

Linking Farmers' Perception of Biodiversity, Subjective Well-being and Conservation in the Tandilia System in the Southern Pampas of Argentina

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Abstract

Much research has focused on the study of society-nature relations, guided by people's perception of nature, well-being and environmental behaviour in relation to this interplay. The perception of farmers on these topics has been less explored, but it is fundamental to enquire into this issue in order to understand the decisions they make in their production units and how these decisions influence their environment. This research explored the link between farmers' perception of biodiversity, their subjective well-being, and conservation practices in the Tandilia System in the Southern Pampas of Argentina. The information obtained from semi-structured interviews with farmers was analysed through Thematic Analysis. Potential associations between farmers' perceptions of biodiversity, subjective well-being and land management practices were investigated. Although most farmers were aware that agricultural practices negatively affect biodiversity and that contact with nature generates well-being, inconsistent narratives were noted when they talked about their own practices. Their awareness of biodiversity and well-being does not necessarily translate into more sustainable practices.

Keywords: decision-making, farmers, sierras, Argentine Pampas region, Tandilia System

Abstract in Spanish: <https://bit.ly/3zy5pq8>

INTRODUCTION

Changes in land use related to extractive activities, such as agriculture, livestock production, mining, tourism and

fishing, have affected biological diversity at different levels and the associated ecological processes worldwide (e.g., cycle of water and nutrients, dynamics of wildlife populations and communities) (Bilenca et al. 2012). Despite recognition of these adverse consequences on the ecological and social conditions of life, attempts to conserve biodiversity have not made much progress. This impasse has led several scholars to investigate how people perceive nature (Santoro et al. 2019; Sefcik et al. 2019; De Rito et al. 2020a); in particular, biodiversity (Campos et al. 2013; Qiu et al. 2013), its association with well-being (Howell et al. 2011; Pritchard et al. 2020) and how this association is reflected in people's

Access this article online	
Quick Response Code:	Website: www.conservationandsociety.org.in
	DOI: 10.4103/cs.cs_20_124

environmental or ecological behaviour (Kals et al. 1999; Sorice and Conner 2010; Zylstra et al. 2014; Floress et al. 2018). These relations have also been insufficiently explored in relation to social actors who work the land (e.g., farmers) (Ahnström et al. 2009; Mastrangelo 2018; De Rito et al. 2020a). Advancing in this type of study is of the utmost importance for the conservation of biodiversity.

The perception of biodiversity refers to the way humans understand, interpret and value biodiversity (Bennett et al. 2015). Some studies have investigated farmers' values and attitudes towards the environment and their decision-making (Vignola et al. 2010; Lopez and Mijail 2017; Mastrangelo 2018; De Rito 2020), while others have focused on ecosystem services (Vignola et al. 2010; Lamarque et al. 2011; Morales-Reyes et al. 2017; De Rito et al. 2020a). However, only a few have directly focused on farmers' perceptions of biodiversity (Stilma et al. 2009; Lamarque et al. 2011; Kelemen et al. 2013; Caballero-Serrano et al. 2017). The knowledge of such perception in farmers is important because they are in continuous contact with natural ecosystems through their daily work and have personal experience of biodiversity, which is different from that of other non-agricultural social groups (Soini and Aakkula 2007; Junge et al. 2009).

Specialised literature provides evidence of the relationship between individuals' actions and their subjective well-being (Kahneman and Krueger 2006; Dolan et al. 2008), understood as people thinking and feeling about their lives and the cognitive and affective conclusions that they reach when they evaluate their existence (Cuadra and Florenzano 2003). People's contact with different attributes of the rural landscape and nature contributes to their sense of belonging, identity and cultural heritage, generating well-being (Auer et al. 2017); in the case of farmers, this contact with nature leads to environmentally friendly practices, which, in turn, increases well-being (Capaldi et al. 2014; Mzoughi 2014). As argued by Markussen et al. (2018), if farmers' behaviour is the factor that most influences the structure and functioning of ecosystems and rural landscapes, it is imperative to make farmers' perceptions and their subjective well-being the central factors in policymaking.

