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RECONCILING LANDOWNER INCOME AND LAND PRICES: THE CASE OF SPANISH AND CALIFORNIA OAK WOODLANDS

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Reconciling landowner income and land prices:
the case of Spanish and California oak woodlands[*]

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Abstract

We integrate data from commercial operations, non-market private amenities and capital gains to measure landowner income and profitability in six oak woodland case studies from Spain and California. Results show that private amenities make the greatest contribution to landowner income, while commercial benefits alone fall short of explaining land prices. We also estimate landowner self-employed labor income, but its contribution is marginal. Total real profitability ranges from 3.2 to 7.8% in the Spanish cases and from 6.0 to 9.3% in the California cases, showing that these oak woodlands compete with alternative investments when private amenities and capital gains are considered.

JEL classification: Q23, Q56
Key words: capital gains, dehesa, income accounting, private amenities, ranch, contingent valuation.

1. Introduction

Conventional accounting of agricultural income usually focuses on commercial operating income (AAEA 2000; European Communities 2000), leaving out the contribution of environmental amenities and capital gains to the total income obtained by rangeland owners. It is widely recognized that these landowners enjoy private amenities (e.g., scenic, recreational, legacy and lifestyle value) from land ownership, and that these have a significant influence on the price of ranches in many places (Martin and Jefferies 1966; Pope 1985; Bastian et al. 2002; Torell et al. 2005; Campos et al. 2009; Wasson et al. 2013). The omission of some measure of the value of the private amenities produced by rangelands leads to a perceived gap between land prices and landowner benefits from commodity production. This problem results from limiting the concept of production to market commodities, as it is applied in agricultural income accounting and in conventional economic analysis in general.

Martin and Jefferies (1966) and other authors after them (Torell et al. 2005; Campos et al. 2009) have pointed out that long-term capital gains, which include land revaluation (appreciation)[2], are also important for understanding landowner decisions and the total benefit captured from agricultural investment. Capital gains are part of the total income from an economic activity (McElroy 1976; Eisner 1989; BEA 2010) and are a financial return to rangeland owners. However, they are often omitted from conventional accounting, reducing our ability to understand land prices and investment decisions. An additional income component often present in ranching is self-employed (landowner and household) labor. When this production factor is present, the income the landowner earns from a ranching operation is a mix of labor and capital investment returns. National accounts do not separate these two components, which makes it difficult to estimate the profitability rates of capital investments. An alternative is attributing to self-employed labor time an average hourly wage rate value according to local markets (Fogerty et al. 2014) and the residual value of the mixed income to capital investment. Self-employed labor, however, offers lower levels of productivity than hired labor so it would be more realistic to attribute a lower productivity to it than would be attributed to a hired employee (Hamilton 2000).

The integration of all these income components in an operative accounting framework would allow a better understanding of landowner investment and management decisions, the interrelationship between income components, and the factors that impact rangeland values in

[2] We use land revaluation as it is the term used in national accounting (European Commission et al., 2009).

rural land markets. This should help improve the efficiency and impact of policies addressing resource allocation, land protection and land use planning.

The objective of this article is to integrate non-market private amenities and capital gains into measurement of landowner income and profitability rates in six case studies of privately-owned oak woodland range in Andalucía (southern Spain) and California. Oak woodland rangelands in both locations are in Mediterranean climate zones with an annual grassland forage base and open oak overstory. They are most often used for commercial operations and land ownership is partly driven by private amenities.

We apply at the farm scale the Agroforestry Accounting System (Campos et al. 2008), using data on commercial operations and investments from case studies, private amenity valuation and land prices from two contingent valuation surveys applied at regional scale, and land revaluation rates from published statistics. We also estimate the part of total income corresponding to self-employed labor, with the constraint that it cannot be negative or higher than 80% of the employee hourly wage in the area. Results show that private amenities contribute more than commercial activities to landowner income and profitability, and that the estimated profitability rates are competitive with alternative investments. If we only consider commercial activities, profitability is negative or near zero. We also obtain that self-employed labor makes a relatively small contribution to landowner income.

The paper is structured as follows. After background review, we present the case studies, followed by the methods and the data and materials used in our applications. Next we show our main results. We close with discussion and conclusions.

2. Background

The rangeland research literature in the United States (US) has a long-standing tradition of analyzing the role of amenities in rangeland management and ownership (Smith and Martin 1972; Starrs 1998; Brunson and Huntsinger 2008; Campos et al. 2009; Huntsinger et al. 2010; Sorice et al. 2012; Oviedo et al. 2012). This topic has been also explored in rangelands and forestlands in UK (Samuel and Thomas 1999), Ireland (Howley 2013), Finland (Kallio 1999), Spain and Portugal (Campos et al. 2009).

We consider private amenities to be any service (intangible) that landowners obtain from their property that does not include a direct market transaction or input into commercial activities. Such services cover a wide range of benefits to landowners, including recreation, open space, legacy values and lifestyle, and have been described and notated in diverse ways

in the literature. Smith and Martin (1972) and Pope (1985) talk about consumptive use, Torell et al. (2005) use quality-of-life, and Bastian et al. (2002) and Wasson et al. (2013) refer to rural and environmental amenities. Hereafter we refer them as private amenities, because they are a result of private ownership.

The main implication from an economic perspective of the existence of private amenities is that they are capitalized into land prices and become a market value when the land is sold (Pope 1985); buyers are willing to pay to acquire the right to enjoy these amenities and sellers incorporate into the land price the value of the amenities they are giving up. Once the land is acquired the annual amenity benefits obtained by the landowner is not subject to a market transaction, so it does not have a directly observable market value. The common analytic approach for this phenomenon is hedonic pricing. In the context of onsite contribution of amenities to land values, this method relates land prices to land attributes and estimates the part of the land price explained by amenities. It has been applied to ranchland and ranchettes in Arizona (Martin and Jefferies 1966; Sengupta and Osgood 2003), rural agricultural land in Texas (Pope 1985), undeveloped private land in California (Standiford and Scott 2001), agricultural land and rangeland in Wyoming (Bastian et al. 2002; Wasson et al. 2013) and to New Mexico ranches (Torell et al. 2005).

Hedonic pricing proves useful for showing that private amenities are capitalized into land prices and how much of the land price is due to amenities. However, if we want to incorporate amenity values into income accounting we need to assume a discount rate that allow us to transform the amenity capital value into an amenity benefit using the standard capitalization formula. This procedure has the limitation that both the income value and the estimated amenity profitability rate will depend on the selected discount rate. To estimate the actual profitability rates for landowners, the ideal is having separate estimations of land price and private amenity benefits, the same way land price and commercial benefits are separately estimated in other studies.

Thus, the challenge in incorporating private amenity benefits into income accounting relates to the absence of a direct observable market value. In this context, non-market valuation methods are available and techniques such as contingent valuation are widely accepted for ecosystem and natural resource analysis. These methods are usually applied for valuing public environmental benefits although non-market private benefits, such as those we analyze in this article, can also be estimated. Results from these methods are often integrated into cost-benefit analysis, although some studies have started to integrate non-market values into accounting applications (Caparrós, Campos and Montero 2003).

The other two income components we consider in our analysis have received less attention in the literature in terms of economic quantification. Both Torell et al. (2001) and AAEA (2000) incorporate capital gains through land revaluation into their discussion about rangeland and agricultural profitability in the US. However, national accounting does not include capital gains in its estimations, and self-employed labor is not differentiated from operating income. Huntsinger et al. (2010) show the increasing relevance of self-employed labor in ranching in California and this could be the case for other ranching areas in the US.

We contribute to the existing literature by (i) using in our accounting proposal separate estimations of land price and income for both commercial and private amenity activities; (ii) estimating non-market amenity output values from two contingent valuation surveys applied in the studied areas; (iii) incorporating capital gains from both manufactured (e. g., buildings, infrastructure) and natural assets (e. g., land, animals) in income measurement; and (iv) estimating the value of self-employed labor assuming that it is of lower productivity than that of hired labor. All this allows estimating income and profitability rates for the landowner from both commercial and private amenity activities.

