



# Agriculturisation and trade-offs between commodity production and cultural ecosystem services: A case study in Balcarce County



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## ABSTRACT

Increased production of commodities in Latin America has transformed the rural landscape with a potential loss of cultural ecosystem services (CES). The aim of our study was to assess the extent and mechanisms by which the agriculturisation process in Balcarce County in the Pampas region of Argentina has affected the supply of CES of the rural landscape and consequently, the well-being of local inhabitants. Data were obtained through exploratory interviews with selected inhabitants of Balcarce County (Argentina). We focused on people's perceptions regarding landscape changes in the last two decades and the rural landscape aspects that provide identity, sense of place and cultural heritage. Interviews were qualitatively analyzed through content analysis. Results showed that twenty years ago the landscape sustained food provision along with CES. Agriculturisation has implied an undeniable increase of commodity production (i.e. soybean) and economic benefits at the expense of a significant loss of natural environments and changes in the rural livelihoods that sustain CES. The *sierras* (low mountains) emerge as the last remnants of natural environments sustaining identity, sense of place and cultural heritage.

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## 1. Introduction

In recent decades Latin American countries have experienced a sustained increase in the production of new agricultural commodities and an appropriation of rural areas by external agents, through the sale or lease of land to investors (often international). These lands are transformed into major food crops, biofuels or both, thereby exacerbating social conflicts, poverty and vulnerability of rural communities (Overbeek et al., 2012). In Argentina this process of increasing and continuous use of lands for agriculture in detriment of other uses is known as "agriculturisation" (Manuel-Navarrete et al., 2005). In the Pampas region of the country, this process began in the 1970s and is characterized by intensive use of machinery and chemicals, as well as expansion of crops, predominantly soybean, over natural grasslands or traditional crops - cattle rotation, whereby cattle production is

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concentrated in feedlots or displaced to marginal areas (Manuel-Navarrete and Gallopín, 2007; Reboratti, 2006). This process led to significant increases in yields (from 3.7 million soybean tons in 1980/81 to 58.8 million in 2015/16; MAGyP, 2017), but also to unemployment, rural depopulation (Morello et al., 2006) and loss of natural ecosystem and native biodiversity (Herrera et al., 2013). At the same time, average farm size increased 25% (whole country) while 24% of small and medium size farmers (farms size from 10 to 500 ha) withdrew from agriculture between 1988 and 2002 (SAGyP, 2002). Thus, a new agricultural model emerged, based on the incorporation of new technologies, large amounts of invested capital, low rural employment, productive concentration and land leasing, with a significant loss of small and medium farmers, who often chose to rent or sell their farms, leading to the simplification of the rural social structure and the weakening of local communities (Iscaro et al., 2014; Gras and Hernández, 2016; Reboratti, 2006). The resulting rural exodus and the concentration of land in large farms gave place to a phenomenon labeled as "agriculture without farmers" (Teubal, 2009).

Land use and cover change (LUCC) has been recognized as the most important single factor influencing the conservation of

natural environments (Vitousek et al., 1997). Globally, some adverse impacts of LUCC have resulted in modified biodiversity, altered functional processes and diminished provision of ecosystem services to society (De Groot et al., 2002; Balvanera et al., 2006; Díaz et al., 2006; Metzger et al., 2006). Ecosystem services –the “aspects of the ecosystem” that contribute directly or indirectly to human wellbeing (Fisher et al., 2009; MEA, 2005)– are both a concept and a framework to understand people–nature relationships. MEA (2005) classified ES in provisioning, regulating and cultural services. Cultural ecosystem services (CES) are defined as ecosystem contributions to non-material benefits (e.g. capabilities and experiences) that arise from human–place relationship (Chan et al., 2012). Examples of CES are identity, spirituality and sense of place, which are important components of sustainable development and human well-being (Brown, 2005; Buijs et al., 2006; Cheng et al., 2003) and are the focus of this study. Their importance lies on the fact that cultural values of the landscape are irreplaceable and once degraded these services are unlikely to be replaced by technologies or other goods, so that their recognition and the observation of their dynamics is fundamental to evaluate the impact of socio–environmental alterations on human wellbeing (Hernández-Morcillo et al., 2013). In turn, most CES are experienced and appreciated directly and intuitively by social actors, being this intangibility, subjectivity and un-easy quantification of CES in biophysical or monetary terms which makes them difficult to incorporate into the decision-making processes (Daniel et al., 2012).

The relations between landscapes, human values and wellbeing have long been explored from different disciplines, such as health (e.g. Conradson, 2005), rural sociology (e.g. Barbic, 1998), landscape ecology (e.g. Nassauer, 1995a) and geography (e.g. Liu and Opdam, 2014). These studies set the bases for the study of the relationships between CES flows and human values and wellbeing. However, under the ecosystem services framework, there are few studies that investigate the way in which changes in land use are perceived and valued by people and their impact on the supply of CES, being necessary a better comprehension of the relationships between ES and wellbeing (Bennett et al., 2015; Carpenter et al., 2009; Chan et al., 2012; Daniel et al., 2012; Plieninger et al., 2013). This underrepresentation of CES in ES studies is more pronounced in South America (Balvanera et al., 2012), and are scarce the studies of trade-offs between CES and other services (Hernández-Morcillo et al., 2013). In the Pampas region of Argentina few studies analyzed the effects of landscape transformations on the provision of CES or the social values and wellbeing these ecosystem services sustain. Some studies examined the agricultural transformation and its relation with rural depopulation, the perceptions of family farmers on global changes, and their values and social reproduction strategies in face of rural transformation (e.g. Litre et al., 2007; Stratta Fernández and De los Ríos Carmenado, 2010). Mastrangelo et al. (2015) showed that the diversity of services studied and the analysis of trade-offs between them were often low in most studies using the ecosystem services framework in the Pampas region, and that the majority of evaluations focused in provision and regulation services, with little or no attention to cultural services.

Cultural services may be provided directly by the ecosystem, but also by the productive and social activities undertaken there, such as the traditional knowledge transmission or identity associated with agricultural landscapes (Nahuelhual et al., 2014). For example, the country people identity (*gauchezca* culture) in the Pampas region of Argentina is closely related to farming activities, mainly livestock, which have promoted values and traditions that have been transmitted for generations (Litre et al., 2007). Landscape values can be understood as the qualities attributed by people to

