

## Article

# Fire Eaters: Exploring Consumer Preferences for Labeling Extensive Livestock Products Providing Wildfire Prevention Services

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**Abstract:** Extensive livestock grazing has proved to be a valuable tool to reduce wildfire risk in Mediterranean landscapes. Meat from herds providing wildfire prevention services exhibit sustainability traits that can appeal to ethical consumers and find a suitable niche in local markets. This study assesses the preferences of a consumer sample in the province of Girona (north-eastern Spain) for different lamb meat labeling options from herds providing wildfire prevention services. The aim is to disentangle consumer profiles, providing evidence for improved product labeling. This may increase the added value and the viability of small farms providing this service. Employing a latent class modeling approach, we explore how meat consumption patterns and socioeconomic features may contribute to explain preferences for different meat labeling options. Our results have identified three consumer profiles: traditional rural consumers relying on trust with producers, younger consumers more akin to new labeling schemes, and urban consumers that support local butchers as a trusted information source. Different labeling mechanisms may work in a complementary way to arrive to different audiences of potential consumers. Geographical indication labels can serve as a good departure point, complemented with information cues on environmental factors related to wildfire protection.

**Keywords:** lamb consumption; lamb labeling; local production; credence attributes; land abandonment; wildfire risk reduction; latent-class analysis



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## 1. Introduction

Wildfires represent one of the most prominent risks for Mediterranean landscapes, and they are expected to be aggravated with climate change and increased climatic aridity [1]. Progressive abandonment of marginal agricultural lands triggered a loss of mosaic landscapes, increasing homogenization due to spontaneous vegetation expansion [2]. This change in landscape structure made it easier for wildland fires to spread and damage forest ecosystems, infrastructures and human lives [3].

An increasing consensus arises among practitioners and researchers alike, agreeing that social-ecological transformation in our patterns of land use, settlement, energy supply, and ultimately, social values is urgently needed to tackle the increasingly severe wildfire events [4–6]. Accordingly, orienting management to favor fire-resilient landscapes by enhancing value chains that stimulate active forest management for the provision of goods and services beyond wood is increasingly advocated [7,8].

In this context, integrating extensive grazing for the purpose of biomass reduction and fire prevention emerges as an alternative to increase the resilience of Mediterranean

forests to wildfires where livestock can reduce biomass and vegetation undergrowth [9,10]. Several initiatives are sprouting in southern Europe incorporating extensive livestock grazing to fire prevention activities based on existing evidence of how adequately managed herds practicing targeted forest biomass reduction can contribute to wildfire prevention while reducing the high costs of mechanical treatments [11]. Livestock grazing as a sustainable management strategy in fire-prone ecosystems has also been tested beyond the Mediterranean basin such as semi-natural heathland habitats in Atlantic Europe frequently affected by wildfires [12]. In the US, examples abound where targeted grazing could reduce the potential cost of fighting fires [13], breaking up continuous fuels, reducing rangeland fuels, and suppressing brush encroachment [14]. Furthermore, the interactive effects of grazing and fire to restore native grassland species are shown where fire can promote native forb recovery but grazing is necessary to maintain restoration outcomes [15]. Moderate livestock grazing decreases the risk of wildfires in semi-arid and arid rangelands [16,17], supporting the incorporation of herbivory into fuel management practices in areas of high herbaceous productivity to increase the effectiveness of fuel treatments [18]. Examples are also found in East African environments where the interaction of fire and cattle prevents the degradation of ericaceous communities [19]. Extensive livestock farming systems, beyond their potential contribution to wildfire prevention, are the principal form of management of high natural value farmland in Europe [20]. However, market forces and technological innovation have led these systems towards either intensification or abandonment pathways [21]. Labor is a critical factor for the sustainability of livestock systems, especially in the case of small ruminant farming [22], due to its high opportunity cost compared with other activities, and it may trigger the shift towards less labor-demanding species, increasing pluri-activity, operation size in order to pursue economies of scale [23–25] or ultimately, abandonment of the activity. Rendering these extensive farming systems viable may require a mix of farming conservation policies to compensate farmers for the positive externalities they provide while simultaneously increasing farm profitability through added-value products [26]. The latter is especially relevant for lamb since the current trend to reduce meat consumption [27] is especially affecting it, being gradually replaced by meat from other species [28]. Since lamb is a high-value product exposed to a highly competitive market [29], product differentiation has become a key element in ensuring the viability of production [28]. The increasingly greater value that consumers place on health or ethical factors related to the production process, and extrinsic factors such as origin or production method, may constitute an opportunity to develop new products aimed at certain consumer segments that will allow producers to optimize profits [27,28,30]. Meat from extensive livestock herds linked to the provision of wildfire prevention services exhibit sustainability traits that can appeal to ethical consumer profiles and hence may find a suitable niche in the market for these products in a context of increasing consumer awareness for sustainability dimensions. However, appropriate labeling and differentiation are needed so that consumers trust the certifying agent or system as credence attributes of lamb.

