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abstract

In France, agricultural land abandonment constitutes a critical issue. Mountains, in particular, are reckoned to be particularly vulnerable to this phenomenon; therefore, several policy measures attempt to maintain agricultural activities in mountains. In addition to the role of targeted subsidies in reducing abandonment of mountainous areas, we contend that place attachment helps explain the permanence of economic activity in these areas. By using survey data and controlling for several variables likely to influence place attachment, we investigated the relationship between place attachment and living in high or lower altitude mountains in a sample of livestock farmers in the French Southern Alps. Applying an ordered probit model, we found high-mountain farmers to be relatively more attached to their place compared to medium-mountain ones. Our findings also suggest that social relations at the family and neighborhood levels, satisfaction at work, and the distinctiveness farmers assign to a place are important factors of attachment. However, we found no significant association between place attachment and farm profitability. Several policy implications regarding agricultural abandonment and support for mountain livelihoods are derived.

1. Introduction

In France and several other European countries, farming abandonment in mountain regions constitutes a critical issue (NORDREGIO, 2004; Terres et al., 2015). Contributors suggest that an increasing number of farms are abandoned due to multiple factors including difficult geographical and climate conditions and distance to markets (see, for instance, Cocca et al., 2012, for Italy and Gellrich et al., 2007, for Switzerland). Nevertheless, recent counter-intuitive findings show that, notwithstanding the fact that agricultural land abandonment is widespread, it happened at lower levels in high mountains areas, where remoteness and biophysical constraints impose more difficult conditions comparatively to lower altitude medium-mountain areas (Hinojosa et al., 2016; Garde et al., 2014). Arguments used to explain this observation point out to the role of specific subsidies at both the national and European levels in supporting mountain agriculture and incentivizing high-mountain farmers to maintain their activities (Renwick et al., 2013), the likely effect of transhumance activity, environmental regulation on land use, and the presence of second home developments (Hinojosa et al., 2016).

Without negating the relevance of the aforementioned arguments, this paper contends that the relatively lower abandonment in high-mountain areas may also be explained by another factor, namely place attachment, that is, the emotional relation between an individual and a given place (Altman and Low, 1992; Stedman, 2003). Place attachment is being studied by disciplines such as sociology (e.g., Greider and Garkovich, 1994; Trentelman, 2009), human geography (e.g., Shamai, 1991), environmental psychology (e.g., Scannell and Gifford, 2010), and environmental education (e.g., Ardoin et al., 2012). These studies provide evidence to the importance of place attachment in various groups (local residents, tourists, etc.), with implications for natural resources and environmental management (Williams and Stewart, 1998; Stedman, 2003; Jorgensen and Stedman, 2006). In other words, places are important to people and place attachment may shape individuals' land use decisions.

The objective of this paper is to address the relationship between livestock farmers and place in areas deemed to present stronger constraints for economic activity, notably the mountains. The following questions framed our research: to what extent can place attachment be associated with the biophysical and social characteristics of a mountain space? Can place attachment counteract economic forces leading to land abandonment? Taking the farmers' current location as a given result of past people-environment interactions, we enquire on the factors that influence their level of place attachment. Given that recent research shows that agricultural land abandonment is relatively lower in high

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mountains, controlling for other variables that are likely to influence place attachment (e.g., farm profitability, social relationships), we particularly tested the hypothesis that individuals located in these areas are more likely to report higher levels of place attachment compared to their counterparts in the medium-mountain and adjacent piedmont areas.[1] Previous studies considered different types of places (i.e., homes, cities, or more specific places like churches and football grounds) and tested the attachment of individuals to a given place even if they did not live there, that is, regardless of actual individuals' location (see Lewicka, 2011a). This study considers attachment to the place where people live and develop their livelihoods, therefore enabling the inclusion of local-scale social and bio-physical factors that define place attachment (Trentelman, 2009), namely the municipality. The French Southern Alps being our study site, this choice is also contextual. Indeed, municipalities (*communes*) in France are historically territorial referents, densely populated areas and often of a small size (Pistre, 2012); they also represent an important aspect of social acceptance (Giblin, 2015). In this mountainous environment we carried out a survey to collect data from a sample of livestock farmers, which we used to analyse and discuss the role of place attachment in enhancing the permanence of farmers in difficult areas.

2. Place Attachment as a Building Concept

As part of research on human-environment interactions, scholars have developed concepts such as place, place attachment, the sense of place and the *culture du terroir* to better understand how human groups relate to their environment. These concepts have been at the core of cultural geography, behavioural and environmental psychology, sociology and environmental politics (see Lewicka, 2011a, for a review). Yet, in economics, these concepts have been insufficiently integrated (Hausmann et al., 2016). Place and environment for economists often appear as embedded terms denoting both some spatial scale where an economic phenomenon is analysed (Anguelovski and Martínez Alier, 2014) and how policy influence peoples' localization choices (e.g., Gobattoni et al., 2015). The economics of place attachment have also been overlooked, partly because of difficulties in its instrumentalization, for example at valuing its contribution to land and biodiversity conservation and the production of ecosystem services (MA, 2005; Chan et al., 2012).