In the Tandilia System, located in the Southern Pampas region of Argentina, the ancient low hill system (sierras) within the crop matrix represents important hotspots for biodiversity conservation (Sabatino et al. 2010; Herrera and Laterra 2011; Echeverría et al. 2017; Herrera et al. 2022). Most of these natural ecosystems are located on private lands, and they are subject to farmers' management decisions. A few of these ecosystems receive public or private protection and most are exposed to different practices that may not match the sierras' functional dynamics (e.g., overgrazing) (De Rito et al. 2020b). At present, except for specific cases, no policies regulate the use and preservation of these environments. Hence, the aim of this research was to explore the link between farmers' perception of biodiversity, their subjective well-being and conservation practices in sierras of the Tandilia System. Given the exploratory nature of this study, we used a qualitative methodological approach, by means of which the voice of the subjects involved provided answers to the questions posed.

AGRICULTURISATION IN THE ARGENTINE PAMPAS

Agriculture in the Argentine Pampas expanded quickly during the twentieth century, transforming native grasslands into croplands and perennial pastures, a process known as agriculturisation (Gras and Hernández 2013). Since the 1990s, rural landscape changes have intensified due to the expansion of an agricultural model based on the technological package of soybean crops, with the direct seeding technique and glyphosate-resistant transgenic seeds (Paruelo et al. 2005). This process, called 'soybeanisation' (Urcola et al. 2015), ignores environmental conservation, affecting not only the structure and function of natural ecosystems and landscapes (Paruelo et al. 2005) but also the social dynamics, with important changes in rurality (Sili 2005). The increase in soybean cultivation has replaced other traditional crops (e.g., oat, barley, wheat) and displaced livestock grazing to sectors that are unfavourable for agriculture (Paruelo et al. 2005), such as sierras, whose natural grasslands are often replaced with exotic pastures of high forage quality. In the social dimension, this process has altered traditional land tenancy patterns in Argentina; the average size of the farms has increased from 25% to 34% (SAGyP 2002), the area operated by tenants has continued to increase (Reboratti 2005), and there is currently a growing number of farm managers (i.e., administrators of large agricultural companies) (Gras 2012). In turn, some farmers have ceased to reside in the production units and move daily from and to the urban space or leave the activity completely in the hands of a farm administrator. As noted by Gómez (2002), rurality, as defined in traditional terms, no longer exists. The industrialisation of agriculture and the urbanisation of rural communities have put an end to traditional rurality, but not to rurality.

Study area

The study area is located within the Tandilia System in the Southern Pampas region of Argentina (38°010–36°540S, 60°140–57°320W) (Figure 1). It forms an arc of discontinuous elevation comprising approximately 1,400,000 ha and six districts: 1) Azul, 2) Balcarce, 3) General Pueyrredon, 4) Lobería, 5) Tandil, and 6) Olavarría, with a total of 4,053 farms (INDEC 2009), 445 of which have sierras (according to the cadastre of the districts studied).

The Tandilia System is composed of ancient (lower Paleozoic) low hills surrounded by an undulating relief with deep soils, where agricultural activity takes place (Núñez and Sánchez 2007). The sierras are characterised by a rich diversity of plant species, with nearly 4,00,600 native species belonging to more than 50 families (Matteucci et al. 2012). The predominant plant communities are grasslands, locally called flechillar, and scrubland composed of *Paspalum quadrifarium* (known as *paja colorada*, or red straw) (Herrera et al. 2013; Echeverría et al. 2017). The former are characterised by a great diversity of grass and *dicotyledon* genera (e.g., *Piptochaetium*, *Nassella*, *Briza*,