The Fireflocks project (Ramats de Foc) aims to create fire-resilient landscapes through innovative support for extensive livestock farming. The project started its activity in 2016 in three pilot sites in the province of Girona (Catalonia, northeastern Spain). Shepherd-guided herds graze the understory of forests and shrublands to reduce fuel load, and to create open spaces in and between forested areas. Grazing takes place in strategic areas identified by firefighting services as key for firefighters to operate safely and more effectively in wildfire suppression. Importantly, the project also aims to improve the financial viability of the small farms that provide this service by increasing the added value of their products and hence the income received by these farms. Fireflocks takes a step forward through labeling and promoting meat and dairy products from these farms. The project has developed a certification scheme for products sourced from the Fireflocks project. The scheme is accompanied with a communication campaign (website, promotional video and postcards), to motivate citizens to consume Fireflocks products, while building knowledge of the advantages of shepherding for fire control.

This study assessed consumer preferences for labeling lamb meat heralding from extensive herds providing wildfire prevention services through a sample of consumers in the region of Girona (Catalonia, north-eastern Spain). To our knowledge, this is the first study of its kind that aims to cover a gap in the research regarding consumer preferences for products stemming from production systems that provide wildfire prevention services as a positive externality benefitting society. The hypotheses underpinning this study were that heterogeneity among consumers may exist with respect to the preferred labeling and marketing channel to identify meat products from extensive livestock farming systems that provide wildfire prevention services. Furthermore, we hypothesized that these differences may relate to variables such as age or rural/urban place of residence of consumers.

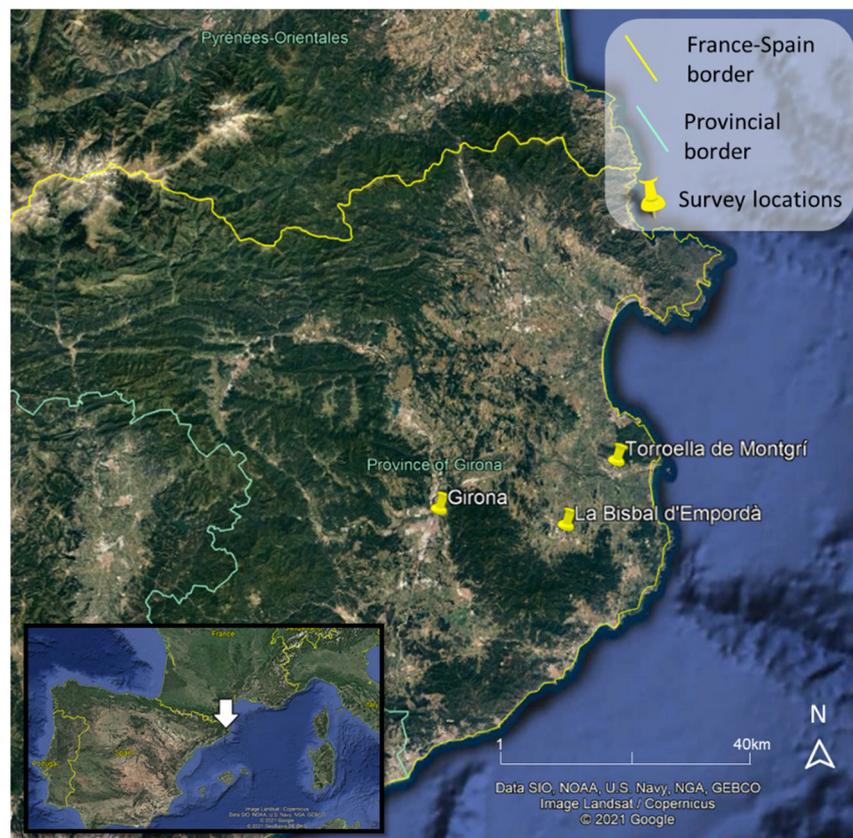
Employing a latent class modeling approach, we explored how meat consumption patterns and socioeconomic features of a consumer sample may contribute to explain their preferences for the different labeling options offered. The ultimate goal is to disentangle consumer profiles, providing evidence for decision-making processes towards improved marketing and labeling of these products that may add value to the producers and ultimately, increase the future viability of these small farms by providing a key landscape protection service. Our results indicate that three consumer profiles can be disentangled according to the labeling preferences for different lamb meat. These profiles range from traditional rural consumer profiles that rely on a trusting relationship with producers, urban consumers who place trust in local butcherries, and younger profiles more akin to new types of labeling schemes.

