Supplementary material for:

Incomes and ecosystem services comparisons of refined national and agroforestry accounting frameworks: application to holm oak open woodlands in Andalusia-Spain

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S1. Background to holm oak open woodlands in West and South-West Spain

S1.1. Extent of holm oak open woodlands

The holm oak open woodlands defined in this study as having a canopy cover fraction (CCF) of between 5% and 75% are mainly found in the west and southwest of five Spanish autonomous regions, with pure and mixed stands covering an area of 4,845,798 ha which account for 72.1% of the total woodland area and 44.7% of the areas of forest and open Woodland in the five regions (Table ST1). The 22,281 tiles in which HOW predominate in Andalusia have an average area of 63 ha, ranging from less than a hectare up to 730 ha (Table S2). Andalusia, with 1,408,170 ha, is the region with the largest area of tiles in which holm oak open woodlands (HOW) predominate, accounting for 29.1% of the total, followed by Extremadura with 28.7% and Castilla-La Mancha with 24% (Table ST1 and ST1)[1]. The HOW make up 47.6% of the total area of forests and open woodlands in Andalusia. The average CCF of the HOW in Andalusia is 32%, which is similar to that of the HOW area in the five regions. This CCF is considerably lower than the 49% for tiles in Andalusia with a predominance of timber-yielding conifers.

Table ST1. Open woodlands[*] in tiles with a predominance of hardwood species in West and Central Spain (hectares).

Class	Andalucía	Castilla-La Mancha	Castilla-León	Extremadura	Madrid	Total (ha)
Holm oak	1,408,170	1,165,064	750,459	1,390,896	13,.209	4,845,798
Cork oaks	248,015	24,493	7,059	151,786	190	431,543
Other oaks	28,992	175,383	745,760	94,995	24,260	1,069,390
Others	127,476	113,202	113,536	8,270	12,918	375,402
Total	1,812,654	1,478,142	1,616,815	1,645,946	168,576	6,722,133

*Open woodlands correspond to tiles with a canopy cover fraction ranging from FCC ≥5% to FCC ≤75% (including all standing tree "developments").

Source: Eloy Almazán based on the [24].

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[1] According to preliminary information from the NFI6 (February 2013), holm oak as the dominant species covers a total area of 331,790 in Portugal. This area also includes, among others, areas of holm oak which constitute "dense holm oak woodland" [41] (p. 15)

Holm oak open woodlands
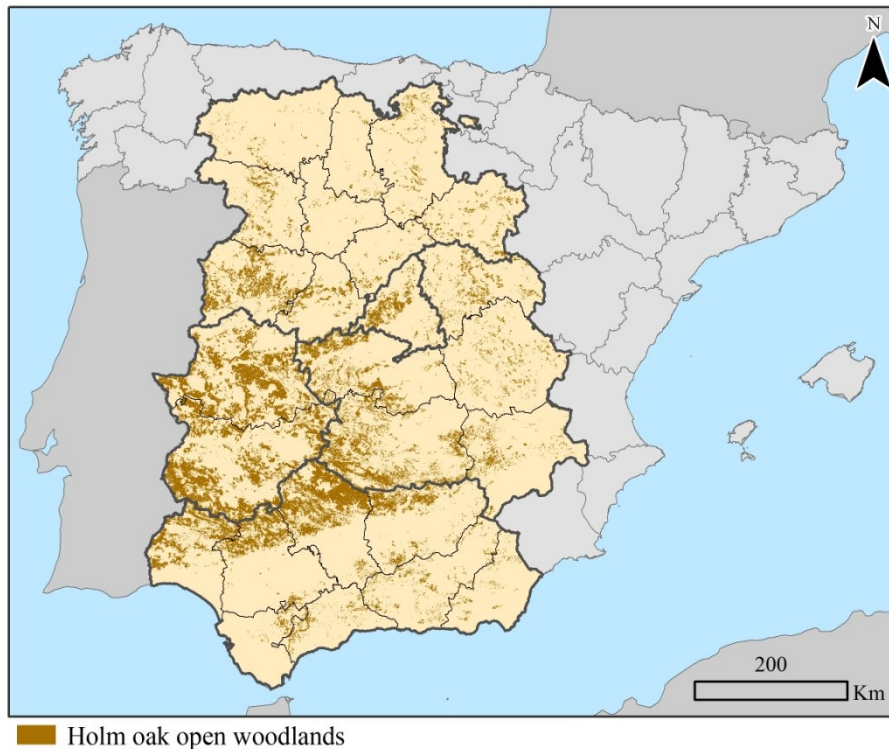
Source: Eloy Almazán based on the [24].

Figure ST1. Open woodlands in tiles with a predominance of holm oak species in West and Central Spain

S1.2. Holm-oak open woodland institutional settings

The regulations for protected areas[2] affect 27.5% of the HOW area in Andalusia, while 38.2% of forest falls under protected areas and this figure rises to 46.2% in the case of timber yielding conifer forest (Figure ST2). The predominant location of forests in areas at the head of the watersheds has favoured greater government regulation in order to provide greater protection as part of the implementation of ongoing policies for historical repopulation aimed at mitigating damage to the environment and to infrastructures caused by occasional intense precipitation episodes downstream. The private owners, in the main part non-industrial, manage 92% of the total area of tiles with a predominance of HOW in the five regions, a share which is similar to that of the private HOW in Andalusia (Figure ST3).

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[2] Areas not included in the types of protected spaces of HOW in the regions: Community Importance Zone ZIC (ZEPA/ZEC), Regional Interest Zone and Zone belonging to the European Ecological Network Natura 2000.
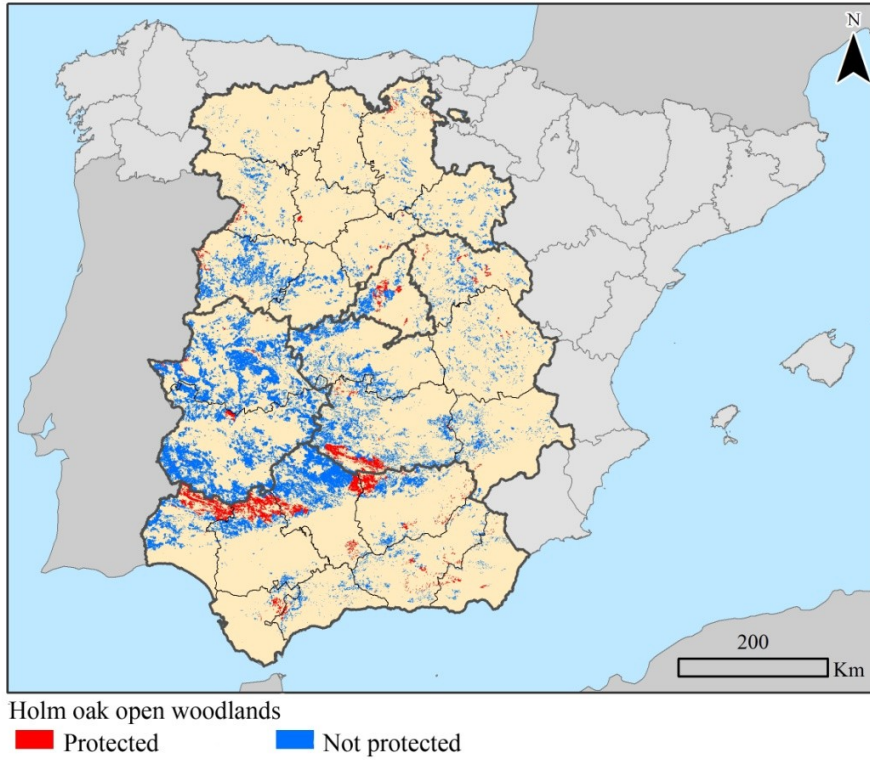
Figure ST2. Protected and non-protected open woodlands in tiles with a predominance of holm oak species in West and Central Spain.
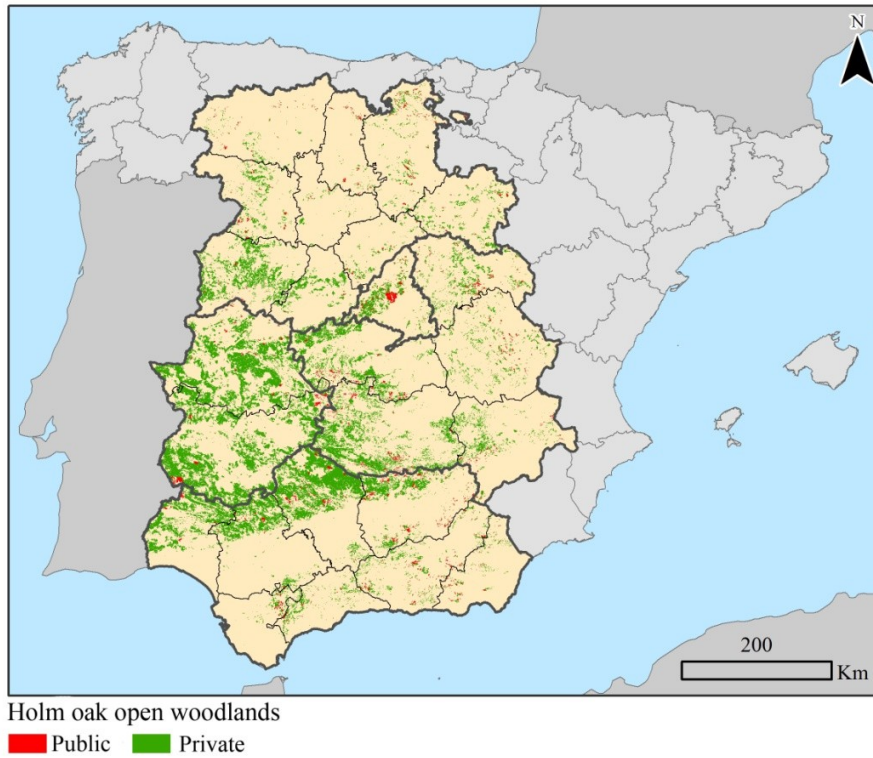
Figure ST3. Private and publicly owned open woodlands in tiles with a predominance of holm oak species in West and Central Spain.