3. Case studies

Six case studies of privately-owned oak woodlands, three from Andalucía (southern Spain) and three from California are the focus of this research. The oak woodlands from these areas share a dry-summer, frost-free Mediterranean climate and similar vegetation, including oaks with an annual grassland understory, but there are some differences in land use and management. The influence of private amenities has been noted in both areas (Campos et al. 2009; Huntsinger et al. 2010). These case studies fall into the category of remote agricultural land as opposed to agricultural land in the urban fringe, which is more subject to development pressures. Thus, we avoid the consideration that both the amenity income and the land price we estimate include values associated with potential land use change. In addition, in the Spanish cases zoning and land use regulation precludes land development.

Largely found in the south-west (Andalucía and Extremadura regions), the managed oak woodlands of Spain are called *dehesa*, which is equivalent to the English term enclosure. The dehesa is a multiple-use land system dominated by producing livestock, often in concert with oak products and crops, creating an agro-sylvo-pastoral system in oak woodlands. Cattle, pigs, sheep, goats, hunting, cork and other products are marketed from woodlands with well-spaced oaks and a grass understory. Holm oak (*Quercus ilex*) is the most

widespread tree species, but there is often a mixture of other oak and pine species. Landowners usually live in nearby cities and visit their property during weekends where they have a residential house. There is a trend of increasing household labor in large dehesa properties, but on site management is mostly done by hired workers and managers.

Oak woodland properties with cattle production are referred to as ranches in California. They are found in coastal and Sierran foothills. They are naturally open oak savannahs grazed by livestock and game. Other uses are also present, such as cropping to provide supplemental feed or to attract game, but uses are not as diverse as in the dehesa. Blue oak (*Quercus douglasii*) is the most common oak, but there are several other common oak species. Ranchers often live on the property year-round and household labor is a common part of the operations (Huntsinger et al. 2010).

Table 1. Land use and vegetation for the dehesa and ranch case studies.

Vegetation type	Dehesa A	Dehesa B	Dehesa C	Ranch A	Ranch B	Ranch C
Woodland (%)	99.6	86.7	86.6	33.6	65.3	99.0
Oak (%)	99.6	86.7	43.2	33.6	65.3	38.1
Pine (%)			37.2			60.9
Other (%)			6.2			
Shrubland (%)		8.5	7.6		14.9	
Grassland (%)		3.0		54.7	8.9	
Cropland (%)			5.5	11.7	10.9	1.0
Unproductive land (%)	0.4	1.8	0.2			
Total land (ha)	178.8	1,336.4	1,260.4	2,671.3	1,358.1	2,656.8
Useful agrarian land (ha)	178.0	1,312.0	1,257.6	2,671.3	1,358.1	2,656.8

We analyze three dehesa (Dehesas A, B and C) and three ranch (Ranches A, B and C) case studies. Table 1 show the land uses, vegetation and property sizes of the case studies. Holm oak is predominant in the dehesa cases, but cork oak (*Quercus suber*) is also present and Dehesa C has some stands of stone pine (*Pinus pinea*). Blue oak is the main oak species in the ranches, although we also find a mix of pine species on Ranch C. All dehesa cases are livestock-oriented operations with cattle and Iberian pigs in Dehesa A, cattle in Dehesa B and sheep and Iberian pigs in Dehesa C. Ranches A and C are cattle operations and Ranch B is hunting-oriented, although Ranches A and C also collect hunting-fees. Hunting is also present in the dehesa cases. Silvopastoral practices to improve pasture productivity and acorn yields, and firewood harvesting, are carried out in Dehesas A and B. Cork is also harvested in Dehesa B. In the three ranches firewood is sold as stumpage. Irrigated pastures contribute to

livestock feeding activities in Ranch A. In Ranch B crops are cultivated for big game and for a small herd of cattle. Ranch C includes 1,619 hectares of timber forest that is not currently in operation. Self-employed labor occurs on Dehesas A and C and on Ranches B and C.

4. Methods

We apply the experimental Agroforestry Accounting System (AAS) to estimate the landowner income and profitability from our case studies. This system has been developed to extend the criteria of the System of National Accounts (SNA) (European Commission et al. 2009) for estimating the total income from an ecosystem that incorporates both natural processes and human interventions (Campos et al. 2008).

According to Eisner (1989: 17) if income is defined as "that which can be consumed while keeping real wealth intact, saving is the difference between this measure of income and actual consumption. Both income and saving will then include real capital gains. To preserve the saving-investment identity, investment would also have to include these capital gains. Failure to include them causes a disparity between income statements and balance sheets that reflects market values." McElroy (1976: 222), European Communities (2000: 87), Caparrós, Campos and Montero (2003: 179) and BEA (2010: 18) use similar definitions for total income. Thus, the two components of total income from an oak woodland ranch are the net value added and capital gains (McElroy 1976). While the SNA admits that total income should include capital gains, it is not included when the SNA is applied.

The AAS extends the concept of production from the ecosystem to include the non-market private amenities obtained by the landowner—something not part of the operating income measured in the SNA. In addition, while the SNA classifies production from economic activities in institutional sectors (companies, households and government), the AAS uses agroforestry economic activities that are spatially-explicit (forestry, hunting, livestock, crop, services). The SNA also misses natural resource growth and depletion. These omissions are overcome by additional AAS extensions in income estimation (Campos et al. 2008) that are applied in our case studies, although they are not our main focus[3].

[3] These extensions refer to: (i) the output value of forage grazed by livestock in the accounting period and of the annual natural growth of tree and shrub products that will be harvested in a future accounting period (e.g., firewood and cork annual natural growth); and (ii) the cost value of tree and shrub products grown in previous years that are harvested, or contribute to products harvested, during the accounting period (e.g., shrubs browsed by game and wood products from trees).

The two components of total income are obtained from the two accounts used by the AAS: the production account and the capital balance account (Campos et al. 2008). The production account measures output and cost flows from current production, including "own gross capital formation" (gross investments) as output and "work in progress used up" as cost (opening capital of ongoing work on products not yet finished). The net operating margin (operating benefit) is the balance between outputs and costs to the production account. The net value added is estimated as net operating margin (the net surplus from the operation before taxes and subsidies on production) plus labor. Labor includes compensation to both employees and self-employed labor. The capital account includes entries, withdrawals and revaluation (changes in the value) of fixed capital and stored work in progress (i.e., stored wood that is not harvested in the accounting period). Capital gains are measured from capital revaluation less capital destruction plus normal depreciation during the accounting period. The production and capital accounts provide the information needed to estimate the immobilized capital (IMC), which is the average annual capital investment (opening fixed capital plus working capital) in a woodland operation, including in land, infrastructure, equipment and animals.

The income from the woodland to the landowner is the capital income or total benefit (net returns to investment) and paid self-employed labor (compensation to landowner and household labor). These indicators are the main focus of our analysis as they are directly linked to the landowner. Capital income results from adding net operating margin and capital gains, and represents the return to capital investment (manufactured and natural) obtained annually both as an actual monetary and expected return. Paid self-employed labor provides compensations to landowners, and households, when they work in the woodland operation.

Outputs and durable goods sales are valued at producer prices and costs and durable goods bought are valued at purchase prices. Both prices exclude operating subsidies and taxes (European Commission et al. 2009: pp. 101 and 102). We do not consider subsidies and taxes, and nor does the SNA in national income estimates, because they are economic transfers between sectors. In addition, tax and subsidy regimes are different between countries and would partly distort our results. While in Spain woodland owners mostly receive direct subsidies, in California they are more likely to benefit from tax breaks.

Profitability rates are measured as the ratios of net operating margin, capital gain and capital income to the total IMC over the accounting period. This provides the operating, capital gain and total profitability rates, respectively. For illustrative purposes, we show in

our results the IMC from commercial and private amenity activities separately, but all profitability indicators are calculated over the aggregated total IMC of the case study.

5. Data and materials

We gathered information on commercial operating activities and investments from bookkeeping, in-depth interviews and field data in 2010 for the dehesa case studies and in 2007 for the ranch case studies. We obtained estimations of private amenity output, land price and land price revaluation from other sources as explained below. We also detail the criteria for estimating the value of the residual estimate of self-employed labor.