In human geography and environmental psychology place attachment is broadly defined as the overall feelings, bonds, thoughts, and behavioural intentions that people develop over time in relation to their social-physical environment (Brown and Perkins, 1992). Place attachment develops over time based on factors such as residency, shared social experiences, and place-related learning (Vaughan and Ardoin 2013). Place attachment can be functional, when a resource provides amenities necessary for desired activities, or emotional, when psychological investment in a setting develops through experience over time (Oakes et al., 2016). Sometimes also referred to as 'sense of place,' place attachment is associated to rootedness, and the emotional connections with place developed by individuals over the long-term (Holloway and Hubbard, 2001; Anderson, 2010; Holton, 2015). However, while often used interchangeably (Hausmann et al., 2016), sense of place goes beyond the location perspective of place attachment and involves a psychological construction in relation to a place, due especially to its permanence despite high levels of residential mobility in modern society (Hay, 1998). Hence, the place-making process includes a temporality dimension, which is linked to the individuals' residential status (see also Pretty et al., 2003). Mobility in a globalized world, as Cheshire et al. (2013) suggested, decouples the individual, farming and place. Given that places are inevitably tied to culture, geography and social relationships, different cultures naturalise 'nature' in different ways and to different ends. Therefore the sense of place can be created around geographical scales, but also around cultural ideas (Anderson, 2010). Accordingly, the significance of physical places to the development of conceptions of the self was described as the conjunction of four principles: distinctiveness (of a place), continuity (in a place), self-esteem (based on association with a place), and self-efficacy (the belief in one's ability to carry out chosen activities in one's environment) (Twigger-Ross and Uzzell, 1996; Lokhorst et al., 2014).

Place attachment is also recognized as a concept that could be used to influence behaviour. For example, studies on tourism suggest a positive correlation between individual's willingness to protect a place and the meaning of that place to the individual based on its biophysical attributes (Dredge, 2010; Ramkissoon et al., 2013). Recent contributions on resilience and climate change suggest that place attachment is a crucial social-psychological variable regulating people-environment transactions (Bonnes et al., 2003; Manzo and Devine-Wright, 2014) and may support basic preventive behaviours related to environmental risk, enhancing resilience (De Dominicis et al., 2015). In environmental psychology, the transactional school of perception demonstrates that the relationship between the subject (the individual) and the object in perception (the environment) is based not on their specific characteristics but on the dynamic, reciprocal, interdependent and temporally-related processes of interactions between the two elements; therefore, both objectively environmental determinism and subjectively intra-psychic conditions and psychological phenomena can be evidenced (Castello, 2010; Steg et al. 2013). This perspective also overcomes the initial limitation observed by Hidalgo and Hernandez (2001) that attachment to place mostly portrayed "place" as the social environment only, with very few references to the physical dimension of place, which limited its operationalization.

These multiple approaches to depict place and place attachment for policy and management poses difficulties (Williams, 2014) regarding how and by whom (residential occupants, visitors, tourists, or other stakeholders) place attachment is experienced. Another difficulty regards the context-sensitive governance of place, which is influenced by the scale assumed for place, i.e., neighbourhoods, landscapes, municipalities (Wilbanks, 2015) and the emphasis on social processes as drivers of place-making (Williams, 2014; Larsen, 2008). In the next section we deal with these concerns focusing on the biophysical and social factors that influence place attachment of residential occupants at the scale of municipalities.

3. Data and Methods

In June 2015, a survey questionnaire was sent to 1472 livestock farmers located in the French Southern Alps (Fig. 1). These farmers constitute the whole population in the Provence-Alpes-Côte d'Azur region of breeders operating in medium-mountain and high-mountain areas and having >50 sheep, 25 goats or 10 cattle. Noteworthy, 601 municipalities in the study area are in a mountainous location, among which 201 municipalities are located in a "high-mountain" area and 400 in a "medium-mountain (and piedmont)" area. Mountain areas are an administrative definition based on altitude and slope: mountains municipalities have a minimum average altitude of 800 m (in the Mediterranean area); or, slopes larger than 20%.[2] High-mountain municipalities have a minimum altitude of 1200 m for at least 50% of the municipal area.[3] Before sending the questionnaire, we tested it among some experts to improve its readability. We received 310 responses

[1] The classification of high-mountain and mountain municipalities done in France differentiates the piedmont areas from other mountain categories. Given the small number of adjacent piedmont municipalities in our sample, for simplicity, we considered these within the "medium-mountain" category.

