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Employing contingent and inferred valuation methods to evaluate the conservation of olive groves and associated ecosystem services in Andalusia (Spain)

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ABSTRACT

The present study explores how people perceive the conservation of an olive agro-ecosystem within a natural reserve, in Andalusia (southern Spain). Using the contingent and the inferred valuation methods, we performed a field survey to identify the socio-economic factors that affect willingness to pay for conservation of the olive groves, and to specify the priority people give to ecosystem services. Results showed that respondents who gave a high score to cultural and regulating ecosystem services were more likely to pay for a conservation plan. This would indicate that factors linked to the historic presence and ecological functionality of the olive groves prevail over their economic aspect in respondents' willingness to pay. Willingness to pay is found to be positively correlated to appreciation of ecosystem services. The contingent method revealed that mean willingness to pay ranges from 31 to 43 €/year/respondent, whereas the inferred method pointed to a slightly higher range of willingness to pay, from 37€ to 44 €/year/respondent. Different alternative policies (for example, payment for ecosystem services) should be considered according to the outcome of our study within a sustainable management plan to attenuate the trends of intensification or abandonment of olive groves and to ensure rural development in the region.

1. Introduction

In the Mediterranean Basin, olive groves (plantations of *Olea europaea L.*) constitute a very traditional land use presenting highly recognised ecological, cultural, social and economic values (Loumou and Giourga, 2003). In the Andalusia region (southern Spain), these crops represent a basic component of the regional economy (even at national scale), a structuring factor of the rural landscape and a part of the local culture and society. The region produces close to 40% of olive oil worldwide (IOC, 2011); olive groves cover 17% of the area (45% of total arable land), employing 40% of workers in the agricultural sector and constituting 26% of the agricultural income (INE, 2013). Recently, the Andalusia administration, in accordance with the "greening" tendency of the Common Agricultural Policy (CAP) for the coming years, decided to economically support olive farmers implementing environmentally friendly farming practices to promote biodiversity, provide ES and to maintain landscape quality (ORGAB, 2015). The overall result has been an increase in environmental awareness which in turn has increased organic and integrated production (from 2% to 4% and from 3% to 22%, respectively). However, at the same time, many farmers have directly intensified (from 20% to 30% irrigated olive crops) or have directly abandoned (close to 1%, official date) their olive exploitations, because they were unable to adjust to the new practices while maintaining the desired level of profitability (Guzmán and Alonso, 2008; Mili et al., 2015).

The agricultural olive-grove landscape plays a very important role as a provider of diverse ecosystem services (ES) for Andalusia's population, in addition to providing table olives and olive oil. These other services provided to society by olive groves in the same manner as other agricultural landscapes (Huang et al., 2015) include regulation and maintenance (pest and disease control, soil formation and composition, carbon storage) functions and cultural (spiritual and physical interactions) ones (Costanza et al., 1997; Tscharntke et al., 2005). However, people find it quite difficult to recognise and appreciate the value of the non-provisioning ES provided by agricultural landscapes (Smith and Sullivan, 2014).

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Lele et al. (2013) point out that, in many cases, alteration of ecosystems, transformation of landscapes and degradation of the resource base upon which people rely, all result from the under-recognition and under-valuation of the contribution of the biotic component (i.e. regulating ES) to human well-being. Even more, different stakeholders (broadly speaking, farmers *versus* non-farmers) may have different perceptions of the agro-ecosystem services, especially in reference to the delivery of a wide range of public goods provided by these systems and to the provision of private goods (Bernués et al., 2014; Hauck et al., 2013). Nonetheless, people's appreciation and greater participation by the local population are necessary factors with regard to ensuring better management of agricultural areas (Raymond and Brown, 2011; Rescia et al., 2008; Tress and Tress, 2003) and to guaranteeing greater trust and support in decision making by authorities or agents.

Many studies highlight the pressing need to assess or value people's preferences for landscape management, as well as for preservation or improvement of certain ES at landscape scale (Howley et al., 2012; Jones, 2007; Sang et al., 2008; Scott and Shannon, 2007; Sevenant and Antrop, 2010). However, recognition of landscape ES becomes more complex when referring to a nature reserve that includes a large area of cropland, as in the present study. This natural reserve is a Natural Park protected and recognised by Spanish conservation regulations (since 1986), and a Biosphere Reserve (since 1983) designated by the UNESCO. In addition, this area has been designated a Special Protection Area for Birds (SPA) and has obtained the European Charter for Sustainable Tourism. This type of protected areas constitute paradigmatic cases in which conservation and production coexist and, in this case, traditional olive crops existed well before the area was given protection status. Indeed, the olive grove landscapes of Andalusia are currently under review by the UNESCO and its World Heritage Centre to be designated as a world heritage cultural landscape. Therefore, in order to contribute to the sustainability of the local socio-ecological system and, in particular, to conserving the traditional olive groves included in the conservation objectives for the Natural Park, there is a vital need to manage agriculture at the landscape scale and to economically evaluate olive crops according to the ES they provide.