In the past, government reforestation and induced natural regeneration in the HOW were concentrated on public properties and mainly involved plantation of timber-yielding conifers. These protective reforestations carried out in the past by the government justified the exclusion from sale in public auction of public forests at the heads of the watersheds during the process of disentitlement of the land belonging to public properties and the church between the second third of the 19th century and the first third of the 20th century. This government policy of mitigating soil erosion in the steepest mountain areas explains the fact that the public owners maintain the ownership in 52% and 57% of the forested areas in the five regions and in Andalusia as a whole, respectively.

HOW areas are mainly concentrated on large private farms where they generally share much of the total area (although the share varies considerably) and where other uses within these properties include scrubland, pasture and agriculture. On these farms, the traditional silvicultural practice of creating open woodland is orientated towards the livestock and game species activities. This type of farm with typically open HOW is known as a *dehesa* in Spain and *montado* in Portugal.

In the case of owners of *dehesas* of more than 200 ha, the average size of the *dehesas* is 502 ha, which account for 62% of the area of open woodland and 64% of the total *dehesa* area of 3,606,154 ha in the five regions of the West and South-West of Spain most of the *dehesas* are found (Table ST2). In Andalusia, the characteristics of the *dehesas* larger than 200 ha are similar to those in the five regions, with the average area of the *dehesas* being 460 ha, open woodlands making up 63% of the total area of the all farms and 68% of the total area of the *dehesas* (Table ST2).

The extensive livestock husbandry in the *dehesas* comprises a wide range of autocthonous species (part of the livestock registered in geneological registers regulated by the government) in the main producing offspring crossed with foreign breeds which are sold once weaned for fattening up in stables, usually outside the farms themselves. More than two thirds of the livestock population is bovine or ovine in similar proportions, followed by goats and pigs of the Iberian breed and crosses with duroc-jersey. Grazing by large game species and migrating birds is of importance in areas where these species settle.

Table ST2. *Dehesas* area extend and open woodland vegetation cover in five autonoous rgions in West and South-West of Spain by size classification.

Farms size (hectares)	Number of farms		Surfaces			
			Open woodlands		Farms	
	Nº	%	ha	%	ha	%
Andalucía	4,408	100	462,240	100	743,775	100
E* ≤ 200	3,309	75	171,369	37	238,670	32
E > 200	1,099	25	290,871	63	505,105	68
Castilla-La Mancha	27,881	100	486,916	100	1,048,713	100
E ≤ 200	26,765	96	158,621	33	326,187	31
E > 200	1,116	4	328,295	67	722,526	69
Castilla y León	41,819	100	392,317	100	687,408	100
E ≤ 200	40,913	98	175,535	44	317,195	46
E > 200	906	2	216,782	56	370,213	54
Extremadura	37,692	100	828,460	100	1,065,189	100
E ≤ 200	36,318	97	314,079	38	400,833	37
E > 200	1,374	3	514,381	62	664,356	63
Madrid	587	100	33,069	100	61,069	100
E ≤ 200	507	86	15,309	46	27,351	45
E > 200	80	14	17,760	54	33,718	55
Spain	112,387	100	2,203,002	100	3,606,154	100
S ≤ 200	107,812	96	834,913	38	1,310,236	36
E ≤ 10	87,395	78	102,611	5	152,867	4
10 < E ≤ 50	12,015	11	183,203	8	287,939	8
50 < E ≤ 100	4,612	4	209,429	10	330,672	9
100 < E ≤150	2,322	2	177,758	8	285,042	8
150 < E ≤ 200	1,468	1	161,912	7	253,716	7
E > 200	4,575	4	1,368,089	62	2,295,918	64
200 < E ≤ 300	1,698	2	265,382	12	416,935	12
300 < E ≤ 500	1,521	1	373,223	17	582,026	16
500 < E ≤ 1000	979	1	394,791	18	658,528	18
E > 1000	377	0	334,693	15	638,429	18

Source: own elaboration after [42].

S1.3. Background to the decline of holm oak open woodlands

The scarce data available based on real measurements of the ages of dead holm oaks in the HOW of Andalusia and Extremadura reveal that there are very few individuals more than 250 years old [43]. If it were possible to generalize these data, the conclusion drawn would be that the current HOW are relatively recent. The hypothesis which seems the most plausible is that almost all the HOW that existed prior to the 19th century have disappeared due to natural death and commercial felling. Hence, without regeneration of the trees destroyed there was a gradual change in land use in areas of HOW which were replaced by permanent natural pasture and agricultural crops.

However, this biological-cultural process of creation and destruction of the HOW up to the end of the Modern age was in part countered from the 19th century onwards by the growth of the local population and immigration to Extremadura and western Andalusia from Castile and Leon, giving rise to the clearance of scrubland and

thinning of the dense "virgin" woodland, transforming the landscape into holm oak open woodland, resulting in much of the HOW in West and South-West Spain which exist today [44, 45]. Once livestock grazing commences following the thinning and establishment of pre-existing natural regeneration, the absence of the usual regeneration cycles accompanied by fencing off of grazing and/or protection of individual seedlings leads to the existing trees reaching maturity, then declining and eventually the natural death of the holm oaks.

The apparent paradox is that the secular trend towards decline and depletion of the trees has not led to the disappearance of the HOW in the area of the five regions in West and South-West Spain where HOW predominate. Silviculture in holm oak open woodlands has traditionally consisted of thinning the trees which come from natural regeneration along with recurrent pruning in rotation periods which vary considerably, in the past depending on firewood prices whereas today such treatments are carried out more for health reasons to mitigate loss of large branches from over-mature trees, formed through "olivado" (pruning as it donen in olive tree) type pruning treatments carried out in the past to encourage acorn production and to allow sunlight to penetrate below the crowns of the trees [46]. This past silviculture of HOW creation-destruction based on clearance of the natural regeneration by the private owners in Spain has been complemented for the first time by government intervention through compensation for ceasing of grazing over a 20 year period and financing of reforestation using European Union funds through the program for voluntary setting aside of agricultural land. In the HOW area of the five regions, 197,600 ha were reforested with holm oaks over the period 1993-2000 [47]. A new phenomenon in recent decades has been the expansion of large game species (mainly deer and wild boar) in the HOW, especially in upland areas and mixed woodland, where livestock grazing has either ceased or is decreasing in intensity.