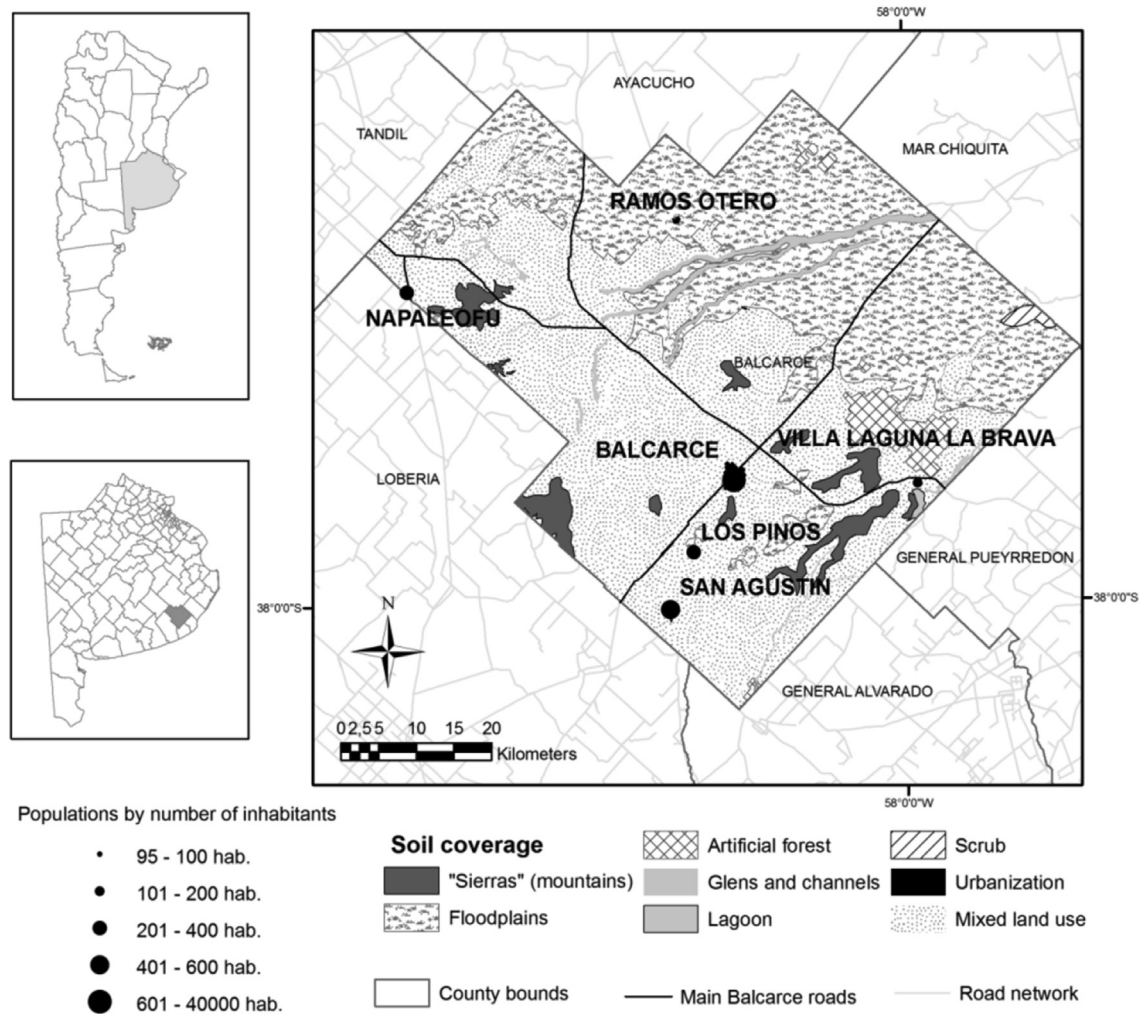
the whole landscape or to some of its components; as it is a social construct, it could vary between individuals and over time (Ruiz and Domon, 2012). Therefore, if landscape and activities change, it is probable that these changes affect CES supply. Although one main characteristic of CES is intangibility, they nevertheless create robust ties between humans and their natural environment, representing one of the strongest incentives for people to engage in natural capital conservation (Daniel et al., 2012; Milcu et al., 2013; Schaich et al., 2010). CES are important in a wide range of situations and industrialized societies frequently value them ahead of other services (Palomo et al., 2011; Quétiér et al., 2010). In this context, the goal of the present study was to address how the agriculturisation process, characteristic of the Pampas Region, has affected the supply of CES, namely identity, sense of place and cultural heritage, and consequently, the well-being of local inhabitants, in a typical rural county of the southeast of the humid pampas. Related research questions were: Which are the main landscapes features sustaining CES? Are there perceived trade-offs arising from agriculturisation? To what extent CES loss has affected wellbeing and rural livelihoods? Relationships between ecosystem services and wellbeing are, to a large extent, context dependent, and therefore local case studies are well suited to deepen our understanding of such relations; yet, generalizations are generally limited.

## 2. Methods and data

### 2.1. Study area

This study was conducted in Balcarce district (surface of 4115.3 km<sup>2</sup>) located in the southeast of Buenos Aires province (Argentina), where 70 per cent of land is planted surface (33 per cent with crops; 36 per cent with forage) while near 30 per cent are natural or seminatural grasslands, concentrated in lowlands and hills (Barral and Maceira, 2012). Its productive characteristics are similar to the rest of the Humid Pampa Region, being the agriculture and livestock the most common activities, but its natural landscape differs from the surrounding plains due to the presence of its hills or *sierras* (low mountains) (Fig. 1). Historically Balcarce was a potato-producing district; however within the last 20 years this crop has decreased and has been partially replaced by soybean (Urcola et al., 2015). Simultaneously, the total cultivated area increased by 58 per cent. In 2013, 57 per cent of cultivated land was covered by soybean at the expense of grazing lands (cattle decreased by 52 per cent in the same period) and other crops (e.g. wheat decreased by 69 per cent) (MAGyP, 2017). Agriculture expansion, associated with an increase in the use of input technologies over other production factors, negatively affected small farmers, who tended to rent their lands to large farmers, leading to the decline of traditional small-scale farms (Urcola et al., 2015). Therefore, Balcarce County did not escape from the agriculturisation process registered in the whole Pampa Region, with its effects of simplification and homogenization of the landscape and loss of natural and semi-natural environments and native biodiversity (Herrera et al., 2013), thus affecting the provision of different ecosystem services (Barral and Maceira, 2012). Traditional agricultural practices, which means the type of agriculture that relies on traditional practices such as people working their land considering the local knowledge, cultivating typical crops of the region (as potato or garlic), doing crop and animal rotations, and taking into account the social practices around the productive activities, changed drastically.

The *sierras* are usually part of private farms and their management depends on landowners; this fact hinders the *sierras* conservation, even if they could be considered as a common good that benefits the whole community. Traditional use of the *sierras* include



**Fig. 1.** Balcarce district map (Buenos Aires province, Argentina) showing soil coverage, main Balcarce roads and road network (IGN, 2012) and location of population centers considering the number of inhabitants (population Census - INDEC, 2010). The "floodplains" cover are predominantly grazing areas and the "mixed land uses" cover is dominated by agriculture.

cattle grassing by farmers and fern harvest by specialized collectors that operate with or without farmers authorization; spring burning is sometimes used to stimulate grass regrowth for cattle. Even if grazing and fire affect sierras biodiversity (Sabatino et al., 2010), the sierras have traditionally had a low productive use because of their slope and rocky soils. However, it is increasingly common nowadays to cultivate up to where rock begins or, in those sierras that have a flat top, to cultivate over it. Another agronomic practice that has become rather common is total herbicide (glyphosate) aerial application to kill bushes and "pajonales", followed by aerial seed of forage grasses as ray grass to increase cattle stocking rate, with de trade off of losing soil protection against erosion and habitat for wildlife. Nevertheless, agriculturisation process not only affected the natural aspect of the landscape. Because of land concentration and lease of farms, the access to the sierras has become more and more restricted to recreationists, who frequently cannot obtain permission to get inside the farms to do their activities such as trekking, running, climbing or paragliding.

In 2001, the district's total population was 42,039 inhabitants. In 2010, this figure increased 4 per cent, with a strong concentration in the capital city (San José de Balcarce) and the consequent reduction of the clustered and dispersed rural population (INDEC,

2001 and 2010 population Census). These demographic changes were associated to social changes in the labor market and to the incorporation of stakeholders from outside the rural sector, modifying lifestyles of local inhabitants (Petrantonio and Aranguren, 2008). Therefore, Balcarce district can be considered representative of the Pampas region regarding land use and social changes linked to the expansion of soybean and the intensification of agriculture. In addition, its beautiful natural landscape and history of traditional activities make it appropriate for this study.