[2] European directive 76/401, April 6, 1976.

[3] The definition of a mountain area in France is ruled by Article D113–14 of the Rural and Maritime Fishing Code, following the European directive 75–268, Article 3, paragraph 3 (April 28, 1975), the successive regulation on rural development and paragraph 2 of Regulation 1305/2013.

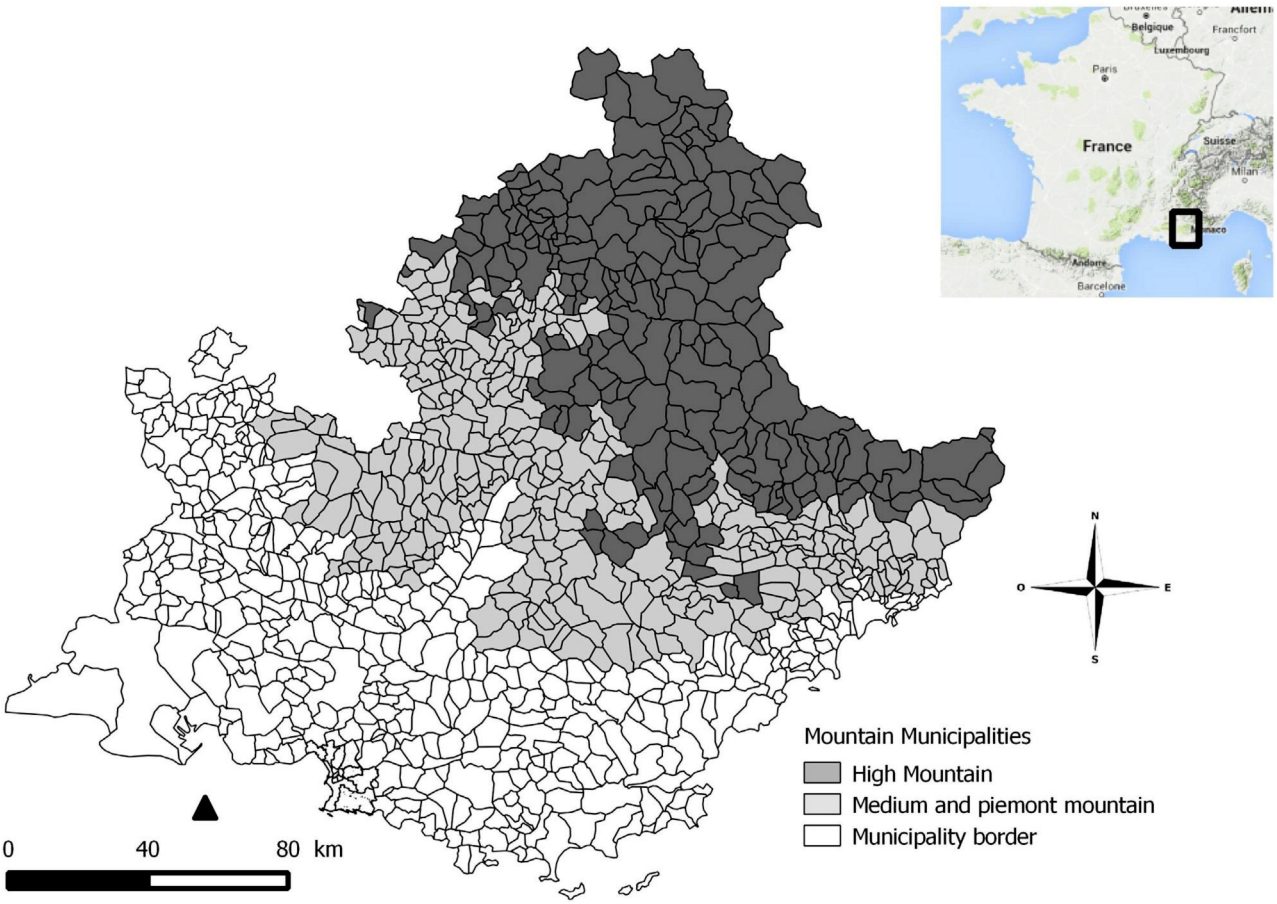

Fig. 1. The study area: the French Southern Alps in Provence-Alpes-Côte d'Azur.

(21%), which can be considered satisfactory for the targeted population. Indeed, Mzoughi (2011, 2014) surveyed similar agriculturalists and pointed out the difficulty in getting a high response rate. Given that some respondents did not answer all the relevant questions, our final sample is composed of 234 individuals.

