, Villalba D, Casasús I. 2011. Sustainability of pasture-based livestock farming systems in the European Mediterranean context: Synergies and trade-offs. *Livestock Science* 139(1–2):44–57.

Birge T, Herzon I. 2014. Motivations and experiences in managing rare semi-natural biotopes: A case from Finland. *Land Use Policy* 41:128–137.

Boogaard BK, Oosting SJ, Bock BB, Wiskerke JSC. 2011. The sociocultural sustainability of livestock farming: An inquiry into social perceptions of dairy farming. *Animal* 5(9):1458–1466.

Brodt S, Klonsky K, Tourte L. 2006. Farmer goals and management styles: Implications for advancing biologically based agriculture. Agricultural Systems 89(1):90–105.

Clemetsen M, van Laar J. 2000. The contribution of organic agriculture to landscape quality in the Sogn og Fjordane region of Western Norway. *Agriculture, Ecosystems & Environment* 77(1–2):125–141.

Cooper T, Hart K, Baldock D. 2009. *Provision of Public Goods through Agriculture in the European Union*. Report Prepared for DG Agriculture and Rural Development, Contract No. 30-CE-0233091/00-28. London, United Kingdom: Institute for European Environmental Policy.

Daugstad K. 2008. Negotiating landscape in rural tourism. *Annals of Tourism Research* 35(2):402–426.

Daugstad K, Rønningen K, Skar B. 2006. Agriculture as an upholder of cultural heritage? Conceptualizations and value judgements—A Norwegian perspective in international context. *Journal of Rural Studies* 22(1):67–81.

de Rooij SJG, de Lauwere CC, van der Ploeg JD. 2010. Entrapped in group solidarity? Animal welfare, the ethical positions of farmers and the difficult search for alternatives. *Journal of Environmental Policy and Planning* 12(4):341–361.

Edwards-Jones G. 2006. Modelling farmer decision-making: Concepts, progress and challenges. *Animal Science* 82(6):783–790.

EEA [European Environmental Agency]. 2004. *High Nature Value Farmland: Characteristics, Trends and Policy Challenge*s. Copenhagen, Denmark: European Environmental Agency.

García-Martínez A, Olaizola A, Bernués A. 2007. Objetivos y opiniones de los ganaderos de vacuno de carne en el Pirineo Central. *ITEA Informacion Tecnica Economica Agraria* 28:324–326.

Gasson R. 1973. Goals and values of farmers. *Journal of Agricultural Economics* 24(3):521–542.

Gasson R, Errington AJ. 1993. *The Farm Family Business*. Wallingford, United Kingdom: CAB International.

Grunert KG. 2006. Future trends and consumer lifestyles with regard to meat consumption. *Meat Science* 74(1):149–160.

Haukeland JV, Daugstad K, Vistad OI. 2011. Harmony or conflict? A focus group study on traditional use and tourism development in and around