The long term tendencies outlined above, the government policies of HOW landscape protection and reforestation, explain the complex phenomenon of the falling numbers of adult trees in the HOW of West and South-West Spain. The concern for the decline in holm oaks is shared by owners, scientists, government and other interested parties and has been confirmed by case studies in scientific publications [41, 46, 48-50] and in the information available from the public administrations [10, 42, 51].

In the Third National Forest Inventory research plots in the five communities where *dehesas* predominate, null or scarce natural regeneration in the HOW ranges from 46% – 75% (Table ST3). These data are explained in general by uninterrupted livestock grazing, consuming the new natural generation of trees during periods of seasonal drought, since continuous grazing is only compatible with the protection of individual trees against grazing of leaves and twigs by controlled animals. Plantation and natural regeneration by plots of woodland requires temporary and/or seasonal

exclusion measures to be put in place against grazing in the regeneration area so that, based on the biological life cycle of the holm oak (generally more than 200 years), rotational regeneration plots can be programmed in the HOW of the *dehesas* [43, 48].

Table ST3. Plot regeneration density classes for plant development categories in open holm oak woodland in West and South-West Spain (%).

Class	Null	Scarse	Normal	Abundant	Total
Andalucía					
Quercus pyrenaica	*99.92*	*0.00*	*0.04*	*0.04*	*100*
Quercus faginea	*98.06*	*0.41*	*0.62*	*0.91*	*100*
Quercus ilex	*68.97*	*5.90*	*5.31*	*19.82*	*100*
Quercus suber	*93.16*	*2.28*	*1.56*	*3.00*	*100*
Quercus canariensis	*99.29*	*0.38*	*0.08*	*0.25*	*100*
Olea europaea	*89.81*	*3.56*	*2.25*	*4.38*	*100*
Todas	63.47	8.69	6.96	20.88	100
Castilla-La Mancha					
Quercus pyrenaica	*97.86*	*0.55*	*0.50*	*1.09*	*100*
Quercus faginea	*91.12*	*2.94*	*3.25*	*2.69*	*100*
Quercus ilex	*51.04*	*11.54*	*14.49*	*22.93*	*100*
Quercus suber	*98.67*	*0.55*	*0.55*	*0.23*	*100*
Fraxinus angustifolia	*99.56*	*0.19*	*0.19*	*0.06*	*100*
Todas	46.75	13.33	16.17	23.75	100
Castilla y León					
Quercus pyrenaica	*87.22*	*2.71*	*3.58*	*6.49*	*100*
Quercus faginea	*95.62*	*1.91*	*1.01*	*1.46*	*100*
Quercus ilex	*50.84*	*11.92*	*15.89*	*21.35*	*100*
Quercus suber	*99.35*	*0.27*	*0.38*	*0.00*	*100*
Fraxinus angustifolia	*98.97*	*0.66*	*0.23*	*0.14*	*100*
Todas	40.59	15.05	18.57	25.79	100
Extremadura					
Quercus pyrenaica	*97.78*	*0.73*	*0.60*	*0.89*	*100*
Quercus faginea	*99.73*	*0.09*	*0.09*	*0.09*	*100*
Quercus ilex	*52.67*	*15.85*	*13.87*	*17.61*	*100*
Quercus suber	*93.28*	*3.39*	*2.24*	*1.09*	*100*
Fraxinus angustifolia	*99.95*	*0.04*	*0.00*	*0.01*	*100*
Todas	48.28	18.16	15.28	18.28	100
Madrid					
Quercus pyrenaica	*92.32*	*1.70*	*2.07*	*3.91*	*100*
Quercus faginea	*98.83*	*0.51*	*0.51*	*0.15*	*100*
Quercus ilex	*30.97*	*15.31*	*18.71*	*35.01*	*100*
Fraxinus angustifolia	*93.92*	*2.81*	*2.18*	*1.09*	*100*
Todas	22.15	24.07	22.50	31.28	100

Null: There are no trees of category 1, 2 or 3 in the plot. Scarce. From 1 to 4 trees in the plot, extrapolating this data gives 1 – 575 seedlings/ha. Normal. From 5 to 15 trees in the plot, in other words 576 – 1,910 seedlings/ha. Abundant. More than 15 trees in the plot, that is, > = 1,911 seedlings/ha.
Source: [42].

S2. Economic activities reconsidered

The conceptualizations of the individual economic activities have been dealt with in [17], hence only a brief description is given in this study in order to facilitate the understanding of the text.

The production functions of the individual activities of the Andalusian HOW contain manufactured factors (except for water) and inputs at zero cost for the hours employed by free-access consumers of recreational services and mushroom picking. We have not registered self-employed labor cost in the HOW activities valued. This avoids the presence of mixed income.

S2.1. Conservation forestry

The owners do not normally undertake the conservation of HOW aimed at commercial acorn and wood production along with other products from associated tree such as industrial timber, cork and fruit (pine nuts and chestnuts). We assume that these products incur no silvicultural costs, the only costs considered being those related to the extraction of the products. We conceptualize that in the Andalusian HOW conservation forestry undertaken by private owners is mainly motivated by auto-consumption of amenities and in the case of public owners by landscape conservation.

Conservation forestry activity refers to interventions involving natural regeneration and planting of trees in the period in which they are recorded as own-account manufactured gross capital formation (GCFm). GCFm also includes road and other infrastructures in the ordinary management of the Woodland.

Past GCFm pending amortization generate a consumption of historic manufactured fixed capital at replacement cost (CFCmh) and the ordinary management for the period a manufactured total cost (TCmog), which together make up the ordinary manufactured total cost (TCmo) of the conservation forestry activity.

The products of the conservation forestry activity are the GCFm valued according to their production cost in the period and the intermediate production of amenity commercial services (ISSca) valued according to the TCmo.

Due to lack of available data the government compensations affecting the historical GCFm of the conservation forestry activity have not been considered. This omission is important as substantial reforestation has taken place in the recent past which was not included in the NFI3 [47]. As regards the way in which compensations in this activity are dealt with in the accounts, they are annualized in the cycle of their amortization at replacement cost as CFCmh. This CFCmh gives rise to a compensated

commercial intermediate service (ISScc) (see details in [43]). In this study, the ISSc of the private HOW are auto-consumed (ISSca) and incorporated into own commercial intermediate consumption of services (SScoa) of the private amenity activity, and those of the public HOW are donated (ISScd) and registered as SScod of the landscape activity.

S2.2. Grazing

The grazing activity in the HOW includes consumption by livestock and game species. Livestock grazing is valued according to the market price of the leaseholds and game species grazing is estimated by the environmental price (unitary resource rent) according to the captures in the period. The stage at which the possible environmental price of a product is estimated is that of the first possible transaction in the local market of the intermediate product and/or the final product consumed (ordinary).

Holm oak open woodlands are cultural landscapes modelled by animals and pruning aimed at favouring the production of acorns. The animals generally graze the whole area at intensities which do not favour the accumulation of palatable bushy forage, although there are plenty of bushes and scrub that are not consumed.

Over recent decades in areas with steep slopes, which tend to be the places with the lowest production of forage species, livestock grazing is being partially replaced by that of large game species. The evolution of game captures and livestock consumptions indicate that grazing by livestock and game species in the holm oak open woodlands of Andalusia is not decreasing.[3]. Our estimates of acorn production consumed by livestock and wild fauna (including game species) suggest that the game species are adding economic value to grazing (including acorns) in increasing proportions, thus mitigating the persistent tendency towards reduction in the market value of the grazing consumed by livestock [26, 52].

S2.3. Private Amenity

The ordinary final production of the private amenity is implicitly commercial as it is embedded in the market price of the land. Amenity is explicitly accepted in Spanish land law [53, 54], which includes it in the estimation of land prices by the

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[3] In the discussion section we address the consequences of this diagnosis in the design of the silvopastoral public policy of compensations from the European Union for the conservation of *dehesa* landscapes.

government when purchasing/expropriating rural land. In other words, the amenity is conceptually a SNA activity which, by convention is valued at production cost in the SNA. In contrast, it is valued in the AAS according to the owner's willingness to pay [31, 55]. Amenities cannot receive remuneration for the manufactured capital employed in the period as the latter is made up exclusively of own ordinary intermediate consumption of services (SSoo). The ISSca and ISSnca of the HOW activities which produce them (and which are omitted here), namely hunting and livestock husbandry, are those which receive the remunerations from the manufactured investment.