Previous studies on consumers' preferences for lamb meat attributes have importantly focused on the origin, indicating a general preference for local origin [28,29,31] that may vary depending on the frequency of consumption [28], and also on the size of the municipalities where consumers live [30]. Attributes related to production systems, such as organic production, have also been assessed and found to be related to the frequency of consumption, with occasional consumers being more concerned towards organic meat [28]. However, the explicit consideration of production systems and their influence in consumer preferences has been scarcely addressed [32,33], frequently considering pasture grazing as a proxy for animal welfare [34]. These studies show that consumers prefer mountain to lowland pasture systems [32], and outdoor pig feeding based on acorns and pasture [33], respectively. The novelty of our work resides on assessing consumer preferences for labeling an extensive production system that, beyond lamb meat, provides specific wildfire prevention services and addresses consumer preferences for one of the positive externalities (i.e., wildfire prevention) of extensive livestock production systems. The paper is organized as follows: The next section presents the study area, data collection process and modeling approach followed. Section 3 presents the results of consumer survey conducted while Section 4 discusses these results and compares our findings with those of previous studies. Section 5 concludes the paper.

## 2. Materials and Methods

### 2.1. Study Area and Data Collection

The assessment was carried out in three municipalities in the province of Girona (Catalonia, Spain) (see Figure 1) where the Fireflocks project sites and the labeling initiative for meat and dairy products from herds contributing to wildfire risk prevention was taking place. We selected three different municipalities with big, medium and small size to encompass the heterogeneity in consumer preferences that may arise from contrasting urban and rural towns. The city of Girona is the capital of the province (101,932 inhabitants), while Torroella is a big town (12,023 inhabitants) and La Bisbal is a small village (11,190 inhabitants) [35]. The survey was conducted in the study area before commercializing meat products with the project label as a pilot test.



**Figure 1.** Location of the three data collection municipalities.

Data collection was undertaken face-to-face by anonymous participants in public places such as markets or public squares in March and April 2017. A total of 20% of the approached consumers agreed to answer and complete the questionnaire, leading to a final sample of 304 respondents.

## 2.2. Survey Design

The consumer questionnaire included 11 questions, divided into four sections. In the first section, we assessed the respondents' socio-demographic characteristics (e.g., age, gender, occupation and origin, i.e., place they were raised). In the second section, respondents were asked to describe their meat consumption habits (frequency of consumption and type of meat consumed). In the third section, the questionnaire explored the attitudes of consumers towards meat from extensive reared livestock using three statements that were evaluated on a 4-point Likert scale (1—Totally disagree, 4—Totally agree). The statements described meat products from extensive grazing herds as: (i) of superior quality and more expensive, (ii) of stronger odor, taste and texture, and (iii) local and more trustworthy.