## 2.2. Research approach

Our study relied on qualitative research methods, which can generate sensitive data about the social context in which landscape changes took place and reflect the values of people, through synthesis and interpretation of the stories of different actors (Cheng et al., 2003; Klain and Chan, 2012; Satterfield et al., 2013; Stephenson, 2008). The data collection instrument was a personal exploratory interview with open-ended questions. The interviews were made by the first author and were recorded to facilitate the fluency of the interviewee's story and to keep the detail of their words exactly as they have been told. This method is considered an

appropriate approach to CES, because it facilitates the opportunity for “expressing the inexpressible” (Satterfield et al., 2013) in the sense people can talk explicit and openly about their perceptions, feelings, values or memories, and about their relation with landscape and the invisible benefits that it provides. The questions that guided the interview were about characteristics of the rural landscape 20 years ago compared with present time. It was also asked about aspects of the rural landscape that make it unique (identity), aspects that they like most and make them feel part of the site (sense of place), and aspects that they considered important to maintain between generations (cultural heritage). For example, questions to inquire about sense of place were: “What do you like most about living here? What would you miss, in terms of landscape or traditions, if you go to live in a very different place? What places give you this feeling of belonging? Are they related to the natural landscape or to culture aspects? What feelings or sensations give you those aspects of the landscape?”

In this study, landscape is considered in an holistic way as a complex entity that emerges from the localized interaction of physical environmental factors (e.g. geology, hydrology, climate), biological life forms (e.g. plants, animal, humans) and created objects (e.g. machineries, houses) (Conradson, 2005). In turn, rural territory is understood as a socio-ecological system where the natural physical space and the complex set of social actors interact, and where these actors appropriate and transform the landscape through their thoughts, feelings and actions, according to the meaning and valuation of the different places, attributes and processes (Brown and Raymond, 2007).

The interview targeted local people who had lived in rural areas of Balcarce during the last 20 years or more. Perception is understood as the personal vision that humans make of their surrounding world according to their personal experience and social and cultural context, being this image of the world a major determinant of their relationship with nature (Forero et al., 2014). Sociocultural preferences incorporate these individual perceptions, but also knowledge and associated values; thus, they could vary between people or over time due to different factors such as changes in their personal needs or cultural traditions (Martín-López et al., 2012). The methodology used for the selection of interviewees was prior identification, targeting those people who could provide more information for the intended goal; for example, older people who had lived in the rural areas. For that purpose, we first contacted people from different local institutions, like libraries, rural schools and the National Institute of Agricultural Technology (INTA). This approach was complemented with the “snowball” sampling methodology, where the selected informants suggest new respondents. Given the purpose of the study, the selection of interviewees was intentional rather than representative of the county rural population, and possible differences between social agents were not considered in the analysis. Intentional or directed selection has been used in several studies of this type (e.g. Nahuelhual et al., 2014; Van Berkel and Vergburg, 2014; Vouigny et al., 2009). However, when quantifying the qualitative data obtained, this bias could be considered a limitation of the method.

The number of respondents was not set in advance, but interviews were conducted to the “point of saturation”, where new information no longer provides new data, generally occurring after 20–30 interviews (Morgan, 2002). Between May and June 2014, 22 total interviews were performed, a number consistent with sample sizes used in other studies of this nature (e.g. Conradson, 2005; Nahuelhual et al., 2014; Satterfield et al., 2013; Stephenson, 2008; Vouigny et al., 2009). The interviews lasted an average of 45 min. Twelve of the interviewees lived at Balcarce city, six in rural villages (San Agustín and Los Pinos), two in the countryside, and two did not live in the District anymore but had spent the majority of their

childhood and youth in rural areas and kept ties with the county. The average age of respondents was 52 years (range between 30 and 93 years); 14 of them were men and eight were women. Their educational level was heterogeneous, including three interviewees who did not finish school, four that finished primary level, four that finished secondary school, three that finished tertiary level and eight that reached a university degree. They also had different employment activities (e.g. teaching, administrative tasks or extension, small farmers or rural advisers, retired) and most of them had participated in traditional activities (e.g. countryside dances or local festivals) and outdoor recreational activities (e.g. hiking, biking or recreational fishing).

### 2.3. Data analysis

Examination of the information obtained from the recorded interviews was performed through content analysis, a qualitative technique that identifies common ideas based on responses of different participants (Vaismorari et al., 2013). Pre-recorded responses were incorporated into a database by the first author, retaining the actual words (and expressions of feelings) of respondents. With the help of qualitative analysis software Atlas.ti.7 (Berlin, Germany), five steps were followed to assess how agricultural intensification affected the different aspects of the rural landscape that provide CES. In Fig. 2, the five steps are explained with examples to clarify methodology: to start, the different aspects of the landscape that emerged from the stories were codified by the first author, grouping them by families: Rural landscape, CES, Others (Step 1). Then, the intensity of each aspect was measured by counting how many times the “code” appeared in the stories, even during the same interview; it was not counted every time the word appeared, but when the subject arose in the conversation (Step 2). After that, changes in nowadays rural landscape were associated with the aspects that supply CES, where the net change could be related negatively or positively to the aspects that supply CES if they worsen or improve that aspect, respectively (Step 3). As each aspect of landscape provides different CES in different magnitude, changes in CES supply were estimated multiplying the intensity of change in the aspect of landscape that supply CES by the intensity of CES provision by that aspect (Step 4). Finally, the feelings generated by the different CES and the solution proposed by respondents to protect CES were registered (Step 5).

When considering the different landscape attributes, it should be noted that the *sierras*, although part of the natural landscape, were considered separately due to their importance in the landscape of the area and because in several stories (about 30 per cent of cases) only this aspect of the landscape was mentioned.

## 3. Results

### 3.1. Cultural ecosystem services and landscape components valued by people

According to the interviewees, the most important components of the rural landscape that supply identity to Balcarce were the *sierras* in particular and the natural landscape in general (related to natural forms of landscape), followed by fertile soils and potato crop (related to productive practices) and some cultural values of their inhabitants (related to social practices) (Fig. 3). Respondents also considered the Fangio museum, an important element providing place identity (everything related to Fangio, a famous race car driver native of Balcarce) and to a lesser extent, the Balcarce Integrated United (UIB, a research and education institution) and the “Balcarce dessert” (a typical cake). As these are not features of the rural landscape, they were not considered in the study;