S2.4. Fire services

In the HOW of Andalusia, prevention and extinction of forest fires are normally assigned to the owners and government respectively. Among the ordinary costs of the forestry conservation activity is that of fire prevention, meeting government regulations. Once a fire has been observed and detected by the government fire fighting services, the actions required to extinguish the fire are registered in the government fires services activity. This activity is paid for entirely through public spending and this produces both commercial intermediate services (ISSc) and own account manufactured gross fixed capital formation (GCFm) [56]. The ISSc are registered as the balancing entry of the SSco in the public activities which used them, which in the case is mainly the landscape activity. The valuation criteria for the ISSc are the same as those for the conservation forestry activity.

S2.5. Mushrooms

The mushrooms gathered in the HOW are in fact public economic products as the owners do not exercise access exclusion rights in relation to gathering. In this situation the market price of the land does not embrace hunting related resource rent, which *is* appropriated by free-access pickers. Mushroom picking is undertaken by recreational visitors with free access and by definition the opportunity cost of the leisure time spent gathering is zero and the access costs at the farm gate for pickers are considered not to be incorporated in the market price of the product gathered. However, the government does incur costs related to the regulation and vigilance of appropriate harvesting practices.

The final product consumed for mushrooms is obtained according to the amounts harvested by the trading price (weighted by the product quality) declared in telephone surveys to public mushroom pickers resident in Andalusia [57].

The condition of mushrooms being a joint product along with recreational service enjoyment is avoided by not incorporating it into the mushroom activity and assuming that the latter is incorporated in the total estimate of visitor willingness to pay for recreational use of the HOW.

S2.6. Public recreation

It is difficult for owners to prevent access to their farms by visitors off the public rights of way for a variety of reasons, such as the huge size of the HOW in Andalusia, the large network of old paths, tracks and bridleways, many of which are all but impassable today, and the policy of many public owners as well as the government to encourage free-access recreational use of the HOW. However, perhaps the majority of the large owners fence their farms and thus manage to exclude visitor access, above all in farms where there are large game species and breeding of fighting bulls.

The government of Andalusia has established an information service for free-access visitors providing them with audio-visual information and services in centres distributed throughout the region. The government also schedules free visits to public farms through agreements with the local councils and the regional administration, including the provision of guide services in protected natural areas.

In this context, a market has been simulated whereby the final product consumed (FPc) of recreational visits is estimated through visitor willingness to pay in order to continue making visits beyond the usual public rights of way, receiving the same services from the public administration as opposed to the alternative of paying an entrance fee which does not allow them entry in the future [27]. Own- account gross formation of manufactured fixed capital (GFCFm) is estimated in accordance with the production cost.

The ordinary manufactured total cost (TCmo) includes the direct management costs for the period and the historic manufactured fixed capital consumption (CFCmh) at replacement cost for the manufactured fixed capital investments applied to the provision of services for public visitors. The TCmo also includes the SSco used by the recreational activity and which stem from the ISSc of the fire services activity.

S2.7. Water supply

In Spain, by government decision, the market price of economic water used by economic activities as input for production and by households as final product is not included in the ecosystem service. In Andalusia little water is retained in reservoirs and for this reason the price of water derived from a market unrestricted by the government would be higher than that for regulated water, so the resource rent is embedded in the products of the economic activities and in the consumer surplus of households due to paying a lower price than that which would be paid under a monopoly water supply situation such as the current one or a competitive one.

In the case of retained water which has fallen within the area of the HOW of Andalusia, the economic use of which is crop irrigation, its ecosystem service (ES) revealed indirectly in the land prices and in fact this could also be the case in the first transaction of corporations which supply the water to the industry and service sectors and to households. Although this would not by right be the case due to water regulation laws not allowing the ecosystem service of natural retained water to be charged in the first transaction.

Since the regulated prices of water exclude the resource rent we have to employ alternative valuation methods to the market prices of water. In Andalusia, since the demand for irrigation has been shown to be the main use of economic water, we resort to the hedonic price method in order to estimate the value of retained water as an environmental asset used in the irrigation of land in the Guadalquivir river basin [17, 58-60]. We assume a rate of return of 3% from the environmental asset estimated for its use in irrigation and having determined the annual water consumption entitlement through the administrative concession we estimate the unitary resource rent of the water resource used on irrigated land [17, 58].

85% of the regulated economic water is destined for a normal water consumption use in irrigation for agricultural production and the remaining 15% for economic uses and households. We assume that the marginal productivity of the water used for irrigation is lower than that for the rest of the uses. That being the case, if we take the environmental price estimated according to the unitary resource rent of the irrigation water as the mean environmental price of the total water consumed, this establishes it at the lower limit of the environmental price of the water.

The supply of surface water to the reservoirs has no cost until it reaches the natural course of the rivers, which is where the resource rent is estimated in this HOW study. The resource rent of the forest surface water is its positive residual value obtained after subtracting the ordinary operating costs (intermediate consumption and labor), the fixed capital consumption and the normal remuneration of immobilized manufactured capital from the inputs of the supply company at producer prices. In other words, the resource rent of the water is its economic value as a natural raw material prior to the Company incurring any costs for storage, treatment and transport to the site where it is consumed. The concessionary companies and the public water agencies do not transfer the resource rent of the water revealed by the market for products from irrigated farms to the end users. In other words, it is the owner of the irrigated land who appropriates the resource rent for forest water.

S2.8. Landscape conservation

The HOW public landscape activity service is a passive option value incorporated in the marginal willingness to pay declared by consumers to assure the quality and quantity of the offer of current ordinary public assets not threatened with disappearance for at least the next 30 years. Thus, the HOW landscape conservation service excludes the private amenity services used exclusively by the owner as well as the public recreation and threatened wild biodiversity services. In other words, the option value of the landscape represents the simulated payment declared in the experimental choice survey which individuals are willing to incur to assure future use of forest ecosystem economic goods and services for themselves or third parties under the same conditions in which they currently enjoy them [17].

S2.9. Threatened wild biodiversity preservation

In the valuation of the existence of threatened wild biodiversity in the HOW, the same choice of price is assumed for all the threatened species. This criterion is justified by the nature of the service valued. This passive option service of biodiversity consists of assuring the mitigation of extinction risks for an industrially non-reproducible genetic variety, the future asset service of which is unknown. In this situation, there is no public preference for one unique genetic variety over another, not having another equivalent asset service through which a price they are equal to can be determined. Hence, all the unique genetic varieties are equivalent in the period in which they are valued as their

future utility to human consumers is unknown, thus the choice of the same price for all is justified. Thus, we assume in this study of the HOW that the passive consumer of the existence of threatened wild biodiversity service has the same willingness to pay for any unique genetic variety (species) threatened with extinction. Threatened biological variety can also provide other values consumed by people (apart from the biodiversity existence value) which are included in its total economic value, such as free-access recreation services and the landscape conservation service [17].

S2.10. Carbon

Forest carbon possesses characteristics of economic activity given the fact that it offers physical flows of fixation (production) and emission (consumption) as well as liability as it leads to possible loans/debts if physical standards have previously been contractually regulated which must be met by the end of the established term. As the owners have no contractual agreement entailing a financial loan/debt, we have assumed the character of the economic activity of carbon. The practical consequence of this option is the possible generation of a negative carbon environmental asset, which is inconsistent with the economic definition of environmental asset. It is assumed that the government makes implicitly transactions for flows of fixation and emission of carbon among its forest and atmospheric environmental assets.

S3. Accounting methods applied to holm oak open woodlands in Andalusia

S3.1. Refined System of National Accounts

Social accounting (national) registers the values of the transactions for products generated in a period, some of which are revealed by the formal markets and others, implied, which are simulated with the theoretical aim of estimating the total income of the territory, usually at national/regional scale. In practice, the national accounting does not reach its ultimate purpose and is limited to non-geo-referenced measurement of a list of private commercial final products and government spending on free consumption public goods and service production. The products are grouped into activity sectors and institutional sectors.

The activities of mixed holm oak open woodlands (HOW) are divided into, on the one hand, the silviculture (Economic Account for Forestry-EAF) and service sectors, and on the other hand, the institutional sectors of corporations (farmers) and

government. In other words, the total product and cost of the HOW remain invisible in national accounting and as a consequence, the absence of geo-referenced data per ecosystem type makes the measurement of gross/net value added of the HOW impossible.