In the fourth section, we explored aspects related to labeling options. Food labels represent a marketing tool that may influence consumers' perception of food quality [36]. Traceability and linked trust provided by appropriate labeling is directly linked to the production process [34], and while it does not reduce the asymmetry of information between production and consumption, it becomes a necessary condition for controlling unobserved attributes [34]. A central topic of our survey was thus understanding the preference of consumers for different options to label the Fireflocks meat products. Sustainability attributes such as extensive production system or wildfire prevention services can be communicated in a variety of ways, which include product packaging claims and labeling, corporate websites, as well as point-of-purchase information as the most important channels for communicating sustainability attributes [37–39]. Hence, these respondents that provided a positive answer to their willingness to purchase extensive livestock meat from herds

contributing to wildfire prevention were asked to select the option they would best trust to certify this origin of the meat. They were provided with four options: i. through a trusted butcher, ii. through a logo approved by firefighters, iii. consulting a website demonstrating the extensive grazing system, and iv. through a trusted local shepherd.

### 2.3. Data Analysis

Our aim was to identify different profiles of consumers based on their preferences for meat produced in extensive grazing systems, and the relationship of their socioeconomic features and consumption patterns with different types of hypothetical product certificates. For such an endeavor, we adopted a latent class analysis (LCA) approach [40].

LCA is a statistical tool widely applied in social studies to identify unobserved segments or subgroups (i.e., latent classes) within heterogeneous populations. LCA assigns the cases to segments or subgroups considering probabilistic definition of distance, which allows model selection and optimization based on rigorous statistical tests [41].

Considering a single nominal latent variable  $x$ ,  $T$  response variables  $y_{it}$  (indicators), that in our case are nominal and ordinal, an example of an LC model with three categorical indicators ( $T = 3$ ) is (Equation (1)):

$$P(y_{i1} = m_1, y_{i2} = m_2, y_{i3} = m_3) = \sum_{x=1}^K P(x) \prod_{t=1}^3 P(y_{it} = m_t | x) \quad (1)$$

where

$$\prod_{t=1}^3 P(y_{it} = m_t | x) = P(y_{i1} = m_1 | x) P(y_{i2} = m_2 | x) P(y_{i3} = m_3 | x) \quad (2)$$

This probability structure (Equation (2)) shows that the indicators  $y_{i1}$ ,  $y_{i2}$ ,  $y_{i3}$  are assumed to be mutually independent given that one belongs to a certain latent class (local independence assumption).

The conditional response probabilities, i.e., the probability of giving response  $m$  given  $x$ ,  $P(y_{it} = m | x)$  (Equation (3)) are parameterized as follows:

$$P(y_{it} = m | x) = \frac{\exp(\eta_{m|x}^t)}{\sum_{m'=1}^{M_t} \exp(\eta_{m'|x}^t)} \quad (3)$$

With  $\eta_{m|x}^t$  denoting the linear term (Equation (4)) and yielding a multinomial logistic regression:

$$\eta_{m|x}^t = \beta_{m0}^t + \beta_{mx0}^t. \quad (4)$$

$R$  numeric or nominal external variables named as covariates  $z_{ir}^{cov}$  can be included in the previous model to predict class membership of the sampled individuals. Considering the previous model of three categorical indicators and two covariates ( $z_{i1}^{cov}$ ,  $z_{i2}^{cov}$ ) that affect  $x$  and are used to predict class membership, the LC model is (Equation (5)):

$$P(y_{i1} = m_1, y_{i2} = m_2, y_{i3} = m_3 | z_{i1}^{cov}, z_{i2}^{cov}) = \sum_{x=1}^K P(x | z_{i1}^{cov}, z_{i2}^{cov}) \prod_{t=1}^3 P(y_{it} = m_t | x) \quad (5)$$

As indicated by the previous equation, the distribution of  $x$  is dependent on  $z_{i1}^{cov}$  and  $z_{i2}^{cov}$ , i.e., the indicators are assumed to be independent of the covariates given the latent variable  $x$ .