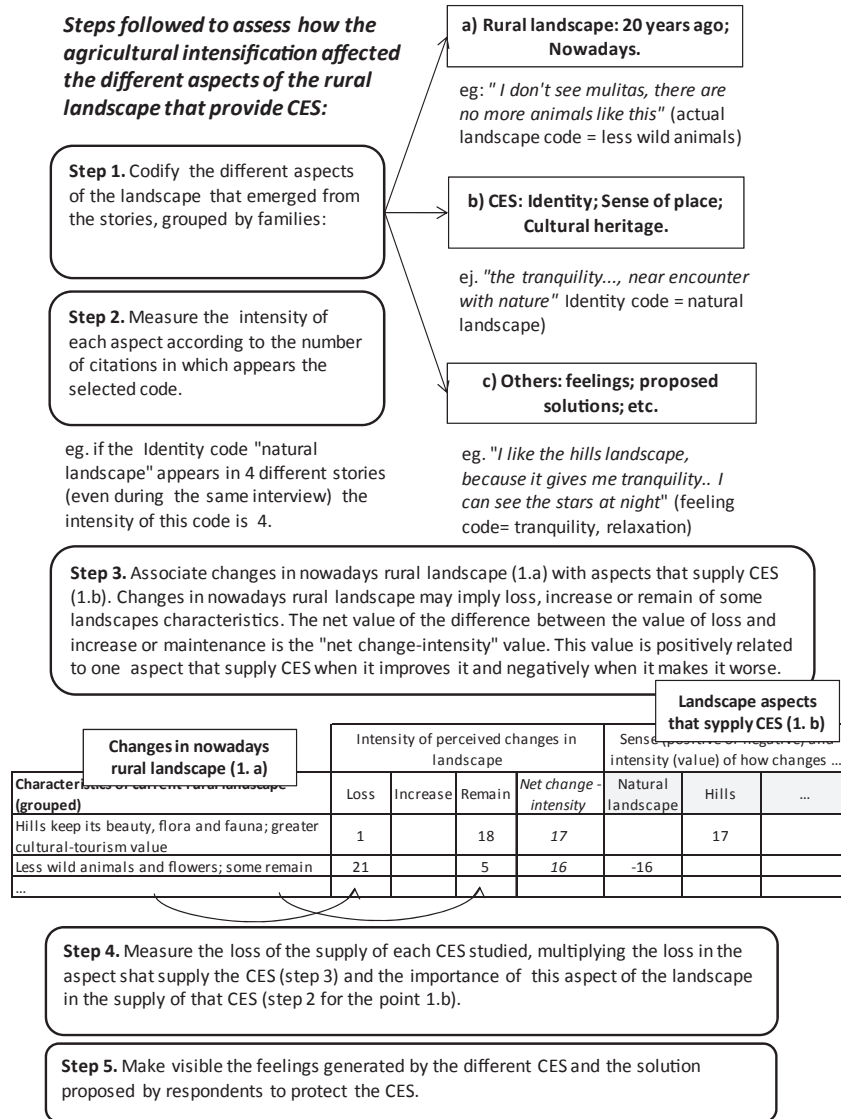


Fig. 2. The five steps followed to assess how the agricultural intensification affected the different aspects of the rural landscape that provide CES.

however, they are important to local identity. One interviewee said: Balcarce is identified with Fangio because he was five times world champion. However, what makes Balcarce known and pleasant to people is the zone of the sierras. Everyone who comes to Balcarce speaks of its sierras, because they can enjoy seeing them, walking or climbing on them, quietly (Employee, 56 years old).

According to the participants, close connection with the natural landscape in general and with the sierras in particular was the principal supply of sense of place, but also the tranquility and the close ties among people in the rural environment. Cultural heritage was related to natural landscape and natural resources in general and to the sierras in particular. As it was already marked, agriculture activity is mainly concentrated in the fertile highlands of the County, while livestock is raised in the lowlands and in the sierras, although nowadays it is more frequent to see agriculture everywhere. In the sierras recreational activities, such as trekking and climbing, and educational activities are also common. Associated with the countryside in general, cultural heritage was also linked to traditional festivals, such as the rodeo "A Lonja y Guitarra", the "garlic party" or the "potato party", and to cultural values and rural way of life. They considered that tranquility and security of rural

life, provided by the fact that everyone knows each other, were important values to be preserved. They also mentioned some customs and traditions important to be maintained, like folklore music, a typical poetic metric called "décimas", and countryside dances, practiced on Sundays among rural neighbors. An interviewee refers:

*I think it is important to keep our folklore music, dances, "décimas", all that make sense to this place. It is also important to take care of the park, squares and trees (Rural inhabitant, 80 years old).*

In describing their natural landscape, respondents referred to a combination of different landscape attributes, expressed as the mix of plains, sierras, fields, streams, natural vegetation and wildlife, and additionally the proximity to nature and the sound of birds, as they told in their stories:

*Here the landscape has birds, plants and everything what is in nature. You have the sierras, lakes, agricultural fields and the sea at 65 km. It is the environment where I was born, I grew up here and I continue in this place. It generates me satisfaction, it is a caress for*

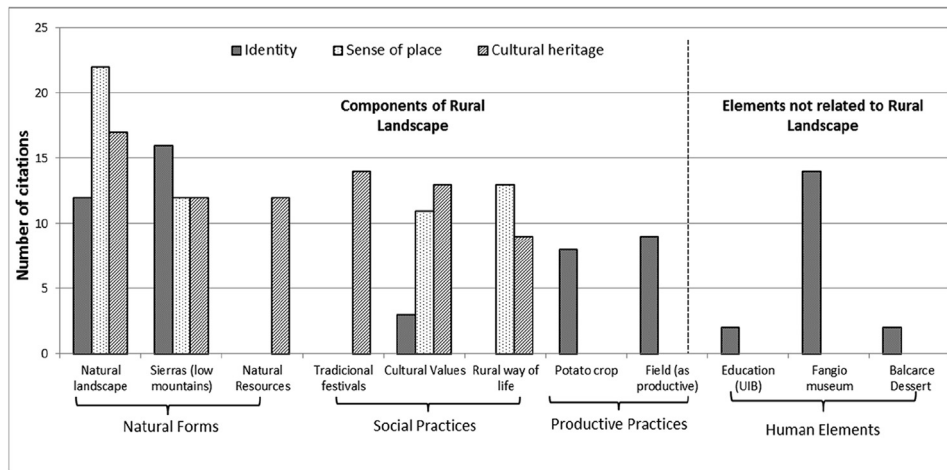


Fig. 3. Components of rural landscape (and other elements not related to it) that supply cultural services of identity, sense of place and cultural heritage.

*the heart. Sometimes I climb the sierras and I sit up there and look the open landscape. It is like doing yoga (Rural technician, 61 years old).*

However, when participants expressed these aspects of the landscape in relation to cultural heritage, they put more emphasis on the conservation of native species, natural vegetation and natural resources, such as quality of water and soil. One interviewee makes it clear:

*The landscape itself has to be something to conserve, in general, everything: the landscape structure, the water quality of streams and its nearby areas; the lakes, the sierras and the access to the sierras (Rural technician, 35 years old).*

When respondents spoke about the rural way of life, they referred not only to work their land and breed animals, but also to ties among community members (by barter or socializing), the tranquility of the locality, characteristics of the local people and other factors affecting well-being, as is pointed out in this story:

*Before, there was more solidarity among neighbors. Nowadays it is not so frequent, especially in the city. People in the rural area still maintain the care of everything. They conserve better some traditions or customs, perhaps because they are more isolated. For example, they help each other in the “carneadas” (pork meat manufactory). The rural inhabitants still live differently, more peacefully (Employee, 50 years old).*

Traditional festivals were considered important as a link between past and future generations and due to the values they contain that help to maintain the rural way of life. An interviewee revealed this:

*Keeping these kinds of habits, such as the countryside dances and the traditional festivals, contains other values that are directly associated with practices, such as solidarity with one’s neighbor. It is good to maintain these traditions because one can understand how the rural reality was before (Rural technician, 35 years old).*

Local well-being was expressed through people’s feelings, such as satisfaction, fulfilment and joy when talking about the sierras and the natural landscape as providers of identity. In some stories above it was already expressed and for this interviewee it was clear:

*One must understand that all these things in the landscape, such as trees, animals, mountains or stones are wonderful and they are elements given to us to be happier (Employee, 43 years old).*

Even more intensively people expressed the tranquility, peace and relaxation provided by the natural landscape and the rural way of life associated with sense of place, as in this story:

*Balcarce is a place where landscape allows doing outdoor activities and I love that. I like to ride a bike, so I take a rural road and I start riding quietly. I like the tranquility and peace you can feel here (Field advisor, 32 years old).*

However, when talking about aspects related to cultural heritage, feelings were mostly of nostalgia, showing both the importance and the feeling of loss of these aspects of the landscape for the local community:

*Our little town looks sad and abandoned. It is not more as it was before. It was beautiful. There were many people. People raised their animals. They were healthier. Now there are no people, nobody to talk with, is another life. No place is more beautiful than my town. I like everything here: my life, the park and the tranquility. Some years ago, it was another environment, more natural. People started to change and their values are being lost (Rural inhabitant, 69 years old).*

Local people also claim for the conservation of the rural area, as in this story:

*It should be important to keep the rural area around Balcarce, so that the beauty of the landscape does not disappear because of the ambition of someone who wants to cultivate and to exploit land to the maximum (Employee, 56 years old).*

All these feelings were reinforced in the people who live in the rural village, who had more contact with these elements, as it was expressed by an interviewee:

*I love this peace, I know everyone, it is like a big family. They are my people. Not living in the anxiety of the town. To leave everything open and to know that one shall not be hurt. To drink a “matecito” (typical hot beverage) in a summer afternoon while listening birds singing. That is a pleasure for me. We live in a privileged area. Every*

*day you discover something new. The sierras and the park are so beautiful, the nature, the peace you feel by sitting under a tree and see the water flow (Rural inhabitant, 54 years old).*

### 3.2. Rural landscape changes perceived by people

According to respondents, a larger number of families living and working in the countryside and a greater connection between people and nature characterized the rural landscape 20 years ago (Fig. 4), as an interviewee told in this story:

*Every little woodlot of four or five eucalyptus that you see when you go from here to Balcarce city points out that there was a house there. Now is not like that anymore. People left the farms and their rural houses because nowadays you could not live more with less than 60 ha. Before, people lived on what they harvested from their soil. They sold some potatoes, won some money and ate chickens, sheep and vegetables from their farms. That was people life (Rural technician, 61 years old).*

These characteristics, coupled with the largest amount of livestock activity, resulted in the existence of a large number of traditional and outdoor recreational activities (e.g. countryside dances, local festivals) which were part of community daily life, as it is told in this story:

*30 years ago it was common to celebrate the countryside parties, in which people of the area joined to celebrate, dance and play games. The rural school was the meeting place where people went to listen music and play the lottery (Employee, 56 years old).*

Those activities strengthened ties and fundamental values such as respect, education and responsibility, associated with family values, solidarity and caring for the neighbors, as this interviewee told:

*The way of life expressed in general that people had their neighbor more in mind. The activities were collective. Everything was much more shared. The typical example were the “carneadas”. Usually pigs were raised in the farms and at certain time of the year some animals were slaughtered. As there were many families in the countryside, the neighbors came to help and after work was finished, everyone took something. People remember it as a party (Employee, 43 years old).*

According to the testimonies, 20 years ago the scenery was more natural and presented a greater diversity of traditional crops such as potatoes, wheat, corn, sunflower, oats, barley and flax. Coupled with the existence of smaller plots, this provided broader color diversity in the landscape such as browns, greens, yellows and lilacs, as summarized this story:

*The flax had a very pretty flower that was in bloom for about 20 or 30 days. In the morning, you could see violet colors in the countryside planted with flax. Nowadays you see a green landscape; you do not see other colors. I would say that the overall color you are seeing is predominantly from soybeans, which is everywhere (Agronomist, 64 years old).*

As in this story, most of the other respondents talked about the current predominance of soybean crops, expansion and intensification of agriculture and the detriment of cattle raising and natural spaces. They also mentioned the diminution of wildlife and

wild flora in the landscape, for example in the sierras, at the edges of the roads and under the fencing that separate farms or plots, due to a greater use of machinery and agrochemicals, as this interviewee said:

*The landscape has changed in terms of less diversification. Spaces previously not considered as productive or fields with only livestock are now under continuous agriculture. With direct sowing, the fields have no rest, there is no rotation with livestock, now you have only soy-maize or wheat. With the new technology package, fields are sown to the edge of the fence. With the use of glyphosate, there are no more weeds in the fields or native species growing along the fences or roads. Even the sierras are modified by man: as they want to have more surface to cultivate, they remove the stones with machinery and apply management practices such as drying natural vegetation with glyphosate or burning it to stimulate the grow of fine grasses for cattle. Diversity affects the visual aspect of landscape, its colors and what could be touched. All this is for a short-term rather than for a long-term usufruct (Rural Inhabitant, 45 years old).*

These changes were associated with a more intensive agriculture, less small farmers and a higher presence of larger properties, working in big plots and sometimes in rented lands, as it is told in this story:

*Previously, the true actors were the producers -big or small- and their families. The rural area had shops, large warehouses of general branches, traditional constructions, the train station, schools, doctor, etc. Nowadays, actors in the area have changed conferring a different imprint to the place, with new commerce of inputs or machineries but with fewer families. Some producers have disappeared; they sold their fields or leased them. It also appeared many more companies with many resources, principally economic. All these generated a more productive, entrepreneurial and individualistic view of production, where the money factor is considered, but not the environmental impact, and producers are swept away by it (Technician in rural extension, 42 years old).*

The small number of people currently living and working in the countryside, and the new communication technologies led to further isolation, reinforcing the values of today's society; a society saw by respondents as consumerist, individualistic, materialistic and based on short term goals. This interviewee explains it clear:

*Today, culture has changed. Today society is much more materialistic, with an individual and a short-term vision, where the one next to me does not matter. Also in relation to nature, where we are only interested in today and now, we do not think about the future, in those who will come. Nowadays there are large areas of soybean production managed by two people, where previously you had perhaps 15 families working and living in the countryside (Employee, 43 years old).*

According to the respondents, these changes in human values influenced landscape changes along the last two decades, and changes in the rural landscape influenced those values, as it was expressed by a respondent:

*“Before, people were joined in a common cause; for example, if something was missing in the community, they joined to solve it. There were other values as the solidarity with the neighbor, but they got lost. The countryside is the reflection of this. Nowadays nothing matters, they are other codes. There is more isolation; each*

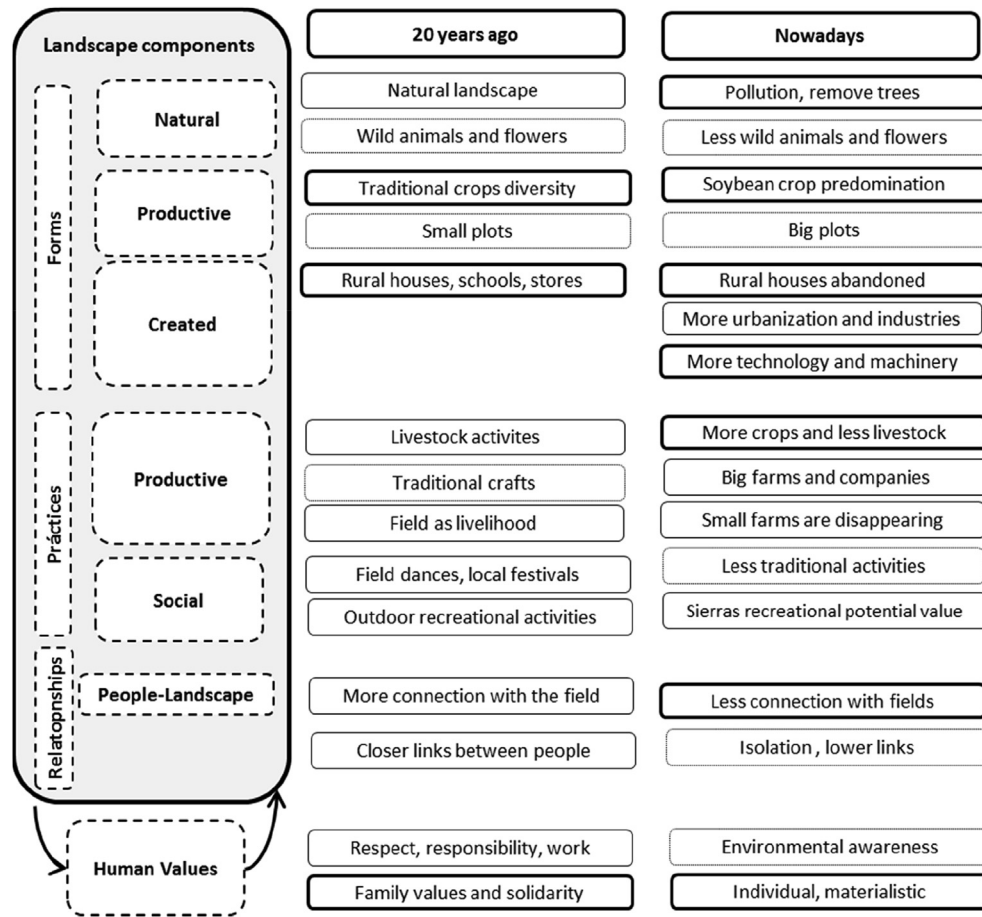


Fig. 4. Principal landscape attributes 20 years ago and nowadays, as perceived by interviewees. The thicker line indicates a greater intensity in the perceived aspect. The arrows show that human values are influenced by and influence changes in rural landscape.

one does what he wants without thinking about neighbors” (Rural inhabitant, 30 years old).