5.1 Private amenity values

To obtain a monetary value for the non-market private amenity output, we use the results of a contingent valuation survey applied in the two analyzed oak woodland regions. The California survey is state-wide (Campos et al. 2009). The Spanish survey focuses on Andalucía (Oviedo, Campos and Caparrós 2015), where the dehesa cases are located.

In both surveys, a contingent valuation scenario was designed for presenting the landowners with two situations: (i) the current situation, where they own the land, obtain commercial operating income Y_0 and enjoy land amenities denoted by Z_0, with landowner utility represented by: $U_0=U(Y_0,Z_0)$; and (ii) a situation where they renounce land ownership, and therefore land amenities, in order to make an alternative investment that increases their commercial income by the amount A, with landowner utility represented by: $U_1=U(Y_0+A,Z_1)$, where $Z_1<Z_0$ and $Y_0+A=Y_1$. Assuming that socio-demographic characteristics and other income sources remain similar in the two situations, the amount A that equals U_0 and U_1 represents the landowner maximum willingness to pay (WTP) for enjoying land amenities. The contingent valuation studies that we use sought to estimate the value of A for a sample of oak woodland owners in Andalucía and California, respectively.

In the Andalucía case, 765 private oak woodland and forest owners were surveyed in 2010. The authors used a single-bounded contingent valuation question, where landowners are asked whether they would pay (give up) or would not pay a specific annual amount of money in order to keep their property and therefore their land amenities in the scenario described above. The amount offered varies among respondents. Using a logistic regression

analysis of the yes/no answers to this question, the authors estimated a WTP function based on the proposal by Cameron (1988).

For California, 115 private oak woodlands owners were surveyed in 2004. The authors used an open-ended contingent valuation question, where landowners are directly asked to state their maximum WTP in the scenario described above. Although this format is less employed nowadays, it becomes useful when samples sizes are small, as it was anticipated in this study (Campos et al. 2009). The authors estimate a function using a weighted least square regression on the maximum WTP stated by landowners.

The contingent valuation questions used are shown in Appendix 1. There are slight differences in the wording of the questions because they were adjusted to each study area and because the Andalucía study benefited from the results and feedback from the California study. The WTP functions, and the resulting values for each case study, are presented in Table 2. The Andalucía study was done with a larger sample and the non-response rate for the contingent valuation question was improved over that of the California study[4]. The WTP is estimated by inserting into the corresponding function the values of the explanatory variables for the case study. The resulting value is recorded as an output in the production account. Values are converted from 2010 Euros to 2010 US dollars in the dehesa cases[5], and from 2002 Euros to 2010 US dollars in the ranch cases[6].

5.2 Land prices and land revaluation

In our analysis we require a land price for the capital account. However, land prices cannot be directly observed unless the land is sold, which is not the situation for our case studies. To get land prices we use data from existing studies. The same surveys that included the contingent valuation questions described above also included two land price questions: (i) one asking landowners what they thought the current sale price of their woodland was; and (ii) another asking landowners to allocate (in %) how this land price was explained by the commercial and amenity benefits from their property. These land price questions are shown in Appendix

[4] A caveat in this study is the high rate of non-response to the contingent valuation question, which left a total of 30 valid observations for the WTP question. However, the obtained model is significant and can be used for the purpose of our exercise.

[5] €1=$1.3257 in 2010 (Eurostat, 2014).

[6] €1=$0.9456 in 2002 (Eurostat, 2014); $1 in 2002=$1.2193 in 2010 (California Department of Finance, 2014). Although the Campos et al. (2009) survey was done in 2004, the results reported in the study are in 2002 Euros.

2. As with wording of the contingent valuation question, the slight differences between these land price questions are due to adaptation to the context of each area and improvements based on the results from the California study.

Table 2 Willingness to pay (WTP) functions for private amenities in Andalucía dehesas and forests and in California oak woodland ranches. Resulting WTP values for the case studies.

Variables	Andalucía dehesas and forests	California oak woodland ranches
	Dependent variable = Log(unobserved WTP per hectare); € 2010	Dependent variable = stated WTP per hectare; € 2002
	Coefficients	Coefficients
Intercept	3.8629***	1,077.4400
	(1.1884)	(1,997.4110)
Property size (hectares)	-0.0004	
	(0.0002)	
Oak woodland (hectares) under canopy cover		-5.8192
		(12.1531)
Square of oak woodland (hectares) under canopy cover		0.0012
		(0.0027)
Eucalyptus (=1 if more than 30% of the property is covered by eucalyptus)	-1.6468*	
	(0.9517)	
Aleppo pine (=1 if more than 40% of the property is covered by aleppo pine)	-1.3387***	
	(0.5132)	
Log of distance (km) from the property to the province capital	0.5292*	
	(0.2821)	
Land price		0.0692**
		(0.0333)
Square of land price		-2.1581E-07**
		(8.7200E-08)
McFadden pseudo-R^2	0.0629	
R^2		0.3838
n	455	25
Resulting WTP values[a]		
- Case study A	510.9	79.1
- Case study B	371.9	185.7
- Case study C	304.9	66.8

Standard errors are shown in parenthesis. Asterisks (e.g.,*,**,***) denote significance at the 10, 5 and 1% level, respectively.

[a] When integrated into the AAS, WTP values are transformed to 2010 US dollars per hectare of useful; €1=$1.3257 in 2010 (Eurostat, 2014), €1=$0.9456 in 2002 (Eurostat, 2014), and $1 in 2002=$1.2193 in 2010 (California Department of Finance, 2014).

Source: Oviedo, Campos and Caparrós (2015) and Campos et al. (2009).

For the dehesa cases we use the land price function directly provided by Oviedo, Campos and Caparrós (2015), and we estimate a function for the percentage of land price explained by private amenities using the data from Oviedo, Campos and Caparrós (2015). For the ranch cases, we use the data from Campos et al. (2009) to estimate both functions[7]. These functions, and the resulting values for each case study, are reported in Table 3. The values are estimated by inserting into the functions the explanatory variables corresponding to each case study. The resulting land price is recorded as the opening land asset value in the capital account. The percentage of land price explained by private amenities allows breaking down the land price between commercial and private amenity activities. Similar to the WTP estimates, land prices are transformed from 2010 Euros to 2010 US dollars in the dehesa cases, and from 2002 Euros to 2010 US dollars in the ranch cases.

The capital balance account also requires an estimation of land revaluation. However, this is a highly variable figure and using the one from a single year would not represent a long-term trend. Instead, we use statistical data for rangeland price variation in the studied areas[8] to estimate an average land revaluation rate. For the dehesa cases, we calculate the average nominal cumulative land revaluation rate for dry natural grassland in Spain between 1994 and 2010 using the data from MARM (2011), resulting in an estimate of 6.7%. For the ranch cases, we calculate the average nominal cumulative land revaluation rate for rangelands in California between 1999 and 2010 using the data from CASFMRA (2012), resulting in an estimate of 7.9%. Both are the longest periods for which there is available data.

As we offer our income and profitability results separately for commercial and private amenity activities, we have to distinguish the share of land revaluation corresponding to these activities. Based on recent literature, real commercial operating income shows a decreasing trend in both areas (Torell et al. 2001; Ovando et al. 2015) while landowner amenities have an increasing influence (Huntsinger et al. 2010; Oviedo, Campos and Caparrós 2015). Thus, we assume that all land revaluation is explained by an expected increase in private amenity values and is entirely attributed to the capital gains of the private amenity activity. Although we admit that there is not enough data to entirely support this decision, we believe it is a reasonable solution given the observed trend and the uncertainty about the future evolution of these values. This is open to re-assessment if trends change.

[7] The land price function directly provided in Campos et al. (2009) cannot be used because we do not have from our case studies information about the values of the explanatory variables needed in this function.

[8] For infrastructure, equipment, animal and natural vegetation, we calculate capital gains from the case studies.

Table 3 Land price functions and percentage of land price explained by private amenities functions in Andalucía dehesas and forests and in California oak woodlands ranches. Resulting values for the case studies.