3.1. Variables Used and Econometric Model

Our dependent variable, denoted *ATTACHMENT*, is an ordinal variable. Surveyed farmers were asked to indicate their attachment to their municipality on a scale from 1 (not attached at all) to 10 (fully attached). Given the multiple understandings of "place attachment"[4] and after testing the questionnaire in a pilot phase, the question did not include any definition of attachment so as not to bias responses towards our understanding but to leave the farmer to freely make an opinion based on his/her own understanding. To avoid using the abstract concept of place attachment that could not be well understood by all respondents, the questionnaire referred to the attachment to their municipalities ("Dans l'ensemble, êtes-vous attaché à votre commune ?" and, elsewhere, "Etes-vous attaché à l'endroit"). In French, it is understood as attachment to the local territory, with its geographical and historical characteristics (i.e., the *terroir*). To test our main hypothesis on the association between living in a high-mountain area and the level of place attachment, we use the variable *AREA*, equal to 1 if the farmer belongs to a high-mountain municipality and 0 if the farmer belongs to a medium-mountain area.

To control for heterogeneity between individuals, we include in our estimation other factors that can also be related to place attachment, falling into four groups: socio-demographic, social, activity/farm level, and local environment variables. First, previous studies argue that socio-demographic variables can be related to place attachment, but mixed findings are reported regarding the sign of such relationships (Lewicka, 2011b). Based on experimental studies arguing that younger people (De Martino et al., 2006) and men (e.g., Croson and Gneezy, 2009) are generally less risk-averse, and given the fact that moving to another place can be considered, at least to some extent, a risky decision, we expect that younger people (*AGE*) and males (*GENDER*) are less likely to report higher levels of place attachment. We also control for the individual's level of education (*EDUCATION*).

Secondly, scholars also provided evidence to the importance of social relationships in place attachment (e.g., Lewicka, 2005). Social ties are expected to reinforce the emotional link between an individual and his/her place. To test this effect, we introduce in our model four factors: the household's size, the presence of family nearby, and the nature of relations individuals have with their farming and non-farming neighborhood (*HOUSEHOLD_SIZE*, *FAMILY*, *RELATION_FARMERS* and *RELATION_NEIGHBORS*). Previous research on place attachment points out to the relevance of the residence length as a predictor of place attachment. Although farmers were asked to indicate for how many generations they lived in the municipality, this variable has been dropped from the model due to strong correlation with several other explanatory variables retained in the model.

Thirdly, one may also argue that activity and farm's characteristics are likely to shape individuals responses regarding place attachment (Brown et al., 2015). Thus, respondents were asked to indicate whether livestock constitutes their only activity. Our prediction is that farmers with other activities would report that they are relatively more attached to their place. Indeed, having other jobs and/or activities would constitute another source of income and thus allows farmers to maintain

[4] The survey instrument is available as supplementary material. For a review of the multiple understandings of place attachment and sense of place, see Hausmann et al. (2016).

livestock, despite difficult conditions. We also asked farmers about the profitability of their activity over the last five years, taking into account public subsidies (*PROFITABILITY*). We expect that farmers who think their activity is profitable have more incentive not to abandon their lands. This behaviour was observed in studies on land abandonment, particularly when a minimum profitability level is complemented by other factors that keep farmers in agriculture and the rural environment (Terres et al., 2015). Further, according to several studies, profitability is not the only dimension that drives individuals' decisions (Coppola, 2014, quoted by Terres et al., 2015; Strijker, 2005). For instance, it has been argued that satisfaction at work is highly relevant (Mzoughi, 2014). So, respondents were asked to indicate whether they are satisfied with their work (*SATIS_WORK*). Moreover, some contributors to rural studies (Herman, 2015; Burton, 2004) argue that farmers in various contexts may choose not to abandon their agricultural lands to preserve the agricultural activity in their place. Thus, to test this effect, surveyed farmers were asked whether they think someone else would take over their business once they stop farming (*SUCCESSOR*). In this perspective, we expect that farmers thinking they would have a successor are less likely to abandon their lands and, perhaps, to perceive more options for their decisions about leaving the place where their farming activity is located.

Fourthly, a number of previous studies contend that attachment also depends on the way people perceive or interpret the considered place (Stedman, 2003; Lewicka, 2011a). Consequently, we asked individuals about the distinctiveness of their place for them (*DISTINCTIVE*). We predict that farmers who think their municipality is unique or exceptional (as opposed to common or ordinary) are more likely to report higher levels of place attachment. In a similar vein, respondents were asked to indicate whether they think the living environment –defined in the survey instrument as the presence, among others, of social, cultural and leisure infrastructures – could be better elsewhere (*OTHER_ENVIRONMENT*). Intuitively, we suppose that place attachment is negatively related to a "yes" answer. Given the current features of other municipalities and the fact that the respondents' main living experience is in their own place, the likelihood of a "yes" reflects an expectation of finding better life conditions elsewhere.