Rondane and Jotunheimen National Parks in Norway. *Scandinavian Journal of Hospitality and Tourism* 11(supplement 1):13–37.
Hersleth M, Naes T, Rodbotten M, Lind V, Monteleone E. 2012. Lamb meat—Importance of origin and grazing system for Italian and Norwegian consumers. *Meat Science* 90(4):899–907.
Hjalager AM. 1996. Agricultural diversification into tourism: Evidence of a European Community development programme. *Tourism Management* 17(2):103–111.
Hostiou N, Dedieu B. 2012. A method for assessing work productivity and flexibility in livestock farms. *Animal* 6(5):852–862.
Karali E, Brunner B, Doherty R, Hersperger AM, Rounsevell MDA. 2013. The effect of farmer attitudes and objectives on the heterogeneity of farm attributes and management in Switzerland. *Human Ecology* 41(6):915–926.
Karali E, Brunner B, Doherty R, Hersperger A, Rounsevell M. 2014. Identifying the factors that influence farmer participation in environmental management practices in Switzerland. *Human Ecology* 42(6):951–963.
Lien G, Kumbhakar SC, Hardaker JB. 2010. Determinants of off-farm work and its effects on farm performance: The case of Norwegian grain farmers. *Agricultural Economics* 41(6):577–586.
Lobley M, Potter C. 2004. Agricultural change and restructuring: Recent evidence from a survey of agricultural households in England. *Journal of Rural Studies* 20(4):499–510.
López-i-Gelats F, Milán MJ, Bartolomé J. 2011. Is farming enough in mountain areas? Farm diversification in the Pyrenees. *Land Use Policy* 28(4):783–791.
MacDonald D, Crabtree JR, Wiesinger G, Dax T, Stamou N, Fleury P, Lazpita JG, Gibon A. 2000. Agricultural abandonment in mountain areas of Europe: Environmental consequences and policy response. *Journal of Environmental Management* 59(1):47–69.
Maybery D, Crase L, Gullifer C. 2005. Categorising farming values as economic, conservation and lifestyle. *Journal of Economic Psychology* 26(1):59–72.
Olaizola A, Bernués A, Blasco I, Sanz A. 2012. Prospects for a meat quality designation: Exploratory analysis for "Serrana de Teruel" beef. *ITEA Informacion Tecnica Economica Agraria* 108(4):546–562.
Olsson EGA, Austrheim G, Grenne SN. 2000. Landscape change patterns in mountains, land use and environmental diversity, mid-Norway 1960–1993. *Landscape Ecology* 15(2):155–170.
Olsson EGA, Rönningen K, Hanssen SK, Wehn S. 2011. The interrelationship of biodiversity and rural viability: Sustainability assessment, land use scenarios and Norwegian mountains in a European context. *Journal of Environmental Assessment Policy and Management* 13(2):251–284.
O'Rourke E, Kramm N, Chisholm N. 2012. The influence of farming styles on the management of the Iveragh uplands, southwest Ireland. *Land Use Policy* 29(4):805–816.
Renting H, Rossing WA, Groot JC, Van der Ploeg JD, Laurent C, Perraud D, Stobbelaar DJ, Van Ittersum MK. 2009. Exploring multifunctional agriculture. A review of conceptual approaches and prospects for an integrative transitional framework. *Journal of Environmental Management* 90(2):112–123.
Riedel JL, Casasús I, Bernués A. 2007. Sheep farming intensification and utilization of natural resources in a Mediterranean pastoral agro-ecosystem. *Livestock Science* 111:153–163.
Rodríguez-Ortega T, Oteros-Rozas E, Ripoll-Bosch R, Tichit M, Martín-López B, Bernués A. 2014. Applying the ecosystem services framework to pasture-based livestock farming systems in Europe. *Animal* 8(8):1–12.
Schmitzberger I, Wrbka T, Steurer B, Aschenbrenner G, Peterseil J, Zechmeister HG. 2005. How farming styles influence biodiversity maintenance in Austrian agricultural landscapes. *Agriculture, Ecosystems & Environment* 108(3):274–290.
Sharpley R, Vass A. 2006. Tourism, farming and diversification: An attitudinal study. *Tourism Management* 27(5):1040–1052.
Sims R. 2009. Food, place and authenticity: Local food and the sustainable tourism experience. *Journal of Sustainable Tourism* 17(3):321–336.
SSB [Statistisk sentralbyrå]. 2012. *Jord, skog, jakt og fiskeri*. Oslo, Norway: Statistisk sentralbyrå. http://ssb.no/jord-skog-jakt-og-fiskeri; accessed on 1 March 2016.
Staaland H, Holand O, Nellemann C, Smith M. 1998. Time scale for forest regrowth: Abandoned grazing and agricultural areas in southern Norway. *Ambio* 27(6):456–460.
van Vliet J, de Groot HLF, Rietveld P, Verburg PH. 2015. Manifestations and underlying drivers of agricultural land use change in Europe. *Landscape and Urban Planning* 133:24–36.
Vatn S. 2009. The sheep industry in the Nordic countries. *Small Ruminant Research* 86(1–3):80–83.
Vik J, McElwee G. 2011. Diversification and the entrepreneurial motivations of farmers in Norway. *Journal of Small Business Management* 49(3):390–410.
Vik ML, Benjaminsen TA, Daugstad K. 2010. Synergy or marginalisation? Narratives of farming and tourism in Geiranger, western Norway. *Norsk Geografisk Tidsskrift - Norwegian Journal of Geography* 64(1):36–47.
Willock J, Deary IJ, Edwards-Jones G, Gibson GJ, McGregor MJ, Sutherland A, Dent JB, Morgan O, Grieve R. 1999. The role of attitudes and objectives in farmer decision making: Business and environmentally-oriented behaviour in Scotland. *Journal of Agricultural Economics* 50(2):286–303.
Willock J, Deary IJ, McGregor MM, Sutherland A, Edwards-Jones G, Morgan O, Dent B, Grieve R, Gibson G, Austin E. 1999. Farmers' attitudes, objectives, behaviors, and personality traits: The Edinburgh Study of Decision Making on Farms. *Journal of Vocational Behavior* 54(1):5–36.

http://dx.doi.org/10.1659/MRD-JOURNAL-D-15-00108.1