The probability  $P(x|z_{i1}^{cov}, z_{i2}^{cov})$  is restricted by means of a multinomial logistic regression model (Equation (6)) to exclude higher-order interaction terms to be able to deal with ordinal and categorical covariates, yielding:

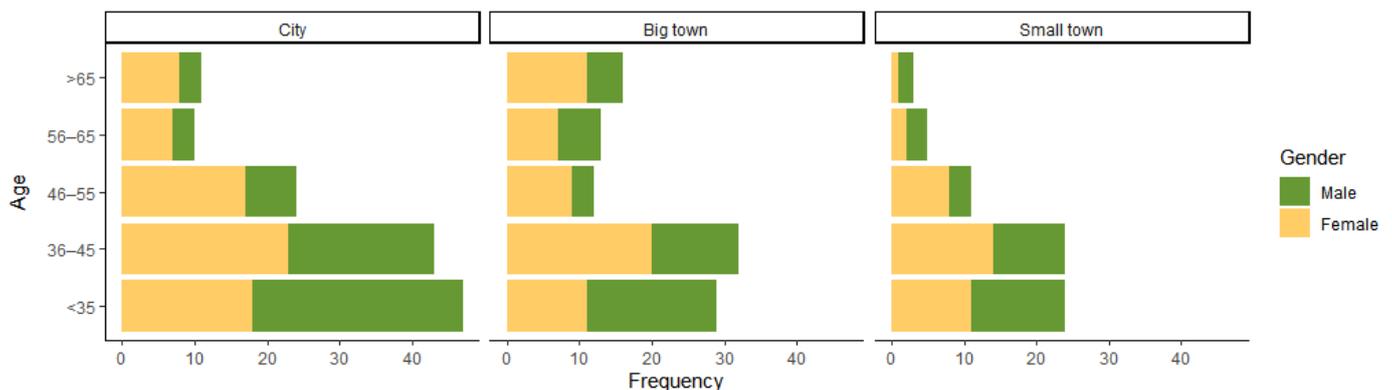
$$P(x|z_{i1}^{cov}, z_{i2}^{cov}) = \frac{\exp(\eta_{x|z_{i1}, z_{i2}})}{\sum_{x'=1}^K \exp(\eta_{x'|z_{i1}, z_{i2}})} \quad (6)$$

With (Equation (7)):

$$\eta_{x|z_{i1}, z_{i2}} = \gamma_{x0} + \gamma_{x1}z_{i1} + \gamma_{x2}z_{i2} \quad (7)$$

### 3. Results

The final sample of 304 consumers was distributed in the three municipalities mentioned, with 44% of the sample belonging to the city of Girona, 34% to the town of Torroella (Big town), and 22% collected in La Bisbal (Small town) (Figure 2). From the total sample, 55% were females whereas in terms of age groups, the sample distributed in 32.9% of individuals below 35 years old, 32.6% between 36 and 45 years, and 34.5% above 45 years old.



**Figure 2.** Descriptive statistics of the sample.

Following the standard procedure, in order to determine the best number of segments in the LCA model, we estimated models ranging from two to six profiles. The three-class model (see Table 1) provided the best equilibrium between parsimony, information criteria on the one hand, and plausibility of the results on the other.

Class 1 was tagged as the rural shepherd confider group, comprising 43% of the sampled respondents. It was composed of consumers who would prefer meat-based products from herds providing wildfire prevention services being certified by known and trusted shepherds, while rejecting web-based certificates. Respondents in this group showed weekly lamb consumption patterns, while consumers who never or rarely consume lamb were less likely to belong to this group. Respondents in this group showed high agreement with identifying pasture-based systems as local and more trustworthy. Older respondents living in small towns were more likely to belong to this group while the opposite applied for city dwellers. We named this group as the rural shepherd confider group.