Variables	Andalucía dehesas and forests		California oak woodland ranches	
	Dependent variable = stated land price per hectare; € 2010	Dependent variable = % of land price explained by private amenities	Dependent variable = log of stated land price per hectare; € 2002	Dependent variable = % of land price explained by private amenities
	Coefficients	Coefficients	Coefficients	Coefficients
Intercept	9,279.7762***	39.1858***	9.1271***	78.8867***
	(1,123.7660)	(8.3014)	(0.1834)	(3.8993)
Property size (hectares)	0.4424*			
	(0.2550)			
Log of property size (hectares)		-3.9174***		
		(0.9296)		
Oak woodland (hectares) under canopy cover			-0.0016***	-0.0222**
			(0.0005)	(0.0104)
Square of oak woodland (hectares) under canopy cover			2.8824E-07**	4.5076E-06
			(1.3570E-06)	(2.7630E-06)
Cork oak (=1 if there is cork oak in the property)	1,855.4456***	5.3998*		
	(497.6243)	(3.0828)		
Holm oak (=1 if there is holm oak in the property)		6.8203**		
		(2.7556)		
Quejigo (=1 if there is *quejigo* in the property)	2,215.4970*			
	(1,139.9781)			
Wild olive tree (=1 if there is wild olive tree in the property)	2,160.1402***			
	(684.1187)			
Eucalyptus (=1 if there is eucalyptus in the property)	-3,353.2150***			
	(1,094.2029)			
Pine (=1 if there is pine in the property)	-944.9363*			
	(520.0866)			
Shrub (=1 if there is shrub in the property)	-823.9877**			
	(367.7118)			
Hunting (=1 if the property has an enclosed hunting reserve)		5.6127**		
		(2.6852)		
Protected (=1 if the property is located in a protected area)	894.7348**			
	(365.2345)			
Western (= 1 if the property is located in western Andalucía)[a]	1,344.8185***			
	(425.8735)			
Log of distance (km) to the closer coastal town	-746.3142***	2.7748*		
	(227.9836)	(1.5308)		
Average slope of the property (%)		71.9957***		
		(13.5682)		
R^2	0.1833	0.0745	0.1652	0.0631
n	588	725	64	82
Resulting values[b]				
- Case study A	6,643.6	43	3,348.6	63
- Case study B	7,493.7	54	3,380.2	61
- Case study C	5,207.4	57	2,978.3	61

Standard errors are shown in parenthesis. Asterisks (e.g.,*,**,***) denote significance at the 10%, 5%, and 1% level, respectively.

[a] Western Andalucía provinces are Cádiz, Córdoba, Huelva and Sevilla.

[b] When integrated into the AAS ,land price values values are transformed to 2010 US dollars per hectare of useful agrarian land; €1=$1.3257 in 2010 (Eurostat, 2014), €1=$0.9456 in 2002 (Eurostat, 2014) and $1 in 2002=$1.2193 in 2010 (California Department of Finance, 2014).

Source: Oviedo, Campos and Caparrós (2015) and own elaboration based on data from Oviedo, Campos and Caparrós (2015) and Campos et al. (2009).

5.3 Self-employed labor

When landowners, and households, devote labor time to woodland operations, they obtain an income that is a mix of net operating margin as return to capital (including both returns to manufactured and environmental capital) and self-employed compensation as return to their labor. This mixed income can be estimated from the production account of the AAS. We propose here a means of separating its two components.

For each activity, we first estimate the total value of this mixed income, with all its components aggregated in a single value, and the hours of self-employed labor. From our case studies, we know the part of this mixed income that corresponds to the environmental net operating margin (also known as the operating resource rent). The remaining income corresponds entirely to the manufactured net operating margin when there is no self-employed labor devoted to the activity. When we identify hours of self-employed labor in the activity, three situations could arise: (i) if the remaining income is negative, we attribute all of it to the manufactured net operating margin; this assumes that landowner labor services will never have a negative value, they are just unpaid; (ii) if the remaining income is positive and on a per hour basis is lower or equal than 80% of the employee hourly wage in the area, all is attributed to self-employed labor; this assumes that landowners prioritize the remuneration of their labor; and (iii) if the remaining income is positive and on a per hour basis higher than 80% of the employee hourly wage, self-employed labor corresponds to the 80% and the rest is manufactured net operating margin; this assumes that self-employed labor cannot equal employee compensation because its marginal productivity is lower than that from hired labor (Hamilton 2000).

6. Results

We present a set of income, capital and profitability indicators resulting from integrating the collected data in the AAS applied to the dehesa cases (Tables 4 and 5) and to the ranch cases (Tables 6 and 7). We differentiate between commercial and private amenity activities. Appendices 3a and 3b present the production accounts of the six case studies, distinguishing five activities: forestry, game, livestock, cropping, and services (including private amenities). Results are in 2010 US dollars per hectare of useful agrarian land and represent nominal values (they are not adjusted by inflation).

Table 4. Income and capital indicators in three dehesa case studies ($ per hectare of useful agrarian land; 2010).

Class	Dehesa A			Dehesa B			Dehesa C		
	Commercial	Private amenity	Total	Commercial	Private amenity	Total	Commercial	Private amenity	Total
Labor (L)	179.3	-	179.3	212.5	-	212.5	64.6	-	64.6
- Employee compensation	179.3	-	179.3	212.5	-	212.5	64.6	-	64.6
- Self-employed compensation[a]	0.0	-	0.0	-	-	-	0.0	-	0.0
Net operating margin (NOM)	-117.8	642.1	524.3	-208.0	465.9	257.9	-13.0	389.3	376.3
Capital gain (CG)	-91.1	377.1	286.0	72.2	704.4	776.6	-4.6	468.3	463.7
Capital income (CI=NOM + CG)	-208.9	1,019.2	810.3	-135.8	1,170.3	1,034.5	-17.6	857.6	840.0
Net value added (NVA=NOM + L)	61.5	642.1	703.6	4.5	465.9	470.4	51.6	389.3	440.9
Total income (TI=CI + L)	-29.6	1,019.2	989.6	76.7	1,170.3	1,247.0	47.0	857.6	904.6
Land price[b]	5,020.2	3,787.2	8,807.4	4,569.8	5,364.6	9,934.4	2,968.5	3,935.0	6,903.5
Immobilized capital (IMC)	9,113.3	3,787.2	12,900.5	6,602.0	5,364.5	11,966.5	3,790.5	3,935.0	7,725.5

[a] Self-employed compensation shows a zero value to denote unpaid labor in the activities (hours of self-employed labor that gets no remuneration) and shows a dash when there is no self-employed labor time devoted to the activities.

[b] Land price at the beginning of the year.

In the three dehesa cases (Table 4), commercial activities offer negative values in the net operating margin and capital income, and private amenity activities contribute more than commercial activities to these income indicators. Capital gains are high for private amenities, as land revaluation is entirely attributed to this activity, and negative or relatively low for commercial activities (in this case they only derive from manufactured investments). The main contribution to total capital income comes from the net operating margin in Dehesa A (65%) and from capital gains in Dehesa B and C (75 and 55% respectively).

Self-employed labor income is unpaid (it has zero value) in the two dehesas where it is present. Thus, income resulting from labor, which only corresponds to commercial activities, is completely derived from hired employment. Net value added and total income have interest for income measurement but go beyond landowners as they incorporate compensation to employees. For these indicators, labor makes the lowest contribution in the three cases and the difference between commercial and private amenity activities remains.

According to the function shown in Table 3, the land price explained by private amenities ranges from 43 to 57% in the dehesa case studies. The contribution of manufactured capital to the immobilized capital comes solely from commercial activities and ranges from 11 to 32% (Table 4). There is no manufactured capital associated with private amenity activities.

Table 5. Profitability indicators in three dehesa case studies (%; 2010).

Class	Dehesa A			Dehesa B			Dehesa C		
	Comm-ercial	Private amenity	Total	Comm-ercial	Private amenity	Total	Comm-ercial	Private amenity	Total
Operating profitability	-0.9	5.0	4.1	-1.7	3.9	2.2	-0.1	5.0	4.9
Capital gain profitability	-0.7	2.9	2.2	0.6	5.9	6.5	-0.1	6.1	6.0
Total profitability	-1.6	7.9	6.3	-1.1	9.8	8.7	-0.2	11.1	10.9

Operating profitability is calculated as (NOM/IMC)*100; Capital gain profitability is calculated as (CG/IMC)*100; and Total profitability is calculated as (CI/IMC)*100; NOM: net operating margin; CG: capital gains; CI: capital income; IMC: immobilized capital.
All profitability indicators are calculated using the total IMC. The IMC from commercial and private amenity activities are shown in Tables 4 and 6 for illustrative purposes.