The net value added (NVA) estimated by the Standard National Accounts (SNA) is a net operating income which hides the revaluation of stockbreeding capital incorporated in the gross formation of capital and which originates from the net variation in the livestock inventory. It also hides the revaluation of manufactured fixed capital embedded in the consumption of fixed capital estimated at replacement cost. Furthermore, the SNA ignores possible net operating surpluses (NOS) and revaluations of capital coming from public products with no market price.

All accounting systems are obliged to fulfil the principle of double entry, but their structure is subsidiary to the ultimate objective pursued. In our case the objective is to measure the concept of environmental income of the HOW in a coherent way, integrating it into the total income at social price and assuming that in the future the expected management of resources will be sustainable from both ecological and economic perspectives.

In [17] we have developed the conceptualizations and measurements of the total incomes derived from the Agroforestry Accounting System (AAS) and the refined System of National Accounts (rSNA) at producer price for the Andalusian forests, woodlands, shrublands and grasslands as a whole. The new aspect presented in this study is the valuation of the Andalusian holm oak open woodland (HOW) ecosystem at social price. In the following sub-sections we briefly describe the different accounting identities of the total income at social price. The identity of most interest for this article is that which shows the factorial distribution of the total income, which makes visible the link between the total income and the environmental income of the Andalusian how (see development of accounting identities in [17, 20, 30, 55].

The organization of the accounts and indicators in the refined System of National Accounts (rSNA) is the same as that of the AAS. The refinement of the SNA (henceforth S) consists of adding the natural growth (NG_{rSNA}) for the period to the gross capital formation (GCF_{rSNA}) and subtracting the environmental work in progress used ($WPeu_{rSNA}$) from the gross operating surplus (GOS_S) and incorporating it into the intermediate consumption of the rSNA in order to estimate the gross operating margin (GOM_{rSNA}). These changes resolve the problem of timing of the gross value added

(GVA$_S$) in the SNA by estimating it in the period in which it is consumed and not in which it is produced, as in the rSNA measurement of the gross value added (GVA$_{rSNA}$):

$$GVA_{rSNA} = GVA_S + NG_{rSNA} - WPeu_{rSNA} \qquad \text{(SM eq. 3.1)}$$
$$GOM_{rSNA} = GOS_S + NG_{rSNA} - WPeu_{rSNA} \qquad \text{(SM eq. 3.2)}$$

Other modifications introduced in the rSNA are due to the incorporation of the intermediate production (IP$_{rSNA}$) and own ordinary intermediate consumption (ICoo$_{rSNA}$) as well as the reclassification of compensations which are taken from the final product consumed in the SNA (FPc$_S$) and incorporated into the IP$_{rSNA}$ as non-commercial intermediate product of compensation service (ISSncc). These modifications affect the results of the individual activities and as they are double entered they cancel each other out in the aggregate gross value added result of the standard (S) and refined (rSNA) methods of the SNA:

$$GVA_{bp,HOW,S} = FPc_{bp,S} + GCF_S - IC_S \qquad \text{(SM eq. 3.3)}$$
$$GVA_{bp,HOW,rSNA} = IP_{rSNA} + FPc_{bp,rSNA} + GCF_{rSNA} - IC_{rSNA} \qquad \text{(SM eq. 3.4)}$$
$$IP_{rSNA} = IPc_{rSNA} + ISSncc_{rSNA} \qquad \text{(SM eq. 3.5)}$$
$$FPc_{bp,rSNA} = FPc_{bp,S} - ISSncc_{rSNA} \qquad \text{(SM eq. 3.6)}$$
$$TPc_{rSNA} = IP_{rSNA} + FPc_{bp,rSNA} \qquad \text{(SM eq. 3.7)}$$
$$GCF_{rSNA} = GCF_S + NG_{rSNA} \qquad \text{(SM eq. 3.8)}$$
$$IC_{rSNA} = IC_S + WPeu_{rSNA} + ICoo_{rSNA} \qquad \text{(SM eq. 3.9)}$$
$$ICoo_{rSNA} = ICcoo_{rSNA} + ICncooc_{rSNA} \qquad \text{(SM eq.3.10)}$$
$$GVA_{bp,HOW,rSNA} = TPc_{rSNA} + GCF_{rSNA} - IC_{rSNA} \qquad \text{(SM eq.3.11)}$$

where subscript bp is basic price, subscript S is standard SNA, subscript rSNA is refined SNA, ICcoo$_{rSNA}$ is own ordinary commercial intermediate consumption of rSNA, ICncooc$_{rSNA}$ is own ordinary non-commercial intermediate consumption compensation of rSNA and TPc$_{rSNA}$ is total product consumption of rSNA.

S3.2. Agroforestry Accounting System

The development and application of the AAS methodology in previous publications by the authors facilitate the simplified description in the present document

of the accounting identities of total income and environmental income of the HOW as a whole.

The structure of the production and balance accounts in the Agroforestry Accounting System fulfils the purposes of estimating the total income (TI) of the economic activities of the owners and government as well as their factorial distribution. We assume the absence of financial liabilities and credits from/to third parties, so that the change in net worth (CNW) is due exclusively to the real flows derived from the production and balance accounts. Our interest is to make the flows and stocks of the land (hence forth environmental) visible in the total product function and factorial distribution of the total income.

S3.2.1. Net value added

In [17] (p. 221) the total product (TP) function (f) explicitly incorporates the environmental intermediate consumption of work in progress used (WPeu) and the environmental fixed assets (EFA) as production factors:

$$TP \equiv f(WPeu, ICm, LC, EFA, FCm) \qquad \text{(SM eq.3.12)}$$

where ICm is manufactured intermediate consumption, LC is labor costs, and FCm is manufactured fixed capital.

Total product (TP) components are: on the one hand, (i) total cost (TC) of manufactured intermediate consumption (ICm) both bought (ICb) and own (ICo) and work in progress used (WPmu), intermediate consumption of environmental work in progress used (WPeu), labor cost (LC) and consumption of fixed capital (CFC) and, on the other hand, (ii) net operating margin (NOM) of ordinary manufactured net operating margin (NOMmo), ordinary environmental net operating margin (NOMeo) and environmental net operating margin investment (NOMei):

$$TP = ICb + ICo + WPmu + WPeu + LC + CFC + NOMmo + NOMeo + NOMei$$
$$\text{(SM eq.3.13)}$$

$$TP = TC + NOM \qquad \text{(SM eq.3.14)}$$

$$TC = ICm + WPeu + LC + CFC \qquad \text{(SM eq.3.15)}$$

$$ICm = ICb + ICo + WPmu \qquad \text{(SM eq.3.16)}$$

$$NOM = NOMmo + NOMeo + NOMei \qquad \text{(SM eq.3.17)}$$

NOMe = NOMeo + NOMei $\qquad$ (SM eq.3.18)

The net value added (NVA) is the indicator which represents the operating income of the HOW economic activities valued. The operating remunerations for production factors embedded in the total product (TP) are the LC and the NOM. The latter remunerates the manufactured investments (NOMmo) and the environmental assets (NOMe):

NVA = TP – ICm – WPeu – CFC $\qquad$ (SM eq.3.19)
NVA = LC + NOM $\qquad$ (SM eq.3.20)
NVA = LC + NOMmo + NOMe $\qquad$ (SM eq.3.21)

Among the components of the total product are the WPeu and NOMeo, and the NOMei accumulated in the environmental asset at the closing of the period comprising natural growth (NG) net consumption of environmental fixed asset (CFCe). The first two correspond to the contribution of the ecosystem services (ES) to the total product (TP) and the third is one of the components of the changes in environmental net worth (CNWe):

ES = WPeu + NOMeo $\qquad$ (SM eq.3.22)
NOMei = NG – CFCe $\qquad$ (SM eq.3.23)

S3.2.2. Capital gain

The concept of capital gain (CG) is one of the most controversial in the definition of total income. In this application of the AAS to the HOW we focus on describing the criteria applied to measure it (for greater detail see [17, 43]). We have not forecast variations in the future prices of the manufactured capital and environmental assets, the capital revaluations corresponding to changes in prices at the closing not forecast at the opening of the period. The CG is obtained from the capital revaluation (Cr) less extraordinary capital destruction (Cd) plus instrumental adjustment of capital (Cadj) which avoids double counting of depreciation and natural growth (see details in [17; Supplementary material, p. 45] and [43]). We divide the GC into manufactured (CGm) and environmental asset gain (EAg).

$$CG = Cr - Cd + Cadj \qquad \text{(SM eq.3.24)}$$

$$Cr = Cc - Co + Cw - Ce \qquad \text{(SM eq.3.25)}$$

$$CG = CGm + EAg \qquad \text{(SM eq.3.26)}$$

where Cc is closing capital, Co is opening capital, Cw is capital withdrawals and Ce is capital entries.