Economic valuation of ES has been incorporated into the strategies of EU and national environmental policies for ecosystem sustainability, with the intention of quantifying the importance of provisioning, regulating, and cultural ES (Brouwer et al., 2013). However, there has been less research on the economic valuation of ES in agro-ecosystems (Costanza et al., 2014; Quintas-Soriano et al., 2016; Vihervaara et al., 2010) in comparison with other ecosystems such as forest or coastal ones, despite the increasing significance of these ecosystems in the sustainability of rural areas. In addition, in the Mediterranean Basin most studies focus on provisioning services (Nieto-Romero et al., 2014), such as organic vegetables, argan oil and wines (Engindeniz and Tüzel, 2003; Lybbert et al., 2002; Marangon and Troiano, 2003). In Spain, a review conducted by Quintas-Soriano et al. (2016), showed that over 70% of the ES studies were related to the provisioning services.

Several methods have been widely used as a tool for estimating the monetary value people place upon public goods and services, and for quantifying the welfare benefits of certain preservation and/or development plans. The contingent valuation (CV) method, in which people are directly asked about their willingness to pay (WTP) for certain changes in the delivery of ES, is considered to be one of the most popular approaches. An alternative approach to this is the inferred valuation method (IV), according to which people are asked about the WTP of their fellow citizens rather than their own. The IV method is intended to eliminate the bias of social desirability and avoid misleading WTP responses (Lusk and Norwood, 2009a).

Numerous studies are based on the multifunctional role played by agriculture, with emphasis on the ecological (conservation) and cultural (recreational and heritage) values associated with agricultural landscapes, which in turn are directly associated with WTP (Arriaza et al., 2008; Grammatikopoulou et al., 2012; Rosenberger and Walsh, 1997; Sayadi et al., 2005, 2009). Specifically with respect to olive groves, Arriaza et al. (2008) analysed the WTP for conserving a mountainous olive-grove area, disentangling the value of different attributes of the conservation plan, and Marangon et al. (2008) indicated an economic value for the explicit conservation of olive plantations. In addition, social preferences were evaluated in order to establish the optimal management regime for mountainous olive groves (Arrianza and Nekhay, 2010), as well as the social demand for food provision and for the aesthetic qualities of an agricultural landscape (Sayadi et al., 2009).

However, studies applying different comparative methods for detecting WTP and social perception of the ES provided by agricultural systems inserted in protected areas are very scarce. In order to fill this gap, the main goal of this study was to formalize the added value of olive agro-ecosystems considering the multidimensional role (economic, cultural and ecological) they play in Andalusia, as well as the important provisioning ES they deliver. Specifically, we estimated the economic value (i.e. WTP) that people attribute to the conservation of olive groves in Andalusia (a); we quantified the effect upon this value of the perception people place on ES and ES values (b); we reported the profile of beneficiaries of a conservation plan (policy implication) (c) and we explored the performance of the IV method in comparison with CV method, since the IV method has recently been introduced in the methodological sphere (d). Finally, we proposed policy recommendations for the public level in order to avoid processes of intensification or abandonment of olive groves, which negatively affect rural development and ES conservation in the study area.

2. Data and methods

2.1. Study area

The Natural Park of "*Sierras de Cazorla, Segura y Las Villas*", with an area of almost 210,000 hectares, is the largest Protected Area in Spain and the second biggest in Europe (Fig. 1). A series of limestone mountain ranges (the highest point reaches 2107 m a.s.l.) occupies its central area, with a predominantly steep and intricate relief. The climate is typically Mediterranean, with an annual rainfall of approximately 600–800 mm (with 1000–2000 mm at higher altitudes) and a mean annual temperature of around 16 °C. Biodiversity is very high, with over 1300 plant species and 200 animal species, most of which are native. In particular, it contains Spain's biggest continuous pine forests, which are characterised by the endemic Spanish black pine (*Pinus nigra* subs. *salzmannii*). In addition, over 50% of the reserve is covered by formations of deciduous trees and Mediterranean sclerophyllous vegetation, along with *dehesas* (i.e. semi-natural silvo-pastoral systems comprising a continuous matrix of grassland with scattered trees). Agricultural areas of the Natural Park are essentially characterised by rain-fed herbaceous crops (approximately 6000 ha) and rain-fed olive plantations, designated as a Protected Designation of Origin (PDO) for extra-virgin olive oil since 1993. The olive groves are mostly distributed on slopes and mountainous terrain and cover over 30,000 ha within the Park, of which only 500–1000 ha are still managed intensively. An area of almost 3,000 ha, the largest in Spain, is under a regime of ecological management. Only a small area of these crops, just over 200 ha, has been abandoned (Rescia et al., 2017), but this situation has been rapidly growing in recent