Profitability rates (Table 5) also show differences between commercial and private amenity activities, with negative or near zero values for the former and positive values for the latter. Total profitability ranges from 6.3 to 10.9%. If capital gains were not considered the total profitability would be reduced between 2.2 and 6.5%. If private amenities were also omitted the total profitability would be additionally reduced between 3.9 to 5.0%, becoming negative

in all cases. If we adjust by the inflation rate in the period 1994-2010, which is 3.1%, real total profitability is 3.2, 5.6 and 7.8% for Dehesa A, B and C, respectively.

For the ranch cases (Table 6), commercial activities offer positive values for the net operating margin and the capital income, although they are particularly low for Ranch C. Private amenity activities also contribute more than commercial activities to landowner income indicators, except for self-employed labor and for the net operating margin of Ranch A. Differences between these activities are less accentuated than in the dehesa cases. Capital gains are contributed mainly by private amenity activities, being low or negative for commercial activities. The main contribution to total capital income comes from capital gains in the three ranches, ranging from 59 to 74%.

Self-employed labor income is paid in the two ranches where it is present, and contributes 19% to total labor for Ranch B and 79% for Ranch C. According to the hours of self-employed labor devoted to ranching operations in these case studies, we estimate an income of $0.9 and $5.8 per hour respectively. These values represent 4 and 24% of the average wage rate for related work in the area in 2010, showing a lower productivity of self-employed labor as compared to hired labor. As in the dehesa cases, labor makes the lowest contribution to net value added and total income in all case studies.

According to the functions from Table 3, 61 to 63% of land price is explained by private amenities in the ranch case studies. The contribution of manufactured capital to immobilized capital ranges from 12 to 15% (Table 6). As in the dehesa cases, there is no manufactured capital associated with private amenities.

The three profitability rates (Table 7) show higher values for private amenity activities except for the operating profitability of Ranch A. Commercial profitability is positive in most cases. Total profitability ranges from 8.7 to 12.0%. If capital gains were not considered the total profitability would be reduced to between 6.5 and 7.1%. If private amenities were also omitted the total profitability would be reduced to 2.6% in Ranch A and near 0.0% in the other two cases. If we consider the inflation rate in the period 1999-2010, which is 2.7%, real total profitability is 9.3, 8.9 and 6.0% for Ranches A, B and C, respectively.

7. Discussion

Our proposed accounting approach integrates commercial net operating margin, which is negative or near zero in our case studies, with additional income components for the landowner that deserve further discussion. The integration of non-market private amenity

Table 6. Income and capital indicators in three ranch case studies ($ per hectare of useful agrarian land; 2010).

Class	Ranch A			Ranch B			Ranch C		
	Commercial	Private amenity	Total	Commercial	Private amenity	Total	Commercial	Private amenity	Total
Labor (L)	35.3	-	35.3	19.6	-	19.6	6.6	-	6.6
- Employee compensation	35.3	-	35.3	15.8	-	15.8	1.4	-	1.4
- Self-employed compensation[a]	-	-	-	3.8	-	3.8	5.2	-	5.2
Net operating margin (NOM)	104.1	90.9	195.0	5.0	201.1	206.1	18.9	63.0	81.9
Capital gain (CG)	4.1	279.5	283.6	31.4	281.0	312.4	-10.7	246.8	236.1
Capital income (CI=NOM + CG)	108.2	370.4	478.6	36.4	482.1	518.5	8.2	309.8	318.0
Net value added (NVA=NOM + L)	139.4	90.9	230.3	24.6	201.1	225.7	25.5	63.0	88.5
Total income (TI=CI + L)	143.5	370.4	513.9	56.0	482.1	538.1	14.8	309.8	324.6
Land price[b]	1,293.2	2,201.9	3,495.1	1,305.3	2,222.6	3,527.9	1,212.4	1,896.2	3,108.6
Immobilized capital (IMC)	1,774.9	2,201.9	3,976.8	2,224.8	2,222.6	4,447.4	1,733.9	1,896.2	3,630.1

[a] Self-employed compensation shows a zero value to denote unpaid labor in the activities (hours of self-employed labor that gets no remuneration) and shows a dash when there is no self-employed labor time devoted to the activities.

[b] Land price at the beginning of the year.

Table 7. Profitability indicators in ranch case studies (%; 2010).

Class	Ranch A			Ranch B			Ranch C		
	Comm-ercial	Private amenity	Total	Comm-ercial	Private amenity	Total	Comm-ercial	Private amenity	Total
Operating profitability	2.6	2.3	4.9	0.1	4.5	4.6	0.5	1.7	2.2
Capital gain profitability	0.1	7.0	7.1	0.7	6.3	7.0	-0.3	6.8	6.5
Total profitability	2.7	9.3	12.0	0.8	10.8	11.6	0.2	8.5	8.7

Operating profitability is calculated as (NOM/IMC)*100; Capital gain profitability is calculated as (CG/IMC)*100; and Total profitability is calculated as (CI/IMC)*100; NOM: net operating margin; CG: capital gains; CI: capital income; IMC: immobilized capital.
All profitability indicators are calculated using the total IMC. The IMC from commercial and private amenity activities are shown in Tables 4 and 6 for illustrative purposes.

output in our income analysis quantifies in economic terms the idea that ranchers and rural landowners receive benefits that go beyond production of market commodities. The WTP results that we present show that landowners demand from an alternative investment an additional operating income that compensates for the loss of land amenities. This translates into an additional operating profitability in the 2 to 5% range in our case studies.

These private amenities are valued using contingent valuation and the estimated mean WTP is integrated into our accounting system as an output. By using the mean WTP for each landowner type owning a similar property (based on the functions from Table 2), we implicitly assume that all landowners within the same type would pay their maximum WTP in the simulated market and that all the WTP is capitalized into the land price. This would imply that we are using a welfare measure (the Hicksian variation) as an output value. This is not ideal for income accounting because it uses exchange values, requiring a single price (WTP) that would be paid by a share of landowners in the simulated market (Caparrós, Campos and Montero 2003). In this case only part of the landowners' maximum WTP is capitalized into the land price. However, in our amenity simulated market we consider it realistic that each oak woodland property represents a unique good differentiated from other properties. Under this assumption, we can accept that each landowner's maximum WTP for private amenities is fully capitalized into the land price and that the mean WTP per hectare for each landowner type is therefore an exchange value. Further research may explore relaxing this hypothesis for different property and landowner types and estimating how it would affect the income and profitability estimations from private amenity activities.

Estimated WTPs in our case studies show a range of values from $77.1 per hectare in Ranch C to $680.3 per hectare in Dehesa A in 2010. These differences between dehesa and ranches were expected, as the California cases determined values from an open-ended

contingent valuation question, while the dehesa case used a closed-ended question. The contingent valuation literature shows that open-ended questions provide lower values and that closed-ended formats are in general more incentive-compatible (Kealy and Turner 1993; Ready, Buzby and Hu 1996). This could imply that the amenity output and profitability rates for California oak woodlands may be larger than those presented in our case studies. Another factor that explains differences in amenity values between ranches and dehesa, and also among case studies, is property size. After a certain point, increases in ranch size no longer increase amenity values much (the total WTP is almost flat), implying that for large properties the amenity value per hectare drops—this is also discussed in Pope (1985) and in Oviedo et al. (2012). This decreasing amenity value per hectare leads to lower amenity profitability for ranches compared to dehesas, as the former are usually of larger sizes.

Capital gains are also included in our accounting framework, with land revaluation its main component. We use an average land revaluation rate over a period of time, which is more appropriate for obtaining indicators that are more likely to anticipate an oak woodland owner's decisions. Had we use the land revaluation rate of the year for which the case study data were taken, we would have obtained very particular results. In 2010, Spain was in the middle of an economic recession that caused dramatic declines in land prices. In 2007, the housing bubble reached a peak in the US with high increases in land values. A caveat is that the land revaluation figures we use are only available for a short period, and the contribution to total profitability could be overestimated. Having a longer period would have probably lower these rates and compensated for the high rates from recent years; prices fell after 2008 in Spain and in the US, and probably increased more slowly before 1999.