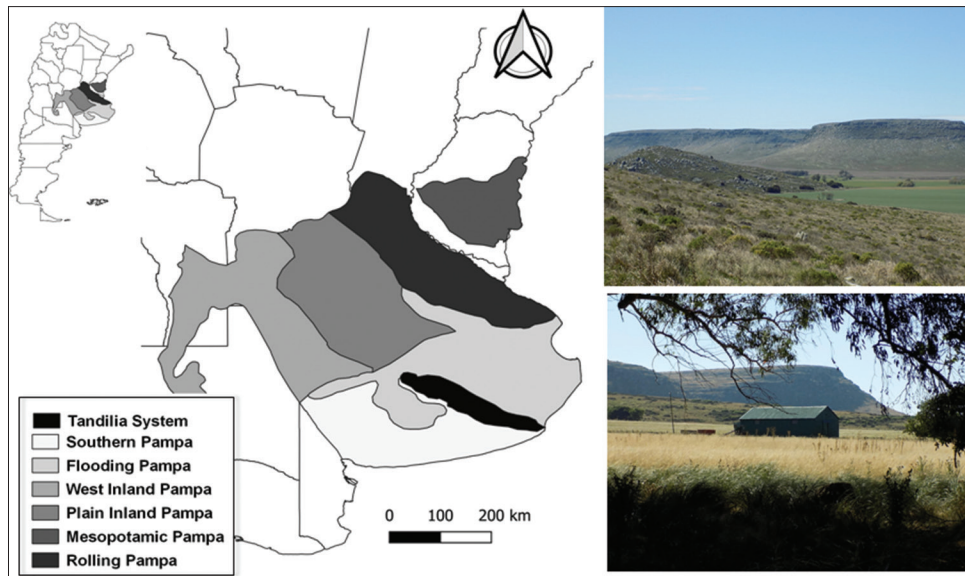


Figure 1

Location of the study area. The figure on the left shows the Pampas sub-regions and the Tandilia System. The photographs on the right show two typical farms. Source: Figure made by the authors

Poa), while the latter dominate almost completely in large sectors. Besides, there is a common shrub layer dominated by *Colletia paradoxa* (curro) and *Baccharis tandilensis* (chilca), which are endemic species in the study zone (Frangi 1975; Sabatino et al. 2017). In turn, the sierras are home to unique fauna, including over 100 birds, 10 amphibians, 12 reptiles and 20 mammalian species (Isacch et al. 2017). In addition, many of the streams in Southeast Buenos Aires have their source in the sierras (Martínez 2011), which is important for the water security, regulation and the biodiversity of the area. In addition, the sierras contribute to preserving the local identity because they are not only the most ancient hills in Argentina but also one of the oldest in the world, and therefore, they represent important cultural heritage (Auer et al. 2017). For this reason, the sierras are currently considered critical hotspots of biodiversity (Sabatino et al. 2010) for endemic species (Gilarranz et al. 2015) and a source of germ-plasm and ecosystem services (Barral and Maceira 2012).

The sierras are generally used by farmers in different ways: 1) winter grazing, accompanied in some cases by spring burning to stimulate grass regrowth for cattle; 2) cropping where rocks can be removed or where there is adequate soil depth; 3) sowing of forage species with previous application of herbicide (glyphosate) to eliminate bushes and natural grassland; 4) afforestation (pines and eucalyptus); 5) mining; 6) ecotourism; and 7) land left idle (i.e., private reserves) (Auer et al. 2017; De Rito et al. 2020b). Some farmers combine different uses in their sierras while others concentrate their efforts on only one management practice or leave them idle. Depending on the intensity and the combinations, these land uses affect wildlife and their habitats and soils, some more negatively (e.g., mining) than others (e.g., ecotourism).

Nowadays the sierras have little protection. Only two of the are under Private Nature Reserve status, as the owners

of the land where they are located have decided to preserve them in this way, while seven other sierras are under provincial protection (De Rito 2020).

METHODS

An intentional non-probabilistic sample of farmers, owners and farm managers (hereafter farmers) whose land contains sierras was generated (Rabolini 2009). A semi-structured interview was used as a data collection instrument (Ruiz Olabuenaga 1996). The interviews were conducted by the first author and recorded to facilitate the fluency of the interviewee's story (Ruiz Olabuenaga 1996). The script was tested with five pilot tests (farmers belonging to the sample). Contact data of farmers were obtained from qualified informants listed by the National Institute of Agricultural Technology (INTA) and the National University of Mar del Plata (UNMdP). Participants were also recruited from previous studies of the research group and the snowball sampling methodology (Scribano 2008). The selection criteria required the farms to have sierras and different land uses, and the farmers to be willing to participate in this study. Between harvests, in October 2016 and September 2017, we collected the data from 40 farms belonging to the districts of Balcarce, General Pueyrredon, Lobería, Tandil, and Olavarría. The interviews were conducted on the farms or in the farmers' place of residence and lasted 45 minutes on average. To protect the identity of the interviewees and create a pleasant environment with the farmers, with whom no previous close relationship existed, the farmers and farm names remained anonymous (Hernández Sampieri et al. 2018).