Class 2 was named as the 3rd party certifier group and it contained 30% of the sample. Respondents in this group preferred options to certify meat-based products contributing to wildfire prevention through either web-based information or the firefighting service. Consumers showing an infrequent consumption of lamb were more likely to belong to this group while the opposite applies to weekly lamb consumers. Respondents in this group were more likely to disagree with the local and more trustworthy consideration of grazing meat production systems. Older respondents were less likely to belong to this group.

**Table 1.** Estimates of the latent class model (3 segments).

Cluster Size	Cluster 1—Rural Shepherd Confiders		Cluster 2—3rd Party Certifiers		Cluster 3—Urban Butcher Buyers		Overall Wald	Overall <i>p</i> -Value
	0.43		0.30		0.27			
	Parameter (s.e.)	<i>z</i> -Value	Parameter (s.e.)	<i>z</i> -Value	Parameter (s.e.)	<i>z</i> -Value		
Certificate							32.352	0.000
Wildfire fighters	−0.469 (0.338)	−1.386	1.104 (0.483)	2.285	−0.6358 (0.350)	−1.816		
Local butcher	0.170 (0.667)	0.255	−1.313 (1.183)	−1.110	1.143 (0.609)	1.878		
Website	−1.094 (0.566)	−1.935	0.988 (0.561)	1.761	0.107 (0.407)	0.263		
Trusted shepherd	1.393 (0.391)	3.566	−0.779 (0.653)	−1.194	−0.614 (0.49)	−1.250		
Lamb consumption							17.364	0.002
Never/infrequent	−1.559 (0.535)	−2.916	0.628 (0.338)	1.858	0.9312 (0.326)	2.859		
Monthly	0.326 (0.299)	1.089	0.006 (0.212)	0.030	−0.3322 (0.237)	−1.400		
Weekly	1.234 (0.321)	3.839	−0.635 (0.322)	−1.972	−0.599 (0.317)	−1.890		
Local and more trustful	0.807 (0.208)	3.879	−0.497 (0.179)	−2.775	−0.31 (0.165)	−1.874	15.178	0.001
COVARIATES								
Age	0.3318 (0.198)	1.677	−1.257 (0.347)	−3.622	0.925 (0.262)	3.535	14.061	0.001
Residency							15.232	0.004
City	−0.815 (0.245)	−3.331	−0.418 (0.311)	−1.345	1.233 (0.413)	2.983		
Big town	0.063 (0.252)	0.250	0.181 (0.340)	0.532	−0.244 (0.483)	−0.505		
Small town	0.752 (0.377)	1.996	0.237 (0.436)	0.543	−0.989 (0.713)	−1.387		
Model performance criteria								
LL	−942.36	BIC	2044.78	AIC	1940.71	AIC3	1968.71	

Finally, Class 3 was tagged as the urban butcher buyer group, gathering 27% of the sample where support was shown toward butchers as the main channel to receive information on the production system, while demonstrating rejection to firefighter certifications. This group showed infrequent lamb consumption patterns and disagreement with the “local and more trustworthy” statement linked to grazing herds. Older and city dwellers were more likely to belong to this group.

#### 4. Discussion

This study presents the results of a segmentation of consumers according to their preferences for labeling extensively raised meat products from herds providing wildfire prevention services. Meat products from these systems may be able to satisfy increasing societal demands for sustainably produced food. The assessment of labeling options that

range from traditional to more innovative approaches together with its focus on meat products providing environmental services constitute the main novelties of this study.

#### *4.1. Consumer Profiles and Insights on Labeling Options*

The segmentation of consumers according to their labeling preferences, consumption patterns and social features unveiled the heterogeneity of consumers' demand, showing that there is a variety of preferences among consumers to verify and receive information on meat from extensive farming systems that provide wildfire protection services. While the small-town dwellers closer to these resources supported shepherds as certifying agents, the city dwellers preferred local butchers as a trusted source of information, similar to other works that highlight the preference for small retailers as a variable for consumer segmentation [42].