### 3.3. Changes in rural landscape and CES loss

Regarding components of the landscape that supply CES, the natural landscape and the rural way of life and traditional festivals were the aspects most adversely affected by agricultural intensification, although some stories expressed that a few of these aspects still remain (Fig. 5). With less intensity, cultural values, natural resources and potato crops showed a similar pattern. In contrast, the countryside as productive fertile land was favored by the changes, because of the increase in agricultural production. According to the stories, the *sierras* still conserve their beauty and biodiversity, being the best-preserved remnants of natural environment.

The natural landscape in general, and some natural resources in particular, were the aspects most negatively affected by agricultural intensification, being sense of place and cultural heritage the most sensitive cultural services in face to these changes (Fig. 6). The loss of traditional festivals, such as the “garlic party” in the rural village of Los Pinos, associated for years with agricultural and livestock practices and the harm caused to the rural way of life by agriculturalisation negatively affected the transmission of cultural values and traditional knowledge to new generations, as well as sense of

place perceived by people. For example, the stories related about the “carneadas”, when neighbors met to kill some pigs, prepare cold meat and then distribute the food among them. The same happened when they interchanged vegetables or fruits from the different orchards and farms. By losing these traditional activities, and the contact among people that they imply, some values such as solidarity between neighbors weakened, as well as the traditional knowledge of how to do these tasks, which are transmitted from generation to generation through practice. The decrease in potato cultivation also affected, although to a lesser extent, local identity. Instead, the agricultural intensification and homogenization benefited the identity of Balcarce in terms of fertile and productive land, because it increased the local countryside productivity. The *sierras* were the components of the landscape that suffered the least changes over time, being currently the main supplier of the three types of CES under study.

## 4. Discussion

### 4.1. Landscape as provider of cultural services

Our study shows that the natural landscape as a whole, as well as particular landscape attributes (e.g. *sierras*) indeed sustain CES, especially sense of place and cultural heritage as perceived by local people. Similar results have been reported in previous studies, where natural areas and biophysical features of the landscape (e.g. mountains or lakes) and special places nearby to community are



Characteristics of current rural landscape (grouped)	Intensity of perceived changes in landscape				Sense (positive or negative) and intensity (value) of how changes in current landscape (rows) affects to the aspects that supply cultural services (columns)								
	Loss	Increase	Remain	Net change-intensity	Natural landscape	Hills	Natural Resources	Traditional festivals	Cultural Values	Rural way of life	Potato crop	Countryside as productive	
Hills keep its beauty, flora and fauna; greater cultural-tourism value	1		18	17		17							
Less wild animals and flowers; some remain	21		5	16	-16								
Fewer families and abandoned houses, "ghost" villages; some return	40		9	31				-31		-31			
Increased urbanization - city head, industries		16		16					-16	-16			
More technology, machinery, irrigation equipment		36		36	-36								
Increased pollution, environmental destruction, agrochemicals, remove trees		31		31	-31		-31						
Expansion - intensification (all planted, mostly with soybean; less livestock)		26		26				-26			-26	26	
More uniform colours (orange fallows, green soybeans), feedlots presence		9		9	-9								
Some traditional crops are still planted			5	5							5		
Traditional activities were lost; some remain as social event or sports	8		7	1				-1					
"External" connection - disconnection with the countryside	12			12						-12			
Isolation, lower links between neighbors	9			9					-9				
Less human values - More individualistic, short-term, materialistic, some remain	23		7	16					-16				

Fig. 5. Perceived changes (sense and intensity) associated with the rural landscape aspects that supply cultural services.

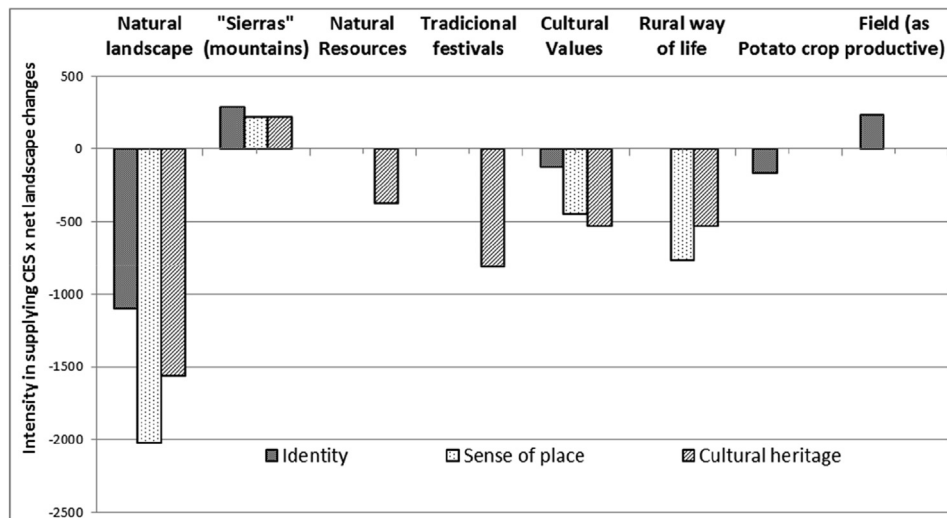


Fig. 6. Changes in the supply of CES (identity, sense of place and cultural heritage) associated to different rural landscape aspects as a consequence of the agriculturalisation process.

suppliers of CES (Brown and Raymond, 2007; Tengberg et al., 2012; Van Berkel and Vergburg, 2014). In our study, CES were not only provided by these natural aspects, but also by some practices and ties among people, showing that culture is embedded in landscape and this is immerse in a social matrix, being a non-dualist relationship between "nature" and "culture" (O'Rourke, 1999). These

kinds of CES were related to the socio-ecosystems where people lived and worked, and were expressed in different attributes conforming the rural way of life, confirming that CES are closely associated with the social and productive practices that are part of the landscape. These results remark the social aspect of landscape, more frequently found in other studies, not coming from the ES

approach, such as Barbic (1998) who found that natural and social environment of Slovenian countryside, where local community interacted, determined rural identity. Kyle and Chick (2007) also remarked that social, historic and culturally settings of landscape, rich in memories, experience and social relations, were more important to sense of place than physical attributes. Therefore, not only landscape forms and significant fauna and flora species supply CES, but traditional food, agricultural knowledge and practices, music and dance or, in a broader sense, the “authentic rural lifestyles” do it (Daugstad et al., 2006; Shannon and Mitchell, 2012). Therefore, in the assessment of this type of CES, where there is a strong connection between natural components of the landscape with social and productive practices, the concept of landscape services, defined as “goods and services provided by a landscape to satisfy human needs, directly or indirectly” (Termorshuizen and Opdam, 2009), seems appropriate. This is because people perceive, experience, interact and appreciate the landscape in general, not just only its natural aspects (Cheng et al., 2003; Vouligny et al., 2009) and also because of the holistic nature of CES and their relationship with different aspects of the rural landscapes (Plieninger et al., 2013; Tengberg et al., 2012).