Priority was given to the decision-makers of each farm, and the sample was composed mostly of men. Only three of the farmers were women as it is men that usually hold

decision-making positions on farms devoted to extensive production systems in Argentina. They were aged between 28 and 74 years and had complete (28 cases) or incomplete university studies (generally agronomists or veterinarians). Only three farms were organic and the rest were engaged in conventional practices of agriculture and livestock. All farmers made different uses of their sierras, in general, aimed at grazing and/or foresting to maximise their incomes. The size of the farms ranged from 160 to 16,500 ha. Half of the farms were family-run (managed by a family along with employees), in most cases inherited. The other farms, either inherited or acquired several years ago, were run by the owners along with employees. Other family members did not work there. Also, some farms (usually large ones) were managed by agrarian administrators who had no previous link with the farm. Although half of the farmers had grown up on a farm, at the time of the study only 12 of them were living there and the rest were living in the nearest city.

The questionnaire covered the following topics: farm and farmers' characteristics, definition of biodiversity, perceptions of biodiversity, subjective well-being and management practices (see Appendix). When the farmers had never heard about the concept of biodiversity and/or were unable to define it, the first author gave them a brief and simple explanation (biodiversity is the diversity of animal and plant species).

Data analysis

The information obtained from the recorded interviews was analysed through Thematic Analysis, a method of qualitative analysis that allows topics to be identified and codified within the dense descriptions obtained from the semi-structured interviews (Tonon 2015). This process makes it possible to identify common feelings based on the responses of different participants (Vaismorari et al. 2013). The recorded responses of the 40 farmers were incorporated into a database by retaining the actual words of the respondents and codified by the authors (Hernández Sampieri et al. 2018). It should be noted that the farmers' responses may be associated with one or more codes. As a result of the responses obtained from the farmers, the associations between three topics were explored, in search of links in the Thematic Analysis among the perception of biodiversity, subjective well-being and management practices. The characteristics of the interviewees and the farms were considered important contextual variables.

RESULTS

The results are shown according to the variables analysed and the relationship among them.

Definition of biodiversity

The results showed that, in general, the farmers understood biodiversity as the 'diversity of species' (57.5% of the cases). For example, one interviewee said, "It is the

coexistence of different species of both animals and plants" (Interview 6, October 27, 2016, Mar del Plata). This definition is the closest to the general concept of biodiversity because it includes a level of diversity (e.g., species). However, in some cases, in addition to relating the diversity of species concept, the participants associated it simultaneously with 'ecological balance' (12.5% of the total cases). One of the farmers stated, "It is the coexistence of different living beings and their interrelation; one exists for the other one to be" (Interview 7, October 27, 2016, Balcarce). Only one of the 40 interviewees defined biodiversity only as 'ecological balance' by stating, "It is the biological balance of the planet" (Interview 22, February 7, 2017, Balcarce). On the other hand, 11 respondents, who represent 27.5% of the interviewees, were unable to define the concept. One of the interviewees acknowledged, "It is not something I know about" (Interview 19, January 5, 2017, Tandil). Six of the eleven farmers stated that they did not remember the meaning of the concept, although some of them held academic degrees in fields like agronomy and veterinary medicine. One of the interviewees commented, "I heard about biodiversity when I was studying at the university, but I don't remember it well. We studied it in a subject ... Ecology, but as we are agronomists, we did not think about that much" (Interview 12, November 10, 2016, Balcarce). In the same vein, although the farmers with a lower educational level had heard about biodiversity from academics in rural meetings, the concept was still unclear to them since they had never been given an explanation on the subject. It should be mentioned that the data collected did not make it possible to differentiate among the responses based on the educational level of the farmers or other characteristics (e.g., age, type of production).