The relation between area and the reported level of place attachment is analysed using an ordered probit regression (Greene, 2003). More formally, Y_i being our observed variable –corresponding to place attachment –defined by:

$$\begin{cases} Y_i = 1 \text{ (not attached at all)} & \text{if} \quad Y_i^* \le u_1 \\ Y_i = 2 & \text{if} \quad u_1 < Y_i^* \le u_2 \\ \quad\vdots & \\ Y_i = 10 \text{ (fullyattached)} & \text{if} \quad Y_i^* > u_9 \end{cases} \tag{1}$$

Y_i^* is the latent variable influencing the reported level of place attachment for the ith individual. u_1 to u_9 correspond to the threshold parameters. We consider the following ordered probit model:

$$Y_i^* = X_i\beta + \varepsilon_i \tag{2}$$

where X_i is the vector of exogenous variables, β represents slope coefficients to be estimated, and ε_i is the disturbance term, which is assumed to be normally distributed with zero mean.

To capture the weight of each variable, we also calculated marginal effects for each outcome of the variable *ATTACHMENT*. These were computed as the difference between the probabilities estimated at the sample means when the dummy variable takes the values 1 and 0, respectively. To check the robustness of our results, several versions of the model have been tested to the omission of some variables. We also did a Wilcoxon-Mann-Whitney test to compare mean responses for the two subsamples.

4. Results

The variables used to estimate our model and some descriptive statistics are presented in Table 1, both for the whole sample and separately for farmers located in medium-mountain areas and those located in high mountains. Moreover, no problem of multicollinearity was detected. In addition to the Pearson correlation coefficients provided in Appendix, we also checked the variance inflation factors (VIF) and the largest value was 1.23, which is largely below the rule-of-thumb cutoff of 10 (Ryan, 1997).

Among other characteristics, Table 1 indicates that individuals in our sample are rather old farmers, mainly men, and, have a family in their municipality. They are also quite attached to their municipality, with a mean response of 7 (on a 1–10 scale). As much as 61% of respondents picked a level of place attachment higher than 8, and, 33% choose the highest level. >30% of individuals report they have off-farm activities in addition to livestock. While 83% of individuals report they are satisfied with their work, only 35% indicate their activity was profitable for the last five years, despite subsidies. Only 29% of farmers think their municipality is unique or exceptional, and 29% think the local environment could be better in another municipality.

Regarding the comparison of farmers by area, the Wilcoxon test suggests that farmers in high mountains report a higher level of attachment to their municipality compared to individuals in medium-mountain areas: while 38% of the former report they are fully attached to their place, only 24% of the latter did so (difference statistically significant at the 5% level). Moreover, the proportion of farmers having family nearby is also higher in high mountains. However, profitability of farming activities is found to be higher in medium mountain areas, but the difference is only significant at the 10% level. Finally, the proportion of farmers thinking their municipality is exceptional is significantly higher for medium-mountain farmers compared to those in high mountains.

Estimation results and goodness-of-fit measures of the ordered probit regression of the relationship between area and place attachment are presented in Table 2. For sake of exposition, we only present marginal effects for the highest level of place attachment, that is, outcome 10. The (adjusted) R^2 of 0.10 indicates that heterogeneity is still relatively important among surveyed farmers. Robustness of our results is reported in Table 3.

Estimation results support our prediction of a positive relationship between being in a high-mountain area and place attachment, as the variable *AREA* is positively significant at the 1% level. In other words, high-mountain farmers report they are relatively more attached to their place. Marginal effects indicate that livestock farmers in a high-mountain area are 15.3 percentage points more likely to report that they are fully attached to their municipality compared to medium-mountain ones. This result remains robust in the alternative models tested by omitting some variables.

Regarding the other explanatory variables, Table 2 shows that place attachment is not related to the considered socio-demographic characteristics, namely age, gender and the level of education. However, farmers having family around are more likely to report higher levels of place attachment. The variable *FAMILY* is significant at the 1% level and has the highest marginal effect (26.4). While the presence of a husband/wife and children is expected to increase place attachment, the opposite result has been found, since the variable *HOUSEHOLD_SIZE* is significant with a negative coefficient. In other words, farmers living alone are found to be more likely to report higher levels of place attachment compared to the individuals whose household is composed of at least two persons. Note however that the concerned variable is only significant at the 10% level and not robust to a change in model specification. In addition, when specifying other thresholds, the variable *HOUSEHOLD_SIZE* turns to be not significant. Respondents having good or excellent relations with neighboring farmers are found to be significantly more attached to their place. Unlike the previous result, good relations with the non-farming neighbours were found not to be related to place attachment.

Table 1
Variables used in estimation and sample statistics.