S3.2.3. Total income

The original accounting identity of the total income (TI) is that revealed by its links with the operating income (NVA) and the capital gain (GC). The net value added (NVA) is the balancing item of the production account and the CG is the balancing item of the balance account.

$$TI = NVA + CG \qquad \text{(SM eq.3.27)}$$

$$NVA = TP - IC - CFC \qquad \text{(SM eq.3.28)}$$

$$TP = IP + FP \qquad \text{(SM eq.3.29)}$$

$$FP = FPc + GCF \qquad \text{(SM eq.3.30)}$$

where TP is total product, IC intermediate consumption, CFC is consumption of fixed capital, IP intermediate product, FP is final product, FPc is final product consumption, GCF is gross capital formation, Cc is closing capital, Co is opening capital, Cw is capital withdrawals and Ce is capital entries.

Through the rearrangement of SM eq.3.27 (TI = NVA + CG), TI is shown through a new instrumental identity to be total product consumption (TPc) less intermediate consumption (IC) plus change in net worth (CNW). We assume that there are no HOW liabilities and in this case the CNW is the net present value of the changes in the COW total capital for the period, with adjusted capital gain. The estimation of the CNW depends on the investments (GCF), the fixed capital consumptions (CFC) and the capital gain (CG) for the period:

$$TI = TPc - IC + CNW \qquad \text{(SM eq.3.31)}$$

$$CNW = GCF - CFC + CG \qquad \text{(SM eq.3.32)}$$

$$GCF = GCFm + NG \qquad \text{(SM eq.3.33)}$$

$$CFC = CFCm + CFCe \qquad \text{(SM eq.3.34)}$$

where GCFmj is own account manufactured gross capital formation, NG is natural growth, CFCm is manufactured consumption of fixed capital and CFCe is environmental consumption of fixed capital.

The TI identity forming the basis for the development of all other aspects of environmental income is the TI factorial distribution, the environmental income (EI) displaying consistent integration with labor cost (LC) and manufactured capital income (CIm) in the HOW application:

$$TI = LC + CIm + EI \qquad\qquad (SM\ eq.3.35)$$

S3.2.4. Environmental income

The production and balance accounts of the AAS allow the fundamental identify of the environmental income to be estimated as the sum of the environmental net operating margin (NOMe) and the environmental asset gain (EAg) [17, 43]. The EAg is estimated by the environmental asset revaluation (EAr) less the environmental asset adjustment (EAad) according to natural growth and carbon fixation valued at the opening of the period. The change in environmental net worth (CNWe) is estimated as the environmental net operating margin investment (NOMei) plus the environmental asset gain (EAg):

$$EI = NOMe + EAg \qquad\qquad (SM\ eq.3.36)$$
$$EAg = EAr + EAad \qquad\qquad (SM\ eq.3.37)$$
$$EAr = EAc - EAo + EAw - EAe \qquad\qquad (SM\ eq.3.38)$$
$$CNWe = NOMei + EAg \qquad\qquad (SM\ eq.3.39)$$

If we rearrange SM eq.3.40 by adding and subtracting WPeu on the right side of the equation, we obtain the EI links with ecosystem services and the change in net worth adjusted (CNWead) according to WPeu:

$$EI = ES + CNWead \qquad\qquad (SM\ eq.3.40)$$

S4. Imputed own non-commercial intermediate consumption of services of holm oak open woodlands in Andalusia

In this study of holm oak open woodlands (HOW) the activities valued do not include non-commercial intermediate services (ISSnc), but they do include the ordinary own non-commercial intermediate consumption of services (SSncoo) of compensation (SSncooc), amenity (SSncooa) and donation (SSncood), which are mainly used by the amenity and landscape activities. These SSncoo stem from the ISSnc produced by the omitted HOW hunting and livestock activities.

As regards the imputation of the SSncoo in the holm oak open woodlands (HOW) of Andalusia, these should be imputed because the available information is at producer price whereas we wish to present it at basic and social prices. Only the SSncoo stemming from non-commercial intermediate services (ISSnc) of animal activities are imputed since, in the activities of the Andalusian HOW, they are estimated and integrated both in the commercial intermediate services (ISSc) which are produced in the conservation forestry, residential and fire service activities, and their balancing entry of own commercial intermediate consumption of services (SScoo).

The estimation of HOW SSncoo is carried out based on the information available from the private and public owners in the holm oak farm case studies under the RECAMAN project. The Spanish forest map provides the proportion of private and public area by tiles.

SSncoo are imputed in the landscape activity in the case of public hectares of the tiles of Andalusian HOW. These SSncoo stem from the compensated (ISSncc) and donated (ISSncd) non-commercial intermediate services of the hunting and livestock activities. A SSncooa is also incorporated in the amenity activity, arising from the family livestock breeders present in public holm oak *dehesas*.

SSncoo are imputed in the landscape and amenity activities in the case of the private hectares of Andalusian HOW. The former (SSncooc) arising from the compensated non-commercial intermediate services (ISSncc) and the latter (SSncooa) from the auto-consumed non-commercial intermediate services (ISSnca).

S4.1. Estimation of the SSncoo of the holm oak woodlands of Andalusia

Based on the data from the holm oak woodland farms, the SSncoo corresponding to the ISSnca (private and public owner), compensated (ISSncc) (private and public

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owner) and donated (ISSncd) (public owner) can be estimated. The three values for the ISSnc of the animal activities are assigned to the HOW tiles as their SSncoo corresponding to the landscape and amenity activities, adding them to the SScoo produced as commercial intermediate services (ISSc) by the conservation forestry, residential and fire service activities.

The imputed SSncoo values which are incorporated in the landscape activity also increase its production by the same amount as the allocation made, such that its production is equal to the ordinary total cost (CTo) plus the additional willingness to pay of the passive consumers (DAPa)[4].

S4.2. Data imputed to estimate the SSnc of the Andalusian holm oak open woodlands (HOW)

For the imputation of the SSnc, aggregate information is used from the sixteen private farms (with a total area of 9,032 hectares) and six public farms (with a total area of 13,499 hectares) in which holm oaks comprise the main vegetation. Table ST4 shows the private *dehesa* hunting and livestock activity non-commercial intermediate services (ISSnc) used as own non-commercial intermediate consumption of services (SSncoo), compensated (ISSncc) and auto-consumed (ISSnca) by the landscape and amenity activities. These SSncoo are imputed to the private areas of the Andalusian holm oak open woodlands (HOW) tiles in which holm oaks comprise the main vegetation.

Table ST4. Private *dehesas* ordinary own non-commercial intermediate consumption of services (SSncoo) used by amenity and landscape activities (2010: €/ha).

Class	Amenity	Landscape
Compensated (SSncooc)		33.9
Livestock		*33.9*
Auto-consumed (SSncooa)	135.3	
Hunting	*57.5*	
Livestock	*77.8*	
Total SSncooc/a	135.3	33.9

Private *dehesas*: 16 farms. Total surface: 9,032 hectares.

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[4] The consumers pay ordinary commercial costs of the landscape and threatened wild biodiversity activities through public spending.

Table ST5 is similar to table ST4 but the results indicated apply to the hectares of public HOW.

Table ST5. Public *dehesas* ordinary own non-commercial intermediate consumption of services (SSncoo) used by amenity and landscape activities (2010: €/ha).

Clase	Amenity	Landscape
Compensated (SSncooc)		1.5
Livestock		*1.5*
Donated (SSncood)		23.3
Hunting		*23.3*
Auto-consumed (SSncooa)	2.1	
Livestock	*2.1*	
Total SSncooc/d/a	2.1	24.8

Public *dehesas*: 6 farms. Total surface: 13,499 hectares.