Perception of biodiversity

Most interviewees considered that agricultural activities affect biodiversity (95% of the cases), generally in a negative way (65%). In this sense, a farmer admitted, "Yes, there is always an impact, plant and animal species are lost in a livestock farming system to favour only one species, which is the crop" (Interview 1, October 4, 2016, Mar del Plata). Three out of 40 respondents (7.5%) claimed that these changes could be positive or negative; one interviewee summarised it as follows, "Since human beings stepped on earth, they have produced changes; these can be for better or for worse, but they alter it, alter the ecosystem" (Interview 31, June 1, 2017, Tandil). Nine farmers (22.5%) agreed that agricultural practices affect biological diversity but did not go into detail about it. One of the farmers replied, "Yes, everything you do has an impact in one way or another" (Interview 25, March 13, 2017, Balcarce). Only two respondents (5%) replied that agricultural practices do not produce changes in the environment. For example, one of the farmers answered, "I don't think so, if the field is well cared for and rotated, agricultural activities do not affect biodiversity" (Interview 39, October 24, 2017, Tandil). This reply implied that if one performs conventional practices in the best possible way,

the environment will not be affected, which is a “theoretical” response since it does not specify whether this is how the farming practice was being performed at the time of the study.

Our study shows that all interviewees agreed on the importance of conserving biodiversity and gave different reasons for doing so. Some respondents reported that conserving biodiversity entails respecting nature (30%). For example, an interviewee pointed out that biodiversity should be conserved “for many reasons: respect for nature, spiritual responsibility and respect for creation” (Interview 1, October 4, 2016, General Pueyrredon). Other reasons that follow in importance are the ecological balance of the ecosystems (18%), productive benefits (18%) and sustainability (18%). Therefore, certain farmers attached economic importance to biodiversity, wishing to maintain productivity in the long term. In this sense, an interviewee said, “It is good business, it favours production” (Interview 33, August 9, 2017, General Pueyrredon) while another replied, “Yes, due to environmental sustainability. We have paid the price for having grown only soy for a long time: fungi and weeds” (Interview 26, March 13, 2017, General Pueyrredon).

Subjective well-being

Most family farm owners (77.5%) hoped that their descendants would take over the farm. They reported having different motives: they regarded the farm as a family inheritance (47.5%), they considered it a very pleasant job (17.5%), and they recognised a sense of belonging in the family (12.5%). When asked whether they would like a child, nephew, niece or grandchild to continue their work, some of the answers were “Yes, I would, I’d like it a lot; it makes me happy to work on this farm, which is what I like. Besides, I am the third generation working in this field” (Interview 30, August 3, 2017, General Pueyrredon).

“Yes, I want them to continue. There are so many reasons: what you learn by looking at nature, you have to know how to look, after 50 years you look in another way. It is wonderful! I want them to continue. I think I’ve transmitted my love for the farm to them” (Interview 7, October 27, 2016, Balcarce).

Other respondents indicated that they wanted their children to do what they liked doing (20%), and one interviewee stated that he would not like his children to do this type of work. This response was given by an administrator, not a farm owner, which may indicate a weaker link between the place and the farming activity.

Some of the farmers attributed their happiness about this type of work and/or life on the farms to contact with nature (30%), followed by a sense of belonging (20%), the serenity they felt in these environments (15%), being able to earn a living by doing what they enjoy so much (15%), a sense of belonging (12.5%) and the beautiful landscape (7.5%). For example, one of the interviewees said, “Sharing with nature, animals, horses, the amplitude, and the slow pace of life. I enjoy everything I see” (Interview 8, November 10, 2016, Balcarce). Another one reported, “The field makes me happy, being in the field is my life” (Interview 33, October 9, 2017, Balcarce).