Variables	Description	Whole sample ($N = 234$)		Medium-mountain ($N = 85$)		High-mountain ($N = 149$)	
		Mean	SD	Mean	SD	Mean	SD
Dependent variable							
ATTACHMENT **	How the farmer is attached to his/her place. Ordered: from 1 (not attached at all) to 10 (fully attached).	7.68	2.48	7.02	2.66	8.06	2.30
Explanatory variables (all binary, equal to 1 if yes, and 0 otherwise)							
AREA	The farmer's municipality is located in a high-mountain area.	0.63	0.48	.	.	.	.
AGE	The farmer's age < 40 years.	0.27	0.44	0.25	0.44	0.28	0.45
GENDER ***	The farmer is a male.	0.74	0.43	0.65	0.47	0.79	0.40
EDUCATION	The farmer went to the University.	0.38	0.48	0.44	0.50	0.34	0.47
HOUSEHOLD_SIZE	The farmer's household's size (= 1 if two or more).	0.86	0.34	0.81	0.39	0.89	0.31
FAMILY ***	The farmer has family around.	0.82	0.37	0.74	0.44	0.87	0.32
RELATION_FARMERS	The farmer has good or excellent relations with neighboring farmers.	0.61	0.48	0.62	0.48	0.61	0.48
RELATION_NEIGHBORS *	The farmer has good or excellent relations with non-farming neighborhood.	0.60	0.49	0.51	0.50	0.65	0.47
PROFITABILITY *	The farm is profitable over the last five years (including subsidies).	0.35	0.47	0.44	0.50	0.30	0.46
SATIS_WORK	The farmer is satisfied in his/her work.	0.83	0.37	0.84	0.36	0.82	0.38
OFF_FARM_ACTIV	The farmer has off-farm activities.	0.33	0.47	0.28	0.45	0.36	0.48
SUCCESSOR	The farmer thinks that someone else will take over his/her business after him/her.	0.56	0.49	0.56	0.49	0.56	0.49
DISTINCTIVE ***	What the farmer's municipality means to him/her (= 1 if unique/exceptional).	0.29	0.45	0.40	0.49	0.23	0.42
OTHER_ENVIRONMENT	The farmer thinks that local environment (defined in the survey instrument as the presence of social, cultural and leisure structures) could be better if he/she moves to another municipality.	0.29	0.45	0.30	0.46	0.28	0.45

*, **, and *** stand respectively for significance at the 10, 5, and 1% level of a Wilcoxon test comparing farmers with regards to their location (i.e., medium-mountain versus high-mountain).

Regarding the variables related to the activity and farm's characteristics, our findings suggest that off-farm activities are highly influential, since the variable *OFF_FARM_ACTIV* is positively significant at the 1% level, and it is associated to a high marginal effect (15.3). In other words, the existence of other activities is likely to increase place attachment. Moreover, the variable *SATIS_WORK* is also significant (at the 10% level), which is consistent with our prediction. However, place attachment was not related to the profitability of the farm. As stressed by other scholars (e.g., Chanel et al., 2014), farmers qualify their economic results in a relative way: for a same level of outcome, the expressed individual satisfaction depends on the level of surrounding peers' outcomes. Another interesting finding relates to the variable *SUCCESSOR*, which is significant with a negative coefficient. This finding supports our prediction and suggests that farmers who are worried about the future of their agricultural activity are less likely to abandon their lands.

Finally, the two variables related to the perception of farmers regarding their municipality (*DISTINCTIVE*, *OTHER_ENVIRONMENT*) are significant at the 1% level and are both associated with high marginal effects. Concretely, individuals who think that their place is unique or exceptional are 21.7 percentage points more likely to report higher levels of place attachment. At the opposite, those who think the local environment could be better in another municipality are 20.2 percentage points less likely to be attached to their place.

Table 2
Estimation results of the relation between area and place attachment.

Variables	Coefficients and significance	Marginal effects (outcome = 10)
AREA	0.474***	0.153***
AGE	−0.088	−0.029
GENDER	−0.064	−0.022
EDUCATION	0.200	0.068
HOUSEHOLD_SIZE	−0.415*	−0.150*
FAMILY	1.003***	0.264***
RELATION_FARMERS	0.292*	0.096**
RELATION_NEIGHBORS	0.129	0.043
PROFITABILITY	−0.201	−0.067
SATIS_WORK	0.337*	0.106*
OFF_FARM_ACTIV	0.438***	0.153***
SUCCESSOR	−0.260*	−0.088*
DISTINCTIVE	0.610***	0.217***
OTHER_ENVIRONMENT	−0.657***	−0.202***
Pseudo R2	0.1061	
Log pseudolikelihood	−407.03316	
Wald Chi2 (14)	96.61***	
Number of observations	234	