The importance of both capital gains and private amenities becomes clear in our results. However, their relation is somewhat circular. Capital gains occur because there is an expectation about future benefits from the asset. If commercial operating income shows a declining trend, the main explanation for these capital gains in the analyzed oak woodland areas should derive from an expectation that amenity values will increase or maintain the same value in the future. Private amenities are then mainly responsible for the positive and competitive profitability from these oak woodlands. Unless commercial operations change their trend, the maintenance of ranching and the cultural landscape of these oak woodlands relies on continuation of amenity preferences in landowners, and the ability to afford them.

For the reasons stated above subsidies (net of taxes) are not considered in our estimations, but they are important in dehesa management as they increase landowner profitability. Adding subsidies make the commercial net operating margin positive in the

dehesa case studies, and partly explains the persistence in livestock enterprises by these landowners. Dehesa A receives higher subsidies on a per hectare basis as it has a very high stocking rate for a small property. In the US, some subsidies take the form of tax relief that, if taken into account, would imply an increase in operating income as compared to other countries without tax relief benefits. In our ranch case studies only Ranch A received a significant subsidy in the analyzed year for the improvement of an irrigation system.

Apart from investment profitability, landowners also benefit from their own work. In two dehesa case studies, self-employed labor is unpaid. In two ranch case studies, there is paid self-employed labor that has a lower productivity than hired labor. It seems then that landowners substitute hired labor with self-employed labor hours and are working without or with a low remuneration for their labor in order to maintain commercial activities. A possible explanation to this is the landowner's desire to enjoy the lifestyle and amenities associated with working in traditional ranch operations.

This brings up the possibility that some amenity values should be actually attributed to work-related commercial activities. For example, livestock management can be part of the rancher lifestyle, and an amenity, and owner WTP for private amenities might not exist without the presence of cattle and related activities. This could apply to Ranch B, where the landowner's main operation is hunting but a small herd of cattle is also kept, which provide negative results in the net operating margin for livestock activities (Appendix 3b). It is also observed that some hunting management in dehesa is unprofitable, but may be sought by landowners for their own hunting enjoyment instead of maximizing commercial profits. This could apply to our dehesa cases as they all offer negative operating income from hunting activities (Appendix 3a). Thus, some commercial activities could be producing intermediate services that are used up as inputs for private amenity activities and, if considered, commercial benefits would be higher than the ones shown in our results. If this is the case, our results from commercial activities are undervalued and from private amenity activities are overvalued, although this would not change the total income and profitability figures—it is only a trade-off between activities. The problem is to estimate the part of the private amenity output that is attributed to these intermediate services, but with the information from our case studies it would largely be a subjective decision.

Finally, we draw some policy implications from our results. In dehesa, the negative results for commercial operations would likely drive cessation of livestock grazing activities and the natural expansion of shrubs into grasslands and woodlands (Ramírez and Díaz 2008). Natural capital would probably suffer losses with this vegetation change. Both amenities and

subsidies play an active role here, but the latter are likely to be more in demand by landowners with limited willingness to accept short term net cash flow losses. On the other hand, it is uncertain whether landowner amenities will persist and how they will affect management in the long-term. There is a risk of continued natural resource depletion if the market is not able to internalize natural capital losses, and if government regulation (subsidies) alone is not sufficient or disappears. In California, the two components that contribute most to total income are likely to foster property subdivision and subsequent habitat fragmentation. Amenity values drop on a per hectare basis for large properties and this could accelerate subdivision if amenities remain as the only values for landowners (Oviedo et al. 2012). In addition, high rates of land revaluation could drive landowners to sell off small parcels to meet cash flow shortages, posing a fragmentation risk with the potential change of habitat. This threat is less likely in dehesa as zoning and land regulation limit land subdivision, but such regulation does not prevent vegetation change. In both cases, the observed decline in commercial operations could cause the change of a historic cultural landscape that provides ecosystem services to society. Policy action addressed to sustaining these working landscapes could benefit from standardized economic information integrating both commercial and environmental values, such as the one we have proposed in this paper.

8. Concluding remarks

We have quantified the income and profitability from oak woodland case studies in Spanish dehesa and California ranches within an accounting framework that integrates commodities, (non-market) private amenities and capital gains, and that estimates self-employed labor income. We find that both private amenities and capital gains are the most important contributors to landowner income and to land prices. Private amenities add between 2 and 5% to total profitability, and capital gains add about 6 to 7% when using historical land revaluation. Our results show that these oak woodlands prove to be competitive with alternative investments of similar risks and time horizon, but this would not be the case if only commercial activities were considered. Our approach helps explaining in quantitative terms why landowners persist in these operations and why the market demands land prices that cannot be explained solely by the benefits from commercial production.

We also find unpaid or low paid self-employed labor in our case studies, with an estimated value that does not reach 25% of the average wage paid in the area. This supports the idea that self-employed labor has lower productivity than hired labor and that the 80%

limit of the hourly wage rate that we set as the maximum self-employed labor value is probably a generous upper bound. Landowner willingness to keep their commercial operations with low, or even null, self-employed labor could be explained by their desire to enjoy land and work-related amenities associated with ranching lifestyle. In other words, self-employed labor income could be embedded in the estimated private amenity values.

Although our case study approach is not statistically representative, it helps in developing the proposed income accounting extensions at the individual property scale. This could serve as the basis for a large scale application that would contribute to (i) progressing in ecosystem accounting and in the integration of market and non-market values into decision-making; (ii) offering a better knowledge of oak woodland values and landowner motivations; and (iii) understanding the economic forces that drive management and change in these ecosystems. These potential contributions highlight the need for improved economic tools to support the design of policies targeting private land conservation.

The main empirical implication from our analysis is that a persistent decline in commercial operating profitability and an uncertain future for landowner amenity preferences are important factors to consider in the conservation and management of these oak woodlands. The amenity values and associated non-market ecosystem services provided to society could be important arguments for policy-makers to support land stewardship and maintaining active ownerships, and to finding new ways to conserve and improve dehesa and ranch working landscapes.

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References

American Agricultural Economics Association (AAEA). 2000. "Commodity Costs and Returns Estimation Handbook. A Report of the AAEA Task Force on Commodity Costs and Returns". Ames, Iowa: United States Department of Agriculture.

Bastian, Chris T., Donald M. McLeod, Matthew J. Germino, William A Reiners, and Benedict J. Blasko. 2002. "Environmental Amenities and Agricultural Land Values: A Hedonic Model Using Geographic Information Systems Data". *Ecological Economics* 40 (3): 337-349.

Bureau of Economic Analysis (BEA). 2010. "Concepts and Methods of the U.S. National Income and Product Accounts". U.S. Department of Commerce: http://www.bea.gov/national/pdf/NIPAhandbookch1-4.pdf

Brunson, Mark W., and Lynn Huntsinger. 2008. "Ranching as a Conservation Strategy: Can Old Ranchers Save the New West?" *Rangeland Ecology & Management* 61 (2): 137-147.

California Department of Finance. 2014. "Consumer Price Index. Calendar Year Averages". http://www.dof.ca.gov/html/fs_data/latestEconData/fs_price.htm.

Cameron, Trudy A. 1988. "A New Paradigm for Valuing Non-market Goods Using Referendum Data: Maximum Likelihood Estimation by Censored Logistic Regression". *Journal of Environmental Economics and Management* 15 (3): 355-379.

Campos, Pablo, Hamed Daly-Hassen, Jose L. Oviedo, Paola Ovando, and Ali Chebil. 2008. "Accounting for Single and Aggregated Forest Incomes: Application to Public Cork Oak Forests of Jerez in Spain and Iteimia in Tunisia". *Ecological Economics* 65 (1): 76-86.

Campos, Pablo, Jose L. Oviedo, Alejandro Caparrós, Lynn Huntsinger, and Inocencio Coelho. 2009. "Contingent Valuation of Private Amenities from Oak Woodlands in Spain, Portugal, and California". *Rangeland Ecology & Management* 62 (3): 240-252.