In this study, some agricultural activities provided CES in a direct way (e.g. potato crops). Therefore, traditional farming does not only provide food, but also collective goods, such as landscape aesthetics and local identity, contributing directly to the improvement of local well-being and social capital (Daugstad et al., 2006). In most cases, is not possible to separate the culturally significant species, the traditional knowledge systems and the social relations between local people (Nahuelhual et al., 2014). These results confirm that ecosystem services are co-produced by the socio-ecological system as a whole (Chan et al., 2011, 2012; García-Llorente et al., 2015), that CES cannot be treated independently of other services (Tengberg et al., 2012) and that a service could benefit more than one dimension of the well-being (Liu and Opdam, 2014). Results show that agricultural traditional landscape was a way of life for the community, supplying food, work, recreational activities and social ties, all fundamental components of human well-being, implying the fulfillment of needs and beliefs, happiness and satisfaction (Liu and Opdam, 2014). This type of landscape that supplies both livelihood and dwelling-place acts as a link for local people with their past and their ancestors (O'Rourke, 1999). Therefore, traditional rural landscape provides most components of well-being, not only nutritious food (basic materials), but mutual respect and solidarity (good social relations), well feeling and satisfaction (health), security and freedom to choose what to produce and how to live. In turn, this close relationship with the rural landscape that provides well-being contributes to maintaining the landscape aspects that supply such ecosystem services (MEA, 2005). Places are consequence of the social interactions among people, interactions between people and things (e.g. with machineries) and between people and other bio-ecological forms (e.g. with animals, rivers, mountains), and these interactions are not only material, but also emotional (Conradson, 2005). Therefore, it is logical that changes in some components of the rural landscape or in their interaction impact on people well-being.

This holistic concept of landscape providing not only economic benefits, but self and social benefits, is not always considered in landscape planning, even when both are encompasses in well-being concept (Liu and Opdam, 2014). Results also remark the intangible cultural heritage, such as oral histories, farmer's traditional knowledge or countryside dances, which are also important components of the community identity, which must be considered to build resilient communities (Beel et al., 2015). In coincidence with other studies (e.g. Ruiz and Domon, 2012; Vouligny et al.,

2009), the results of this research show that people value natural landscape in general and also some particularities, such as the *sieras*, and they also value social aspects of landscape, such as traditional festivals. This is because of their significance for their way of life, their childhood memories, their well-being experiences, and the sense of community generated by them. As in Ruiz and Domon (2012) study, our results show that community shared certain landscape values that pretended to conserve, which are related to more “natural” and colored spaces offered by traditional agriculture and the tranquility and calm that countryside supplies. As in the mentioned study, our results show the different ways people interact with landscape, including their “material” components and the practices beside that interactions, that also imprint with emotional values, not only utilitarian ones. As was also mentioned by Terkenli (2001), the different aspects of landscape, such as forms, meanings and function are interrelated, so changes in one of them is reflected in the others; for example, in traditional agricultural landscape, productive practices fostered human associations and societal solidarity, creating shared values that were expressed in dances and meeting places. The problem is that nowadays, with an “industrial agriculture”, the economic value interferes with those who have another kind of links with landscape, “breaking” the shared values of landscape in benefit of individual values for some people. Perhaps, the links between forms and function related to traditional ways of life are nowadays not as useful as they were before, being seen for some people (at least for those who can change the landscape) as old and obsolete, while the actual forms are considered as the expression of new requirements of modern society (Terkenli, 2001). However, this seem not to be the perception of most inhabitants of rural areas, at least considering the results of this study and the other cases already cited.

#### 4.2. Synergies and trade-offs between commodities production and cultural services

Clear trade-offs between the expansion of new crops (principally soybean) and CES emerged from the narratives. Even if our results ratify the important synergies that existed between provisioning ecosystem services and CES in traditional landscapes of Balcarce County (what was perhaps true for most part of the Pampas region), these synergies became trade-offs in the context of agriculturisation. As well as in other studies, we recognized that landscapes with traditional small-scale farming associated with cultural values could simultaneously provide food and cultural services (De Groot et al., 2010; Martín-López et al., 2012; Tengberg et al., 2012). These characteristic was reflected in most descriptions of the rural landscape 20 years ago, showing a high degree of multifunctionality, providing not only material goods (e.g. range of typical products), but also environmental (e.g. soil protection and biodiversity) and cultural goods (e.g. identity and knowledge transmission). However, this synergy seems to be lost in modern rural landscapes, characterized by an “industrial agriculture” with more machinery and less people in a more homogeneous landscape. Our results show that the increase in commodity production led to a decrease in the provision of CES, mainly in sense of place and cultural heritage. This trade-off relationship arises not only because of changes in biophysical aspects (e.g. loss of remnants of natural vegetation or a less diverse agriculture), but is also associated with changes in less visible aspects of the landscape, such as social practices. These last aspects are also important components of well-being, influence social capital and maintain cultural values (MEA, 2005; Chan et al., 2011, 2012; Plieninger et al., 2013; García-Llorente et al., 2015). Thus, rural identity associated to agricultural landscapes has change in modern era, characterized by industrial agriculture and urban culture –in part “introduced” to the rural

area-, marginalizing the identity and cultural heritage of rurality to the extent of “destroying it” (Barbic, 1998). This results confirm that landscape practices shapes landscape values and at the same time, landscape values influence practices in a recursively link, and that agriculture landscape not only enclosed values to farmers, but to local community in general (Ruiz and Domon, 2012). They also show that the interactions between people with landscape not always have to be through explicitly practices, such as gardening or bird watching, because people who live in countryside interact also in their everyday life, being in any case a way to facilitate a sense of calm and well-being (Conradson, 2005).

Underlying the trade-off between industrial agriculture and CES there is a profound trade-off in general well-being, as long as the economic benefit of new agriculture is only for some producers and traders, principally large and entrepreneurial ones, often non-local, while the social costs, represented by the loss of identity, sense of place, cultural heritage, recreational activities and opportunity of countryside as a way of life is assumed by small producers and local community as a whole. Therefore, the problem is not that people change the landscape to obtain some benefits, because humans have changed the landscape since ever to satisfy their needs and demands for well-being (Liu and Opdam, 2014). The concern is that nowadays changes are so quickly that landscape cultural values losses are less visible to perceive (and therefore to conserve) and these changes are hurting a large part of the ecosystem services beneficiaries, actual and future. Behind this problem are power relationships, where actors with more economic capital have more influence in the agriculturalisation process and in land use planning, thus deciding landscape future and harming those actors whose principal capitals are others, such as social or cultural attributes (Auer and Maceira, 2017). In this way, territory is an arena of power, where different interest and values take place deriving generally in conflicts and even in a “lose–lose” situations (Shannon and Mitchell, 2012). Considering that farmers were and still are the sector that has the greatest impact in rural landscape, also in industrial countries (Daugstad et al., 2006), it is necessary to involve decision makers –public and private–in this issue. The importance of social dimension of landscapes must be also remarked (Vouligny et al., 2009), and greater citizen participation and involvement in these issues is necessary.