It is estimated that of the total 1,408,170 hectares of HOW in Andalusia, 1,280,684 hectares are private and 127,565 are public. Table ST6 shows the values for the imputation of the SSncoo of the Andalusian HOW. The aggregate values in table ST7 show that 173,572,585 euros are imputed to the amenity activity and 46,633,854 euros to the landscape activity.

Figure ST4 shows the value of the imputations per hectare for the SSncoo of the amenity and landscape activities in the Andalusian HOW.

Table ST6. Values imputed for ordinary own non-commercial intermediate consumption of services (SSncoo) in the Andalusian HOW (2010: €).

Clase	Amenity	Landscpae
Private surface	173,305,347	43,473,263
Compensated (SSncooc)		43,473,263
Livestock		*43,473,263*
Auto-consumed (SSncooa)	173,305,347	
Hunting	*73,678,531*	
Livestock	*99,626,817*	
Public surface	267,237	3,160,591
Compensated (SSncooc)		194,409
Hunting		
Livestock		*194,409*
Donated (SSncood)		2,966,182
Hunting		*2,966,182*
Auto-consumed (SSncooa)	267,237	0
Livestock	*267,237*	
Total SSncoo	173,572,585	46,633,854
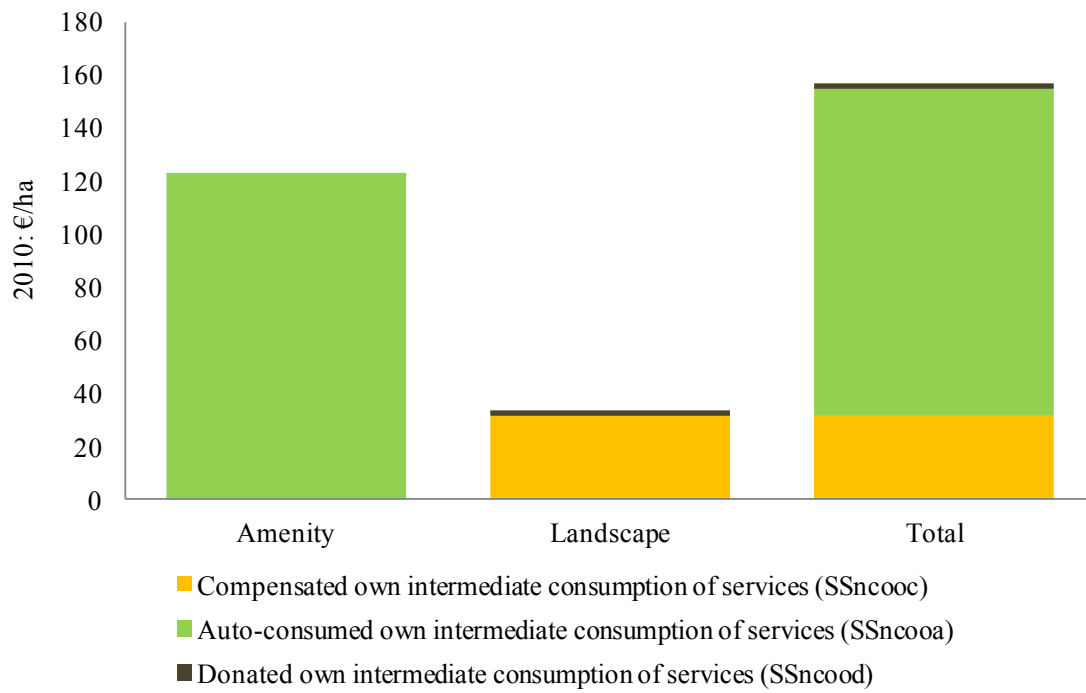
Figure ST4. Values imputed for own non-commercial intermediate consumption of services in the Andalusian HOW (2010: €/ha).

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Supplementary tables for

Incomes and ecosystem services comparisons of refined national and agroforestry accounting frameworks: application to holm oak open woodlands in Andalusia-Spain

Table S1. Tiles with predominant holm oak open woodlands in Andalusia

Class	Surfaces	
	Hectares	Percentage
Without secondary species	750,632	53.3
Quercus suber	225,271	16.0
Without tertiary species	179,301	12.7
With tertiary species	45,970	3.3
Quercus faginea	81,511	5.8
Without tertiary species	49,858	3.5
With tertiary species	31,652	2.2
Quercus cannariensis	743	0.1
Without tertiary species	547	0.0 [*]
With tertiary species	196	0.0 [*]
Olea europaea	113,378	8.1
Without tertiary species	89,504	6.4
With tertiary species	23,874	1.7
Pinus halepensis	37,176	2.6
Without tertiary species	23,731	1.7
With tertiary species	13,445	1.0
Pinus pinea	25,174	1.8
Without tertiary species	14,938	1.1
With tertiary species	10,236	0.7
Pinus pinaster	16,768	1.2
Without tertiary species	7,374	0.5
With tertiary species	9,394	0.7
Pinus nigra	16,298	1.2
Without tertiary species	11,206	0.8
With tertiary species	5,092	0.4
Pinus sylvestris	3,276	0.2
Without tertiary species	1,057	0.1
With tertiary species	2,219	0.2
Juniperus oxycedrus	32,880	2.3
Without tertiary species	23,228	1.6
With tertiary species	9,652	0.7
Arbutus unedo	26,051	1.8
Without tertiary species	15,367	1.1
With tertiary species	10,684	0.8
Castanea sativa	1,568	0.1
Without tertiary species	795	0.1
With tertiary species	772	0.1
Others	77,444	5.5
Total	1,408,170	100

[*] This value is lower than 0.05

Table S2. Tiles with predominant holm oak open woodlands sizes characteristic in Andalusia

Class	Surfaces		Statistics			
	Hectares	Percentage	Number of tiles	Minimum	Maximum	Average
Holm oak without other species	750,632	53.3	11,697	$0.0^{(*)}$	603.3	64.2
Holm oak with secondary species and without tertiary	460,892	32.7	7,381	$0.0^{(*)}$	730.3	62.5
Holm oak with secondary and tertiary species	196,645	14.0	3,203	$0.0^{(*)}$	607.3	61.5
Total holm oak open woodlands	1,408,170	100.0	22,281	0.0	730.3	63.2

$^{(*)}$ This value is lower than 0.05

Table S3. Agroforestry Accounting System total production account at social prices for holm oak open woodlands in Andalusia (2010: €/ha).