Management practices

Most participants (52.5% of the cases including the three organic farmers) considered that their management practices favour the preservation of biodiversity. Regardless of the type of practice, all farmers used the same justifications. When asked if their management practices favour the care of natural environments and biodiversity, an organic farmer replied, “Yes, because of the type of production that we perform” (Interview 1, October 4, 2016, General Pueyrredon) and a conventional farmer stated, “Yes, my practices are less harmful to the environment because we use green-band products” (Interview 21, February 7, 2017, Balcarce). This type of statement was the most common among conventional farmers, and in turn, it was the most worrisome. Green-band products are considered non-toxic to mammals, which does not mean that they are non-toxic to the environment (CASAFE 2019). This shows that farmers lack appropriate information and perhaps, in this particular case, the “green-band” label leads to confusion given that green is used worldwide as a symbol of environmentally friendly, recyclable products. Four out of the 40 farmers (10%) differentiated between the sierras on their farms and the farming area. Fifteen interviewees (37.5%) acknowledged that their practices did not take care of the environment. Such was the case of interviewee 6, “No, why would I lie? Direct seeding and glyphosate, monoculture” (October 27, 2016, Lobería). This statement illustrates a frequent attitude in an area under the soybeanisation process.

Furthermore, 15 farmers (37.5% of the cases) reported being willing to adopt more environmentally friendly practices, and six of them already had some projects in this respect (15%). Such was the case of interviewee 2, “Yes, I am just about to carry out a project for a biodigester that processes cow dung to make organic fertiliser and eliminate feedlot odours” (October 24, 2016, Balcarce). Some interviewees (32.5%) declared that they would perform more ecological practices only if they did not lead to economic losses. One interviewee said, “We all want to conserve biodiversity, but we don’t want to pay for it out of our own pocket” (Interview 33, August 21, 2017, General Pueyrredon).

Link between the perception of biodiversity, subjective well-being and management practices

Table 1 shows the link between farmers’ perception of biodiversity, their subjective well-being, and their management practices. Among the farmers who were able to define biodiversity, 97% (28 out of 29 cases) perceived that agricultural activity affects it, and 59% (17 out of 29 cases) carried out practices that favour the care of the environment and biodiversity.

Despite knowing that agricultural activities affect biodiversity, 39% (15 out of 38 cases) farmers did not carry out practices that favour the environment and biodiversity. On the other hand, 61% (23 out of 38 cases) farmers recognised that agricultural activity in general affects biodiversity and

Table 1

Link between farmers' perception of biodiversity, their subjective well-being and their management practices. Results are based on the number of participants answering "yes" to the following questions: Could you tell me what you mean by biodiversity? (Definition of biodiversity); do you think that different agricultural activities produce changes in biodiversity? (Perception of biodiversity); if you have children, nephews, grandchildren, would you like them to continue with your work? (Subjective well-being); do you consider that your management practices favour the care of natural environments and biodiversity? (Management practices)

Cases	Definition of biodiversity	Perception of biodiversity	Subjective well-being	Management practices	Total 'yes'
Definition of biodiversity	-	28	23	17	29
Perception of biodiversity	28	-	29	23	38
Subjective well-being	23	29	-	20	31
Management practices	17	23	20	-	25
Total 'yes'	29	38	31	25	-

Source: made by the authors based on the survey carried out between October 2016 and November 2017

considered that their practices in particular benefit it. This percentage increased slightly when the farmers who had a connection with the place (subjective well-being) were analysed, with 65% (20 out of 31 cases) carrying out practices that favour the care of the environment and biodiversity. However, the connection to the place did not increase the percentage of farmers who could define it (74%, 23 out of 31 cases) or the percentage of those that perceived that agricultural activity affects biodiversity (94%, 29 out of 31 cases).

Concerning the farmers who carried out practices that care for the environment, 68% (17 out of 25 cases) were able to define biodiversity, 92% (23 out of 25 cases) perceived that agricultural activity affects biodiversity, and 80% (20 out of 25 cases) reported having a connection with the place. In other words, most of those who responded that their practices favour the environment considered that agricultural activity, in general, negatively affects biodiversity.

DISCUSSION

The farmers surveyed showed little knowledge about the concept of diversity. This could be conditioning farmers' sustainable management practices, although it does not seem to affect their understanding that agricultural practices affect biodiversity, as practically all farmers perceive that agriculture generates changes (generally negative) in biodiversity. Sustainable management practices are slightly more associated with the perception of how they affect biodiversity than with subjective well-being.