Caparrós, Alejandro, Pablo Campos, and Gregorio Montero. 2003. "An Operative Framework for Total Hicksian Income Measurement: Application to a Multiple Use Forest". *Environmental and Resource Economics* 26 (2): 173-198.

California Chapter, American Society of Farm Managers and Rural Appraisers (CASFMRA). 2012. "Trends in Agricultural Land and Lease Values Reports". Woodbridge, California: http://www.calasfmra.com/trends.php

Eisner, Robert. 1989. *The Total Incomes System of Accounts*. The University of Chicago Press: Chicago and London.

European Communities, 2000. “Manual on the Economic Accounts for Agriculture and Forestry EEA/EAF 97 (Rev. 1.1)”. Luxembourg: European Commission. http://ec.europa.eu/eurostat/ramon/statmanuals/files/KS-27-00-782-__-I-EN.pdf

European Commission, International Monetary Fund, Organisation for Economic Co-operation and Development, United Nations, and World Bank. 2009. “System of National Accounts 2008”. New York: http://unstats.un.org/unsd/nationalaccount/docs/SNA2008.pdf.

Eurostat. 2014. “ECU/EUR exchange rates versus national currencies”. http://epp.eurostat.ec.europa.eu/tgm/table.do?tab=table&init=1&language=en&pcode=tec00033&plugin=1

Fogerty, Mark, Richard Soffe, and Keith Robbins. 2014. “Lowland Grazing Livestock Production in England 2012/13”. Rural Business Research: http://www.fbspartnership.co.uk/documents/2012_13/Lowland_Grazing_Production_2012-13.pdf

Hamilton, Barton H. 2000. “Does Entrepreneurship Pay? An Empirical Analysis of the Returns to Self-Employment”. *Journal of Political Economy* 108 (3): 604-631.

Howley, Peter. 2013. “Examining Farm Forest Owners’ Forest Management in Ireland: The Role of Economic, Lifestyle and Multifunctional Ownership Objectives”. *Journal of Environmental Management* 123: 105-112.

Huntsinger, Lynn, Martin Johnson, Monica Stafford, and Jeremy Fried. 2010. “Hardwood Rangeland Landowners in California from 1985 to 2004: Production, Ecosystem Services, and Permanence”. *Rangeland Ecology & Management* 63 (3): 324-334.

Kallio, Timo. 1999. “Non-market Benefits and Forest Owners’ Total Utility in Profitability Calculations”. In *The Living Forest: Non-market Benefits of Forestry*, ed. Charles S. Roper and Andy Park. London, UK: Forestry Commission.

Kealy, Mary J., and Robert W. Turner. 1993. “A Test of the Equality of Closed-ended and Open-ended Contingent Valuations”. *American Journal of Agricultural Economics* 75 (2): 321–331.

Ministerio de Medio Ambiente y Medio Rural y Marino (MARM). 2011. “Encuesta de precios de la tierra 2010”. http://www.magrama.gob.es/es/estadistica/temas/estadisticas-agrarias/economia/encuesta-precios-tierra/

Martin, William E., and Gene L. Jefferies. 1966. “Relating Ranch Prices and Grazing Permit Values to Ranch Productivity”. Journal of Farm Economics 48 (2): 233-242.

McElroy, Michael B. 1976. “Capital Gains and Social Income”. *Economic Inquiry* XIV: 221-240.

Ovando, Paola, Pablo Campos, Bruno Mesa, Alejandro Álvarez, Cristina Fernández, Jose L. Oviedo, Alejandro Caparrós, and Begoña Álvarez-Farizo. 2015. “Renta y Capital de Estudios de Caso de Fincas Agroforestales de Andalucía”. In *Renta total y capital de las fincas agroforestales de Andalucía*, ed. Pablo Campos and Paola Ovando. Scientific report for the RECAMAN project: *forthcoming*.

Oviedo, Jose L., Lynn Huntsinger, Pablo Campos, and Alejandro Caparrós. 2012. Income value of private amenities assessed in California oak woodlands. *California Agriculture* 66 (3): 91-96.

Oviedo, Jose L., Pablo Campos, and Alejandro Caparrós. 2015. “Valoración de Servicios Ambientales Privados de Propietarios de Fincas Agroforestales de Andalucía”. In *Renta total y capital de las fincas agroforestales de Andalucía*, ed. Pablo Campos and Paola Ovando. Scientific report for the RECAMAN project: *forthcoming*.

Pope, C. Arden. 1985. “Agricultural Productive and Consumptive Use Components of Rural Land Values in Texas”. *American Journal of Agricultural Economics* 67 (1): 81-86.

Ramírez, José A., and Mario Díaz. 2008. “The Role of Temporal Shrub Encroachment for the Maintenance of Spanish Holm Oak Quercus ilex Dehesas”. *Forest Ecology and Management* 255: 1976-1983.

Ready, Richard C., Jean C. Buzby, and Dayuan Hu. 1996. “Differences Between Continuous and Discrete Contingent Value Estimates”. Land Economics 72 (3): 397-411.

Samuel, John, and Terry Thomas. 1999. “The Valuation of Unpriced Forest Products by Private Woodland Owners in Wales”. In *The Living Forest: Non-market Benefits of Forestry*, ed. Charles S. Roper and Andy Park. Edinburgh, UK: Forestry Commission.

Sengupta, Sanchita, and Daniel E. Osgood. 2003. “The Value of Remoteness: A Hedonic Estimation of Ranchette Prices”. *Ecological Economics* 44 (1): 91-103.

Smith, Arthur H., and William E. Martin. 1972. “Socioeconomic Behavior of Cattle Ranchers, with Implications for Rural Community Development in the West”. *American Journal of Agricultural Economics* 54 (2): 217-225.

Sorice, Michael G., Urs P. Kreuter, Bradfor P. Wilcox, and William E. Fox III. 2012. “Classifying Land-ownership Motivations in Central, Texas, USA: A First Step in Understanding Drivers of Large-scale Land Cover Change”. Journal of Arid Environments 80: 56-64.

Standiford, Richard B., and Thomas Scott T. 2001. “Value of Oak Woodlands and Open Space on Private Property Values in Southern California”. *Investigación Agraria: Sistemas y Recursos Forestales* (fuera de serie 1): 137-152.

Starrs, Paul F. 1998. *Let the Cowboy Ride*. Baltimore: John Hopkins University Press.

Torell, L. Allen, Neil R. Rimbey, John A. Tanaka, and Scott A. Bailey. 2001. “The Lack of Profit Motive for Ranching: Implications for Policy Analysis”. In *Proceedings of the Annual Meeting of the Society for Range Management*, ed. L. Allen Torell, E. Thomas Bartlett, and Rena Larrañaga. 17-23 February, Kailua-Kona, HI.

Torell, L. Allen, Neil R. Rimbey, Octavio A. Ramírez, and Daniel W. McCollum. 2005. “Income Earning Potential Versus Consumptive Amenities in Determining Ranchland Values”. *Journal of Agricultural and Resource Economics* 30 (3): 537-560.

Wasson, James R., Donald M. McLeod, Chris T. Bastian, and Benjamin S. Rashford. 2013. “The Effects of Environmental Amenities on Agricultural Land Values”. *Land Economics* 89 (3): 466-478.

Appendix 1: Contingent valuation questions used in each study area

Andalucía survey

Consider that you are offered the possibility to invest in an alternative non-agrarian investment to your current land property that would increase your benefit in €15,000 per year. Would you sell your land property to move to this investment and get that annual benefit increase?

□ Yes □ No □ Do not know/do not answer

Source: Oviedo, Campos and Caparrós (2015).

California survey

Imagine that you could earn more money by investing in other assets (for example stocks or bonds) of comparable risk and time frame. How much is the maximum amounts of earnings you are willing to give up, per year, in this way, before selling your property in order to invest in an alternative that brings a higher return?

I would be willing to give up a maximum of _____ DOLLARS PER YEAR before I would consider selling my property to make that alternative investment

Source: Adapted to the California case from Campos et al. (2009).

Appendix 2: Land price questions used in each study area

Andalucía survey

How much do you estimate the current market price of your land to be? Include the value of buildings and infrastructure and assume that your property would continue being used as ranchland.