It is recognized that a high use of input technologies in modern agriculture (e.g. machinery, fertilizers, water, pesticides) leads to a decrease in biodiversity and loss of natural areas that provide regulation and cultural services (De Groot et al., 2010; García-Llorente et al., 2015; Martín-López et al., 2012; Tengberg et al., 2012). Nevertheless, it also affects CES due to the displacement of rural workers and changes in their way of life. For example, the replacement of workers by machinery implies less people working and families living in the countryside, which led to fewer schools, warehouses and shops but also to less countryside dances, recreational and social activities, thus strongly changing the traditional rural landscape and way of life. The results shows a handover from a “traditional-arcadian” type of utilitarian relationship, where production was –or intended to be–in harmony with nature, comprising identity symbols and emotional relationship with nature, to a “productivist” type where farmers demand a maximum production in a short term, considering landscape as a resource to be optimized (Ruiz and Domon, 2012). Thus, agriculturalisation enhances certain benefits (agricultural commodities) with the producer as the main beneficiary, in detriment of CES whose beneficiary is usually the entire community. In coincidence with Barbic (1998) results for Slovenian countryside, our results show that in industrial agriculture, the traditional cooperation in rural community has being abandoned or limited to specific occasions, transforming the traditional customs and values. These results

underline the need for comprehensive analysis of the rural territory, considering it as multifunctional, that is not only as a base for productive activities but also as a settlement of social relations and as a source of cultural identity and sense of place, and also as multi-actoral, accounting for the appropriation of rural space and power relationships.

In this study we did not group local actors regarding their relationship with the rural environment and the agriculturalisation process. However, other international preferences studies (Daugstad et al., 2006), showed that general public preferred the “old fashioned” landscapes with many natural elements (e.g. water bodies, trees, vegetation) than the modern industrialized agricultural landscapes, while farmers supported more the tidy, productive and well-farmed landscapes. Thus, it could be expected that farmers who have a more industrialized agriculture consider in a less extent their role as caretakers and upholders of cultural values (Daugstad et al., 2006), mainly because “what is good may not look good” (Nassauer, 1995b).

#### 4.3. The two-way relationship between human values and landscape

Our results show that underneath the trade-offs between agriculturalisation and CES there is a change in perception, valuation and behavior of people about their landscape. This is what Kenter et al. (2015) called people’s “shared values,” principles that guide actions and are shared by the community. The perception of respondents about an increasingly individualistic and materialistic society corroborates the change in people’s view. This view goes from a “romantic” and “pastoral” notion (*sensu* Bishop et al., 2005), where nature is seen as a place for recreation and contemplation and provides a way of life that nourishes the rural culture and values, towards a more “utilitarian” view where nature is seen as a resource to be used. Since people interpret landscapes and the services provided by them according to their beliefs, knowledge and interests (Musacchio, 2013; Nassauer, 1995a; Tempesta, 2010), the loss or weakening of previous beliefs, practices and cultural knowledge may be the reason why actual decisions are more orientated to short term economic benefits. Thus, the rural landscape may change (and always does, as it is dynamic) when some changes in the economic, social and environmental conditions occur, but reacts especially when the culture and the community values change. In this transformation, rental agreements could be a good example of the disconnection that farmers have with the countryside due to economic interest and a preference for a “modern way of living”, because nowadays they prefer to live at the city and from land rent. On the other hand, those who rent the fields do not probably have intense ties with this “producing factor”, that has lost the symbolic value that it had before, being able in part to exploit it without limits.

Changes in social actors involved in territory process impact on the identity and sense of place because they are associated to changes in landscape dynamics, such as social practices. This result agree with others studies that show how new residents in rural areas change traditional identities (Paquette and Domon, 2003). This can also occur in a way opposite to that described in this study. For example, in the Mediterranean region, where land was abandoned by old farmers (because it is cheaper to imported lamb from Argentina than to produce them there, for example), the new residents seem to be a kind of guardians of landscape heritage, as the “néo-ruraux” of Aspre, Roussillon, who recognize the connection between production, identity and dwelling, and try to reconnect culture and agriculture (O’Rourke, 1999).

Tradition are known to persist for a long period, but even them are changing (Barbic, 1998), modifying with them associated

cultural services. External processes are also involved, such as globalization, which imperils the maintaining of cultural values and local traditions that have been held for years and are determinants of local identities (Barbic, 1998; García Canclini, 1995). Therefore, in coincidence with Nassauer (1995a), culture tends to structure and change the landscape, however the landscape also tends to inspire and embody these cultural values, showing the reciprocal exchanges between people and their place (Nassauer, 1995a; Ruiz and Domon, 2012; Vouligny et al., 2009). As values are constructed by individual attitudes but also through social processes (Liu and Opdam, 2014), the agriculturisation process –as an example of territorial process that changes landscapes dynamics– is not only the reflection of changes in social values –such as individualism and materialism–, but is also formative of new values. However, until there is a greater recognition of the landscape patterns as material evidence of long held values, it will be no cultural change (Nassauer, 1995a). To achieve this it is important that community –and particularly farmers– understand and value the ecological function of natural ecosystems and “nonproductive” lands, beginning for example from remnants of vegetation next to the fences and along roads, because if not, they would not take care of the ecological quality of landscape if they lose their proper appearance (Nassauer, 1995b).

Our results highlight the need to include biophysical and socio-cultural factors in ecosystem services assessments, as it was previously suggested (e.g. De Groot et al., 2010; García-Llorente et al., 2015; Iniesta-Arandia et al., 2014; Kenter et al., 2015). Nevertheless, it is also relevant to consider the rural landscape values (ecological, socio-cultural and economic) of those who affect the landscape, and to understand their implications for the quality of life of local communities. To make explicit the values and interest of different stakeholders of the rural landscape allows clarifying the conflicts and searching for solutions. In turn, these participatory processes favors the correct application of proposed measures (Kenter et al., 2015), which helps to protect both the resources and the ecological and cultural values significant for the community (Verschuuren, 2007). It is also important to remark that, if landscape is changing in this way, it is because the whole community is legitimating these territorial processes, at least in part and not always being conscious of it; so it is important to understand that all local inhabitants have some participation in landscape dynamics. One possible explanation could be that people value some natural landscapes but not the process necessary to support them, or that farmers do not design consciously their fields to be adapted to the place and their preferences but following the standard or modern agricultural practices (Nassauer, 1995a). Therefore, until all the community is aware of the goodness of more natural appearance or the badness of some industrial agricultural practices, farmers will have less motivation to change their productive practices, because people is shown as a good neighbor or citizen, having his field as what it is supposed to be good, nice or modern (Nassauer, 1995b). Results show that this kind of social studies are necessary to evidence the different values of landscape and the complexity behind the agriculturisation process, which is not documented in land cover changes analysis or annual agriculture statistics, as it was noticed by Paquette and Domon (2003) when analyzed the different landscapes trajectories.

## 5. Final consideration

Agriculturisation along the past 20 years had modified the rural landscape of Balcarce County, reducing the supply of cultural services and affecting intangible values and social practices related to them, endangering their continuity for future generations. Even if this was a local study, agriculturisation process is a general pattern

and socioecological similarities along the Pampas suggest that the same can be true for most part of the region. In Balcarce, the *sierras* are now playing an important role in this regard, not only as remnants of biodiversity but also as providers of identity, sense of place, cultural heritage and recreational opportunities. Thus, their conservation and appreciation is necessary regarding natural and cultural heritage, as well as elements of great potential for local development. Coinciding with Naveh (1995), the current ecological crisis is primarily a cultural crisis. In this, the search for solutions must extend beyond traditional scientific disciplines, incorporating spiritual and ethical aspects into policies and development plans, including land planning. The intrinsic values of rural landscape (and not just their use value) must be considered and the social valuation of different stakeholders must be taken into account. Political measures to encourage a more balanced and sustainable management of socio-ecosystem are extremely important, and their implementation should not be delayed. The loss of cultural services is a slow and silent process that becomes “visible” after the threshold of irreversibility, and once cultural values are lost, they are difficult to replace.

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