The results obtained confirmed the project hypothesis that butcheries still play an essential role in the commercialization of value-added products. Maintaining these local markets is therefore essential to the lamb value chain. This outcome supports the approach adopted by the Fireflocks project where the participation of the butchers' guild in Girona as partners was considered as crucial already at the project inception phase. Our results also show that innovative communication channels (i.e., websites) can be considered to build trust from consumers as identified in Class 2. These findings point to the importance of market channel diversification to reach different consumer profiles.

Previous studies have characterized food consumers based on sociodemographic data. Differently from Kihlberg and Risvik [43], who used age as the sociodemographic variable as a basis for their segmentation, we considered age to predict and define class membership [44,45]. Sociodemographics are valuable in further describing the identified consumer segments and therefore determine, to a certain extent, the capability to perform a particular behaviour [46,47]. In our study, we found that older respondents were more likely to belong to Classes 1 and 3 and less likely to be part of Class 2, where respondents showed that the distance either with the provider (shepherd) or the retailer (butcher) can be overcome by alternative ways of labeling these products and by providing additional information, either through a website or a certificate provided by firefighters.

Previous studies have signaled the increasing demand for local food as being understood as food distributed and marketed directly by the producers [42]. Results obtained for consumers in Class 1 align with these findings, where meat from extensive rearing management systems can respond to those demands. The preference for local food is also linked with increased trustworthiness and factors like environmental friendliness, support for local rural communities and local producers, and increased food safety [48]. Consumers in Class 1 align with these findings and positively considered lamb from extensive rearing systems as "local and more trustworthy".

Sustainability labels are increasingly regarded as key tools in informing consumers of the impacts of their food choices [49–51]. Labels can indicate sustainable management along the supply chain and simultaneously generate higher incomes for sustainable producing farms [52]. However, sustainability is a credence attribute, i.e., consumers cannot evaluate it personally and hence it requires a traceability system to verify the integrity of the label information [34,53] so that the social and/or environmental performance during the whole production process is guaranteed [39,54]. Consumers should place trust in the source that claims sustainability [55], and this is key, especially where information is hard to assess or complex [56], such as in the wildfire prevention role played by grazing. Aligned with these insights, our results showed that the profiles of consumers identified displayed trust in different labeling mechanisms, either in relying on short value chains where producers and consumers are connected (Class 1: Rural shepherd confidors), counting on local butchers to pass on the information (Class 3: Urban butcher buyers) or opting for new types of certificates and virtual networks (Class 2: 3rd party certifiers). The diverse options presented to consumers in our study may work in a complementary way to arrive

to different audiences of potential consumers, enabling a wider audience to consume these products for their sustainability extra added value.

Additionally, since labels can often generate confusion among consumers, the combination of certification paired with trusting relationships with producers creates a positive tandem to communicate the added value of Fireflocks products. Previous research showed that consumer preferences are affected by their support of local farmers [57] and social embeddedness patterns [58]. Social embeddedness relates to the social relationships between the actors in the local food system based on reciprocity, trust and shared values [59]. The preference of respondents in Class 1 for shepherds as the certifying agent, while holding positive views of this type of meat as local and trustworthy, can be seen as an expression of social embeddedness that, unsurprisingly, was shown in respondents living closer to the herds and landscape in small towns. This result aligned with previous studies, where preferences were shown to be influenced by the respondents' place of residency [60], as well as their engagement with the farmers and the rural community [58,61].

#### *4.2. Recommendations for Labeling Development*

The increasing willingness of consumers to support small local producers [62,63] and to obtain more information about environmental factors in product labels [30–32,64], together with higher societal preference for pasture-fed meat [31] and animal welfare gaining prominence in the hierarchy of social issues [65], may represent an opportunity for market differentiation of Fireflocks products to secure the long-term viability of involved farms and linked landscape conservation initiatives [28]. As consumers increasingly value sustainability attributes, they also tend to be willing to pay a premium for sustainability-labeled products [39], therefore, there is the challenge to develop commercial strategies to adapt to such demand [32].