***, ** and * refer to significance at the levels of 1%, 5% and 10%, respectively.

5. Discussion

Our modelling results relate to two issues raised in the literature. Firstly, the level of an individual's place attachment influences other individual perceptions and this affects the social behaviour that impacts the surrounding landscape quality (Anderson, 2010; Dredge, 2010) or their capacity to be resilient (De Dominicis et al., 2015). This occurs for example through multifunctional rural spaces (Wilson, 2010), that is, 'places' where agricultural production occurs simultaneously with the production of environmental and social functions for rural communities (Van Huylenbroek and Durand, 2003; Brouwer and van der Heide, 2009; quoted by Wilson, 2010). We also found that the relationship between place attachment and the social-capital component of a mountain place (i.e., family ties and relationships between farmers in a mountain municipality) is positive, so it is with the farmers' perception of distinctiveness of their places. Secondly, permanence in mountainous areas, despite economic restrictions regarding profitability, was also observed in other contexts (Herman, 2015). Some evidence was found regarding how the sense of place that emerges within a community, which is shaped and informed by the geographical space occupied by a community, influences the likelihood of diversification of a traditional economic base and promotes sustainable economic, environmental, or social development (Dale et al., 2008). Our finding of a positive correlation between place attachment and the development of other activities, complementary to farming, confirms this. Although these studies did not concern exclusively mountain areas, they corroborate our conclusion that the omission of place attachment as a shadow characteristic that influences individuals' perceptions may introduce a systematic bias in economic assessments of ecosystem services and land rents.

Notwithstanding the robustness of our results, we acknowledge however that place attachment is not the only factor of mountain farming permanence and, very likely nor of land abandonment, for location choice does not equal to place attachment. As any location choice, land-use decisions not to abandon the place of current residence is

Table 3
Check of the results' robustness to the omission of some variables.

	Coefficients and significance					
Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
AREA	0.418***	0.483***	0.494***	0.303**	0.453***	0.228
AGE	.	0.167	−0.071	0.057	−0.226	−0.066
GENDER	.	0.028	−0.047	−0.057	−0.066	−0.051
EDUCATION	.	0.041	0.106	0.145	0.110	0.070
HOUSEHOLD_SIZE	−0.351	.	−0.478**	−0.318	−0.232	−0.132
FAMILY	0.949***	.	0.983***	0.957***	1.051***	0.985***
RELATION_FARMERS	0.291*	.	0.230	0.319**	0.346**	0.351**
RELATION_NEIGHBORS	0.110	.	0.129	0.213	0.104	0.235
PROFITABILITY	−0.220	−0.268*	.	−0.149	−0.159	−0.137
SATIS_WORK	0.357*	0.390**	.	0.374*	0.421**	0.484**
OFF_FARM_ACTIV	0.417***	0.401***	.	0.437***	0.435***	0.436***
SUCCESSOR	−0.225	−0.250*	.	−0.242	−0.255*	−0.268*
DISTINCTIVE	0.574***	0.513***	0.604***	.	0.741***	.
OTHER_ENVIRONMENT	−0.672***	−0.731***	−0.619***	−0.777***	.	.
Pseudo R2	0.1029	0.0680	0.0895	0.0912	0.0854	0.0629
Log pseudolikelihood	−413.25424	−446.79555	−434.95053	−430.84873	−434.37721	−469.52963
Wald Chi2	94.79***	65.15***	85.50***	86.45***	81.12***	63.07***
Number of observations	238	248	245	243	245	257

Model 1: excluding socio-demographic characteristics; Model 2: excluding social characteristics; Model 3: excluding activity/farm level variables; Model 4: excluding place-distinctiveness; Model 5: excluding the variable OTHER_ENVIRONMENT; Model 6: excluding local environment variables.
***, ** and * refer to significance at the levels of 1%, 5% and 10%, respectively.

part of a broader set of factors, some of which may not be identified in our model. Examples of other factors influencing location choices are those with a focus on the biophysical characteristics of a place, identified at a finer level of detail and scale than was done in our survey (c.f. Lokhorst et al., 2014; Ramkissoon et al., 2013), and the people-environment transactions across various relevant environmental-psychological processes that are regulated by place attachment (De Dominicis et al., 2015; Manzo and Devine-Wright, 2014). Both can be approached through ecological and experimental economics methods, but these go beyond the scope of this paper. Moreover, one may argue that abandonment in high mountains may have been so important in the past that those who remain are precisely those not willing to leave. We cannot completely rule out this possibility and caution the reader to not over-interpret our findings. In addition, our data does not allow formal testing of a causal relationship between abandonment and place attachment. This would require time series data over long periods of time. Nevertheless, we argue that the significant differences in place attachment by mountain zones may, at least in part, explain a lower level of abandonment observed in high mountain zones (Garde et al., 2014; Hinojosa et al., 2016).[5]