_____ EUROS or _____ EUROS PER HECTARE

Indicate the percentage of the market price of your land (previously stated) that is explained by the future benefits from:

Commercial operations	%
The value of buildings or other infrastructures	%
The recreational and landscape enjoyment with family	%
Enjoying working on the property	%
Being able to leave the land to my heirs	%
The social prestige (inviting friends and business associates)	%
Rural lifestyle	%
Subsides	%
Other (specify: _____)	%
TOTAL	(should be 100%)

Source: Oviedo, Campos and Caparrós (2015).

California survey

How much do you estimate the current market price of your land to be without buildings or other improvements?

_____ DOLLARS PER ACRE

How important are each of the following to your personal value for your property? Express each as a percentage of the total value, so that the percentages total 100 % at the bottom.

Activity	**Proportion of value to me**
Crop production	%
Livestock production	%
Timber	%
Firewood	%
Hunting	%
Enjoyment of the countryside	%
Tax benefits	%
Conservation of wild plants an animals	%
Have a good place to raise a family	%
Enjoying working on the property	%
Having friends and relatives visit	%
Being able to leave the land to my heirs	%
Other (please specify):_____	%
TOTAL	**100%**

Source: Adapted to the California case from Campos et al. (2009).

Appendix 3a. Production accounts for the dehesa case studies ($ per hectare of useful agrarian land; 2010).

Class	Dehesa A						Dehesa B						Dehesa C					
	FOR	GAM	LIV	CRO	SER	TOT	FOR	GAM	LIV	CRO	SER	TOT	FOR	GAM	LIV	CRO	SER	TOT
1. TOTAL OUTPUT	63.4	7.8	996.3		718.5	1,786.0	213.3	269.1	39.8		550.7	1,072.9	26.8	72.8	21.6	10.3	446.9	578.4
1.1 Intermediate output	62.4				38.2	100.6	103.4	70.2			36.3	209.9	8.7	33.3			15.9	57.9
1.1.1 Raw materials	62.4					62.4	95.9	70.2				166.1	8.7	33.3				42.0
1.1.2 Services					38.2	38.2	7.5				36.3	43.8					15.9	15.9
1.2 Final output	1.0	7.8	996.3		680.3	1,685.4	109.9	198.9	39.8		514.4	863.0	18.1	39.5	21.6	10.3	431.0	520.5
1.2.1 Own fixed investment			122.2			122.2		6.2	21.2		4.7	32.1		0.8	1.2		16.9	18.9
1.2.2 Sales		7.8	447.4			447.4	102.5	149.6	9.4		4.2	265.7	5.7	26.5	16.5	10.3		59.0
1.2.3 Work in progress	1.0		426.7			435.5	6.2	37.8	9.2			53.2	12.4	4.9	2.1			19.4
1.2.4 Owner consumed					680.3	680.3	1.2	1.0			502.2	504.4		6.8	1.8		405.2	413.8
1.2.5 Other final output								4.3			3.3	7.6		0.5			8.9	9.4
2. TOTAL COST	30.9		1,192.4		38.2	1,261.5	286.9	287.1	150.8		90.2	815.0	0.2	96.7	57.7	9.9	37.8	202.3
2.1 Intermediate consumption	9.6		995.2		38.2	1,043.0	147.4	215.5	113.8		36.5	513.2		61.4	33.9	2.3	24.6	122.2
2.1.1 Raw materials			316.4			316.4	73.0	134.9	65.6		0.1	273.6		38.5	16.9	1.3		56.7
2.1.2 Services	9.6		36.0		38.2	83.8	9.1	17.9	31.9		36.4	95.3		9.7	2.1	1.0	24.6	37.4
2.1.3 Work in progress used			642.8			642.8	65.3	62.7	16.3			144.3		13.2	14.9			28.1
2.2 Labor cost	19.4		159.9			179.3	126.0	38.3	24.5		23.7	212.5	0.2	31.2	19.8	5.2	8.3	64.7
2.2.1 Employees	19.4		159.9			179.3	126.0	38.3	24.5		23.7	212.5	0.2	31.2	19.8	5.2	8.3	64.7
2.2.2 Self-employed	0.0		0.0			0.0								0.0				0.0
2.3 Fixed capital consumption	1.9		37.3			39.2	13.5	33.3	12.5		30.0	89.3	0.0	4.1	4.0	2.4	4.9	15.4
3. NET OPERATING MARGIN	32.5	7.8	-196.1		680.3	524.5	-73.6	-18.0	-111.0		460.5	257.9	26.6	-23.9	-36.1	0.4	409.1	376.1

FOR: Forestry; GAM: Game; LIV: Livestock; CRO: Cropping; SER: Services; TOT: Total.

Appendix 3b. Production accounts for the ranch case studies ($ per hectare of useful agrarian land; 2010).

Class	Ranch A						Ranch B						Ranch C					
	FOR	GAM	LIV	CRO	SER	TOT	FOR	GAM	LIV	CRO	SER	TOT	FOR	GAM	LIV	CRO	SER	TOT
1. TOTAL OUTPUT	41.7	3.0	877.1	46.4	95.9	1,064.1	14.7	21.3	12.2	18.4	234.0	300.6	14.4	0.9	52.1	0.9	91.2	159.5
1.1 Intermediate output	36.5		6.8	25.8		69.1	0.8			7.4	12.2	20.4	12.4		1.9	0.9	14.1	29.3
1.1.1 Raw materials	36.5			25.8		62.3	0.8			7.4		8.2	12.4			0.9		13.3
1.1.2 Services			6.8			6.8					12.2	12.2			1.9		14.1	16.0
1.2 Final output	5.2	3.0	870.3	20.6	95.9	995.0	13.9	21.3	12.2	11.0	221.8	280.2	2.0	0.9	50.2		77.1	130.2
1.2.1 Own fixed investment	2.5		8.6	20.6		31.7	3.5	0.3	6.4	1.1	0.3	11.6	1.7		8.6			10.3
1.2.2 Sales	2.7	3.0	564.7			570.4	10.4	21.0	2.4	9.9	3.6	47.3	0.3	0.9	33.7			34.9
1.2.3 Work in progress			297.0			297.0			3.4			3.4			5.8			5.8
1.2.4 Owner consumed					91.2	91.2					214.1	214.1					77.1	77.1
1.2.5 Other final output					4.7	4.7					3.8	3.8			2.1			2.1
2. TOTAL COST	3.9		832.8	32.1	0.3	869.1	9.1	24.9	24.5	17.2	18.9	94.6	9.7	0.3	50.5	2.5	14.6	77.6
2.1 Intermediate consumption	0.8		808.4	17.7		826.9	2.8	13.4	10.0	7.6	13.2	47.0	7.4	0.3	43.8	2.1	14.4	68.0
2.1.1 Raw materials	0.1		65.8	10.5		76.4	0.7	8.4	5.1	3.9	0.6	18.7	6.2	0.1	24.0	1.3	0.2	31.8
2.1.2 Services	0.7		30.6	7.2		38.5	2.1	5.0	1.7	3.7	12.6	25.1	1.2	0.2	7.2	0.8	14.2	23.6
2.1.3 Work in progress used			712.0			712.0			3.2			3.2			12.6			12.6
2.2 Labor cost	2.9		20.5	11.9		35.3	2.3	4.3	5.8	2.6	4.6	19.6	1.7		4.7	0.0	0.2	6.6
2.2.1 Employees	2.9		20.5	11.9		35.3	2.3	4.3	5.8	2.5	0.9	15.8	0.1		1.3	0.0		1.4
2.2.2 Self-employed							0.0	0.0	0.0	0.1	3.7	3.8	1.6	0.0	3.4	0.0	0.2	5.2
2.3 Fixed capital consumption	0.2		3.9	2.5	0.3	6.9	4.0	7.2	8.7	7.0	1.1	28.0	0.6	0.0	2.0	0.4	0.0	3.0
3. NET OPERATING MARGIN	37.8	3.0	44.3	14.3	95.6	195.0	5.6	-3.6	-12.3	1.2	215.1	206.0	4.7	0.6	1.6	-1.6	76.6	81.9

FOR: Forestry; GAM: Game; LIV: Livestock; CRO: Cropping; SER: Services; TOT: Total.