In designing appropriate labeling options for Fireflocks products, the current system of geographical indications can serve as a good departure to raise market awareness while also advocating for the conservation value that this type of management delivers to society [52], adding heritage and culture dimensions as credence attributes in labeling formation [66,67]. Origin is also a highly ranked attribute in meat consumption [68]; localness can be connected with qualities linked to the materiality of the product (including sensory aspects as well as health and safety), and to a number of immaterial (credence) qualities that cannot be inferred from the product itself, but are closely related to its history and how it was produced [42].

Regarding environmental factors related to wildfire protection, Bernués et al. [30] found that information cues on those were highly relevant for many consumers. Furthermore, the contribution to wildfire prevention may appeal to altruistic reasons that likely lead consumers to pay price premiums [58]. Greater consumer sensitivity towards environmental and/or social aspects implies greater purchasing motivation towards products that reflect environmental and/or social commitment, because consumers will seek to align their values with the products that they purchase [69].

#### *4.3. Limitations and Future Research Directions*

The focus of this study on assessing consumer preferences for marketing channels for lamb meat from herds that provide fire prevention services presents some limitations that namely reside in the survey approach adopted. Our survey did not consider preferences for standard lamb meat, and in that sense, outcomes of this study do not allow disentangling whether the attributes that define the preference for standard lamb meat differ from those that influence the preferences for lamb with environmental added value. Similarly, our survey does not allow to unveil whether different consumer profiles can be ascertained linked to these different types of productions. Our study does not address the role played by search attributes (i.e., those used by the consumer at the point of purchase to make selections) [70] or experience attributes such as flavor or texture that have been found to strongly influence purchase decisions [71]. Furthermore, questions related to food choices,

and lifestyles that have been found to significantly explain food choices [72], were not included in our study, limiting the characterization of the consumer segments identified.

Accordingly, future research following-up our findings will aim to cover these gaps and gain further understanding on consumer perception of specific labeling options as well as on contextual variables, such as values and attitudes of consumers, that have shown their potential as predictors to explain consumer decisions [73]. Future research will also focus on assessing the linkage between a wider range of consumer traits and attributes that motivate purchasing lamb with unique characteristics [74]. This will also involve the use of discrete choice modeling methodologies to assess the trade-offs that consumers make among different attributes of meat products (e.g., [74,75]).

## 5. Conclusions

This study assesses consumer preferences for lamb meat labeling options from extensive herds that provide wildfire prevention services. It is framed within the Fireflocks project, which aims to increase the added value of these extensive livestock meat products, and hence the long-term viability of extensive farming systems through innovative labeling and marketing that highlight their contribution to providing wildfire prevention services. The ultimate goal of the project is to create wildfire resilient landscapes for society as a whole.

Despite abundant studies assessing consumer preferences for different production systems, our focus on production systems that provide wildfire prevention services is a distinctive novel feature of our survey. Our study identified three distinct profiles of consumers according to their preferences for labeling lamb meat from these herds. Our findings show that different labeling mechanisms may work in a complementary way to arrive to different audiences of potential consumers; these findings can support both current and future initiatives aiming to increase the added value of farming systems that provide distinctive environmental services.

The practical suggestions stemming from our findings recommend the development of labeling initiatives that highlight attributes common with geographical indications, such as the local origin and traditional dimension of lamb meat associated with extensive production systems. However, our results point out the necessity to complement these cues to build trust and understanding among consumers on the role of livestock as a wildfire prevention agent. Since consumers are heterogeneous, trust-building should undertake different strategies depending on the type of municipalities where consumers live. Local butchers in cities can be engaged as trust agents to communicate with consumers about the benefits of this type of production. Local administrations in smaller municipalities can facilitate contacts between shepherds and consumers to enhance short-value chains through farmers' markets, while virtual platforms may help to engage younger consumers. These are three complementary alternative pathways that may expand the share of potential buyers, which can help generate more inclusivity as we work toward creating resilient landscapes to wildland fire.

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**Data Availability Statement:** Data from interviews contains personal information and is not publicly available; for any queries contact corresponding author.

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