In this study, the farmers' notion of biodiversity was vague and varied, as proposed by other authors (Jurt 2003; Herzon and Mikk 2007). It was demonstrated that farmers' narrow notion of biodiversity is associated with their difficulty in accepting schemes targeted at biodiversity conservation (Herzon and Mikk 2007). It is for this reason that knowing what farmers understand as biodiversity may help explain their perception and management decisions.

Most farmers seemed to be aware that different agricultural practices affect, in general negatively, biodiversity (95% of the farmers interviewed, 38 of 40 cases), in agreement with the results reported by Herzon and Mikk (2007) in their study of farmers' biodiversity perception in Estonia and Finland. Even so, the interviewees considered that their management

practices favour the environment and biodiversity. The fact that 61% of the farmers who perceive that agricultural activity affects (in general, negatively) biodiversity considered that their management practices are beneficial raises the question of whether their practices are really beneficial, whether the responses were politically correct, or whether it is easier to blame others. In this sense, 45% of the farmers interviewed stated that their production practices, defined as conventional, care for the environment and the biological diversity of their farms, illustrating their incongruent accounts. This group does not include the three organic farmers, whose discourse on productive sustainability was coherent throughout the interview. In addition, four participants (10%) distinguished between their practices in the sierras and the rest of the field. It should also be noted that these farmers are the ones who considered it important to protect biodiversity because of the benefits it brings to the productive activity. One of them said, "For example, in the case of a plague, if I eliminate natural enemies, I will have to use more insecticide" (Interview 5, October 24, 2016, Balcarce). This type of comment reveals that the farmers' decision not to intervene in the sierras is linked to economic rather than ecological concerns. According to De Rito (2020), this differentiation between sierras and the rest of the property may be due to the fact that farmers do not view the sierras as productive for different reasons: some plant species are harmful to livestock, the exposed rocks make planting and harvesting difficult, or they wish to conserve the sierras to protect their biodiversity and contemplate the landscape.

A worrying discourse was identified in the narratives of 13 conventional farmers, representing 32.5% of the interviewees, who stated that they were aware that agricultural practices harm biodiversity and the environment that surrounds them, but they were not willing to modify their management practice if this led to economic losses. Their stories show the predominance of the productivist view, typical of the systems governed by industrial agriculture. This view is the result of the current industrial model based on "intensive accumulation" and the possibility of unlimited production and consumption of goods (in this case, unlimited agricultural production) (Souza 2007). Authors such as Souza (2007) question the prospect of achieving sustainable practices without breaking with the productivist perspective, since those farmers who are willing to adopt sustainable practices are trapped in the paradox of having to survive in the current market economy and adapt

to the demands of the consumer society and the premises of productivism. Almost half of these farmers (47.5%) are farm owners coming from several generations working the same land. Some of them (17.5%) justified their decision to continue with conventional farming, even if they disagreed with it and it weighed on them, on the grounds that they had to pay many taxes and keep several employees on the payroll, and they considered that organic or agroecological production would not allow them to generate as much income as they needed. The fact that 65% of those who have a connection with the place (subjective well-being) considered that their practices are beneficial reveals that this factor has less weight than, for example, the knowledge or perception of the consequences of the activity; alternatively, due to certain external limitations, even if they would like to conduct more beneficial practices for the environment, they cannot do so. Another reason could be that in Argentina there is no governmental incentive to conserve biodiversity in agroecosystems, as opposed to other parts of the world (Pascual and Perrings 2007; Greiner 2015).

Although it was expected that higher subjective well-being would equal higher care for biodiversity among the farmers, this was not the case. Twelve farmers (30%) recognised what made them happy about working on the farm was being in contact with nature. Their narratives are consistent with the results found by Auer et al. (2017) in their research conducted in a similar study area of Buenos Aires province. Also, authors like Vaske and Kobrin (2001) and Capaldi et al. (2014) have claimed that a more connected sense of self to nature is conducive to environmentally responsible behaviour and that place attachment is, in fact, a potential driver of significant environmental action. However, seven of the 12 farmers (17.5%) acknowledged that they were not taking care of the surrounding environment due to the conventional practices they used. This result was most striking, since the category ‘contact with nature’, identified through their stories, was the one closest to the concept of biodiversity. Something similar was observed with regard to intergenerational continuity. The farmers would like future generations to continue working in their fields, but they were not conducting sustainable practices there, and they would be willing to make certain changes as long as they did not affect their income (30% of the interviewed farmers). On the other hand, those not interested in their children continuing their legacy were the most unsure about making changes in their production systems (15% of the interviewed farmers). These results are consistent with those of De Rito et al. (2020a), who investigated farmers’ perception of ecosystem services in the same study area.