6. Conclusion and Policy Implications

Using survey data among a sample of livestock farmers in the French Southern Alps, we found empirical evidence supporting a positive relationship between being a high-mountain farmer and expressing a stronger place attachment, compared to medium mountain farmers, even if the difference between mean values for both areas are not large. In addition to providing support to the literature on place attachment, our contribution adds content to the literature on agricultural abandonment by providing a better understanding of the drivers of place attachment for farmers in mountain areas (Hinojosa et al., 2016; Terres et al., 2015; Garde et al., 2014; Strijker, 2005; NORDREGIO, 2004). In particular, our results suggest that social and psychological factors embedded in place attachment also explain why some farmers decide not to abandon their land and their activity. Our empirical study is not intended to fully explain why agricultural land abandonment is low in high-mountain areas. Rather, it invites scholars to consider dimensions other than solely profitability or demographic ones. Beyond an adaptation of farming practices to constraining environmental conditions, place attachment can shape the effect of other factors on land use decisions.

A better understanding of the role of place attachment in marginal areas is important to explain patterns of human settlements and land uses, especially as global-scale land use modelling adopts integrative, multiscale methodologies (Lambin and Geist, 2006). From a policymaking perspective, many policies in favour of disadvantaged areas (e.g., European subsidies for disadvantaged areas) are based on the assumption of a monotonic relationship between the burden of environmental characteristics (e.g., altitude or duration of snow period) and probability of land abandonment. A more refined understanding of place attachment could enhance the efficiency of public support, for instance by also supporting elements that increase peoples' ties with their environment, such as social relations among peers. Moreover, policy-makers and regional planners, particularly those in charge of the EU's Rural Development Programmes, could consider place attachment as an "instrument" to address multiple constraints affecting the mountain environment and society. This could include: (i) reinforcing place attachment mechanisms that would increase individual well-being associated with a place – e.g., information on landscape beauty and distinctiveness, recognition of cultural ecosystem services as elements for geographical indications attached to local products and services, and research on environmental history; (ii) providing direct support to individuals and communities engaging in activities that reinforce the functional and emotional connections of land users with their local environment. In the same vein, policies could also strategically utilize the relatively higher level of place attachment in high mountains (and more generally in difficult areas) to foster environmental conservation, notably of mountain biodiversity.

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Appendix A. Pearson correlation coefficients.

	AREA	AGE	GENDER	EDUCATION	HOUSEHOLD_SIZE	FAMILY	RELATION_FARMERS	RELATION_NEIGHBORS	PROFITABILITY	SATIS_WORK	OFF_FARM_ACTIV	SUCCESSOR	DISTINCTIVE	OTHER_ENVIRONMENT
AREA	1.00	.	.	.	.	.	.	.	.	.	.	.	.	.
AGE	0.02	1.00	.	.	.	.	.	.	.	.	.	.	.	.
GENDER	0.15	0.02	1.00	.	.	.	.	.	.	.	.	.	.	.
EDUCATION	−0.10	0.16	−0.31	1.00	.	.	.	.	.	.	.	.	.	.
HOUSEHOLD_SIZE	0.10	−0.16	−0.00	0.06	1.00	.	.	.	.	.	.	.	.	.
FAMILY	0.17	0.10	0.18	−0.15	0.14	1.00	.	.	.	.	.	.	.	.
RELATION_FARMERS	−0.01	0.01	0.04	−0.01	0.05	0.10	1.00	.	.	.	.	.	.	.
RELATION_NEIGHBORS	0.12	0.03	0.02	0.01	0.04	0.09	0.26	1.00	.	.	.	.	.	.
PROFITABILITY	−0.14	0.01	−0.03	0.07	−0.08	−0.08	0.05	−0.04	1.00	.	.	.	.	.
SATIS_WORK	−0.02	0.12	0.03	0.08	−0.01	−0.01	0.09	0.10	0.23	1.00	.	.	.	.
OFF_FARM_ACTIV	0.07	0.02	0.03	−0.02	−0.02	−0.01	−0.09	−0.05	−0.09	−0.07	1.00	.	.	.
SUCCESSOR	−0.00	0.02	−0.05	0.15	0.11	−0.05	0.06	0.01	0.08	0.25	−0.17	1.00	.	.
DISTINCTIVE	−0.17	0.16	0.00	−0.02	0.04	0.01	0.10	0.12	0.10	0.16	−0.03	0.04	1.00	.
OTHER_ENVIRONMENT	−0.01	0.13	−0.00	0.08	−0.13	−0.17	−0.11	−0.03	−0.03	−0.05	−0.00	0.05	−0.23	1.00

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