The inconsistencies in the interviewees’ accounts could be related to one or a combination of the following statements: 1) a lack of information or ecological understanding about ecosystem functions and the inability to see their farming activities as part of a larger ecosystem including land, wetlands and the associated spontaneous vegetation; 2) inability to view biodiversity as a critical factor in the well-being of their land and productivity, and life itself; and 3) the prevalence of an ambiguous understanding of the biodiversity conservation paradigm. This paradigm requires people to think of nature

in biological or ecological terms as an ‘ecosystem’, in which, biodiversity offers key services or functions that keep the ecosystem working. A misreading of this paradigm does not enable people to implement it in their farming practices and land management. Furthermore, according to Turner-Erfort (1997) and Kelemen et al. (2013), farmers regard short-term economic gains as more important than biodiversity conservation. When they make management decisions, the highly productivist vision linked to the agriculturalisation process of the Pampas region outweighs their appreciation of the landscape and natural surroundings, the sense of belonging and the cultural heritage (De Rito et al. 2020a). Thus, the farmers conveyed two contradictory perceptions of the environment (De Rito 2020); their responses showed that ‘feeling’ is not consistent with ‘doing’.

CONCLUSIONS

This study shows that although most farmers in the Tandilia System are aware that industrial agriculture negatively affects biodiversity, when talking about their own practices and management, they expressed various opinions. For instance, most participants argued that their conventional production practices do take care of the biological diversity of their farms. These farmers, mostly farm owners, simultaneously asserted that they would not modify their management practices if this brought economic losses. The findings also revealed that the farmers’ desire for their subjective well-being does not lead to a greater likelihood of adopting more biodiversity-friendly farming practices.

This study illustrates the productivist vision linked to the agriculturalisation process of the Pampas region. This prioritisation of economic viability over other factors reflects contrasting perceptions of the economic and ecological relationship between farming and biodiversity conservation. This may be due to the lack of adequate information on the longer-term economic consequences of declining agricultural productivity as biodiversity and ecosystem services are degraded. Hence, it may be necessary for agroecologists and agronomists to work together with farmers to provide clearer explanations and practical advice on how their agricultural productivity can be sustained by promoting biodiverse agroecosystems. Such an approach could include workshops on agroecology and biodiversity with follow-up monitoring programmes. This would contribute to more effective adoption of agrobiodiversity conservation practices by farmers in the Argentine Pampas.

Appendix: <https://bit.ly/3SaTVQc>

Acknowledgements

This publication is part of the first author’s doctoral thesis in Agricultural Sciences in the Graduate Program of the Faculty of Agricultural Sciences, Balcarce Integrated Unit, National University of Mar del Plata. The authors thank the 40 farmers who graciously participated in this study, and Sebastián Muñoz and Jorge Giuliano

for their assistance in field trips. It was developed in the framework of project INTA PNNAT112803400 "Support and training in rural land use planning processes" and with the support of IDEA WILD and The Neotropical Grassland Conservancy.

Author contributions statement

DM and HL conceived and designed the study/research/work; DM collected the data; DM and AA analysed the data; DM, AA, MC and HL led the drafting of the manuscript. All authors contributed critical, intellectual content to the drafts and gave final approval of the version to be published.

Financial disclosures

a) IDEA WILD (\$600 dollars) and The Neotropical Grassland Conservancy (\$5000 dollars); and b) DM and HL respectively.

Research ethics approval

The National University of Mar del Plata does not have a formal Ethics Review board/process. However, in this investigation the anonymity of the interviewees was preserved as well as the location of their establishments to preserve statistical secrecy.

Data availability

The data is not accessible due to privacy restrictions. They are in the library of the Faculty of Agronomy, National University of Mar del Plata.

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