Class	Timber	Cork	Fire-wood	Nuts	Grazing	Conservation forestry	Residential	Amenity	Farmer	Fire services	Recreation	Mushrooms	Carbon	Landscape	Biodiversity	Water	Government	Holm oak open woodlands
	1	2	3	4	5	6	7	8	∑1-8	9	10	11	12	13	14	15	∑9-15	∑1-15
1. Total product (TP$_{sp}$)	0.4	2.2	1.8	0.1	33.9	4.5	14.7	342.7	400.2	41.3	31.8	18.0	41.8	110.8	12.2	89.7	345.7	745.9
1.1 Intermediate product (IP$_{sp}$)					33.9	2.8	14.7		51.3	38.1							38.1	89.4
1.1.1 Raw materials (IRM)					33.9				33.9									33.9
1.1.1.1 Grass and browse (IRMgg)					18.8				18.8									18.8
1.1.1.2 Acorn (IRMga)					6.9				6.9									6.9
1.1.1.3 Game grazing (IRMgh)					8.2				8.2									8.2
1.1.2 Services (ISSsp)						2.8	14.7		17.4	38.1							38.1	55.6
1.1.2.1 Commercial (ISSc)						2.8	14.7		17.4	38.1							38.1	55.6
1.1.2.2 Non-commercial (ISSnc)																		
1.2 Final product (FP$_{pp}$)	0.4	2.2	1.8	0.1		1.7		342.7	348.9	3.2	31.8	18.0	41.8	110.8	12.2	89.7	307.5	656.5
1.2.1 Final product consumption (FPc$_{pp}$)	0.3	0.7	1.5	0.1				342.7	345.3		31.0	18.0	41.8	110.2	11.2	89.7	301.7	647.0
1.2.1.1 Sales (FPs)	0.3	0.7	1.2	0.1					2.3									2.3
1.2.1.2 Autoconsumption (FPa)			0.3					342.7	343.0									343.0
1.2.1.3 Other final product (FPo)																		
1.2.1.4 Public goods and services (PGS)											31.0	18.0	41.8	110.2	11.2	89.7	301.7	301.7
1.2.2 Gross capital formation (GCF)	0.1	1.5	0.3			1.7			3.6	3.2	0.8	0.1		0.7	1.1		5.8	9.4
1.2.2.1 Gross capital formation manu. (GCFm)						1.7			1.7	3.2	0.8	0.1		0.7	1.1		5.8	7.5
1.2.2.1.1 Gross fixed capital formation manu. (GFCFm)						1.7			1.7	3.2	0.8	0.1		0.7	1.1		5.8	7.5
1.2.2.1.1.1 Plantations (GFCFmp)						1.7			1.7	0.0							0.0	1.7
1.2.2.1.1.2 Construction (GFCFmc)										2.7	0.6	0.1		0.0	0.8		4.1	4.1
1.2.2.1.1.3 Others (GFCFmo)										0.5	0.2	0.0		0.6	0.3		1.7	1.7
1.2.2.2 Natural growth (NG)	0.1	1.5	0.3						1.9									1.9
1.2.2.2.2 Gross work in progress formation (GWPFe)	0.1	1.5	0.3						1.9									1.9
1.2.2.2.2.1Environmental woody natural growth (GWPFew)	0.1	1.5	0.3						1.9									1.9
2. Total cost (TC$_{sp}$)	3.2	0.7	0.8	1.0	5.0	4.5	9.5	137.9	162.6	41.3	8.9	0.2	13.2	79.1	6.3		149.1	311.6
2.1 Intermediate consumption (IC$_{sp}$)	0.6	0.6	0.4	0.1	0.6	1.6	0.8	137.9	142.6	12.4	3.2	0.1		74.4	1.8		91.9	234.5
2.1.1 Raw materials (RM)	0.0	0.0	0.2	0.0	0.2	0.0	0.2		0.6	0.1	0.1	0.0		0.0	0.0		0.2	0.8
2.1.1.1 Bought raw materials (RMb)	0.0	0.0	0.2	0.0	0.2	0.0	0.2		0.6	0.1	0.1	0.0		0.0	0.0		0.2	0.8
2.1.1.2 Own raw materials (RMo)																		
2.1.2 Services (SS$_{sp}$)	0.4	0.0	0.1	0.1	0.3	1.6	0.6	137.9	141.0	12.3	3.1	0.1		74.3	1.8		91.7	232.7
2.1.2.1 Bought services (SSb)	0.4	0.0	0.1	0.1	0.3	1.6	0.6		3.1	12.3	1.6	0.1		1.9	1.8		17.6	20.7
2.1.2.2 Own services (SSoo$_{sp}$)								137.9	137.9		1.6			72.5	0.0		74.0	211.9
2.1.3 Environmental work in progress used (WPue)	0.2	0.6	0.2						1.0									1.0
2.1.3.1 Timber harvested (WPuet)	0.2								0.2									0.2
2.1.3.2 Cork stripping (WPuec)		0.6							0.6									0.6
2.1.3.3 Firewood pruning (WPuef)			0.2						0.2									0.2
2.2 Labor cost (LC)	2.5	0.1	0.3	0.9	3.4	2.8	3.1		13.1	26.1	4.1	0.1		4.0	3.8		38.2	51.3
2.3 Consumption of fixed capital (CFC)	0.0		0.0	0.0	1.1	0.1	5.6		6.8	2.8	1.6	0.0	13.2	0.7	0.6		19.0	25.8
2.3.1 Plantations (CFCp)	0.0					0.1			0.1									0.1
2.3.2 Constructions (CFCc)	0.0			0.0	1.0		5.6		6.6	1.4	1.3	0.0		0.2	0.2		3.1	9.7
2.3.3 Equipments (CFCeq)	0.0		0.0	0.0	0.1		0.0		0.1	0.2	0.0	0.0		0.0	0.0		0.3	0.5
2.3.4 External environmental (CFCe)													13.2				13.2	13.2
2.3.9 Others (CFCo)										1.1	0.2	0.0		0.5	0.4		2.3	2.3
3. Net operating margin (NOM$_{sp}$ = TP$_{sp}$ - TC$_{sp}$)	-2.7	1.5	1.1	-0.9	28.9	0.0	5.1	204.8	237.7	0.0	22.9	17.8	28.6	31.7	5.9	89.7	196.6	434.3
3.1. Environmental net operating margin (NOMe$_{sp}$)	0.1	1.5	0.3		28.3			204.8	235.0		21.6	17.8	28.6	31.5	5.8	89.7	194.9	429.9
3.1.1.Ordinary net operating margin (NOMeo)					28.3			204.8	233.1		21.6	17.8	41.8	31.5	5.8	89.7	208.1	441.2
3.1.2. Investment net operating margin (NOMei)	0.1	1.5	0.3						1.9				-13.2				-13.2	-11.3
3.2. Manufactured net operating margin (NOMm$_{sp}$)	-2.9	0.0	0.8	-0.9	0.6	0.0	5.1		2.7	0.0	1.3	0.0		0.2	0.2		1.7	4.4
4. Net value added (NVA$_{sp}$ = LC + NOM$_{sp}$)	-0.2	1.6	1.4	-0.1	32.3	2.9	8.3	204.8	250.8	26.2	27.0	17.9	28.6	35.7	9.8	89.7	234.8	485.6
5. Ordinary total cost (TCo)	3.2	0.7	0.8	1.0	5.0	2.8	9.5	137.9	160.8	38.1	8.1	0.1		78.5	5.2		130.0	290.9
6. Investment total cost (TCi)						1.7			1.7	3.2	0.8	0.1	13.2	0.7	1.1		19.0	20.8

Table S4. Agroforestry Accounting System ordinary and investment production accounts at social prices for holm oak open woodlands in Andalusia (2010: €/ha).

Class	Timber	Cork	Fire-wood	Nuts	Grazing	Conserv. forestry	Residen-tial	Amenity	Farmer	Fire services	Recrea-tion	Mush-rooms	Carbon	Land-scape	Bio-diversity	Water	Govern-ment	Holm oak open woodlands
	1	2	3	4	5	6	7	8	$\sum$1-8	9	10	11	12	13	14	15	$\sum$9-15	$\sum$1-15
1. Total product consumption (TPc$_{sp}$)	0.3	0.7	1.5	0.1	33.9	2.8	14.7	342.7	396.6	38.1	31.0	18.0	41.8	110.2	11.2	89.7	339.9	736.5
1.1 Intermediate product (IP$_{sp}$)					33.9	2.8	14.7		51.3	38.1							38.1	89.4
1.2 Final product consumption (FPc$_{pp}$)	0.3	0.7	1.5	0.1				342.7	345.3		31.0	18.0	41.8	110.2	11.2	89.7	301.7	647.0
2. Intermediate consumption (ICo$_{sp}$)	0.4	0.0	0.2	0.1	0.6	1.0	0.8	137.9	141.0	11.4	3.0	0.0		74.2	1.5		90.0	231.0
2.1 Bought (ICmob)	0.4	0.0	0.2	0.1	0.6	1.0	0.8		3.1	11.4	1.4	0.0		1.7	1.5		16.0	19.1
2.2 Own (ICmo$_{sp}$)								137.9	137.9		1.6			72.5	0.0		74.0	211.9
2.3 Manufactured work in progress used (WPmuo)																		
3. Labour cost (LCo)	2.5	0.1	0.3	0.9	3.4	1.7	3.1		12.0	23.9	3.6	0.1		3.6	3.1		34.2	46.3
4. Consumption of fixed capital (CFCmo)	0.0		0.0	0.0	1.1	0.1	5.6		6.8	2.8	1.6	0.0		0.7	0.6		5.7	12.6
5. Manufactured net operating margin (NOMmo$_{sp}$)	-2.9	0.0	0.8	-0.9	0.6	0.0	5.1		2.7	0.0	1.3	0.0		0.2	0.2		1.7	4.4
6. Ecosystem services (ES$_{sp}$)	0.2	0.6	0.2		28.3			204.8	234.1		21.6	17.8	41.8	31.5	5.8	89.7	208.1	442.2
6.1 Environmental work in progress used (WPeu)	0.2	0.6	0.2						1.0									1.0
6.2 Environmental net operating margin (NOMeo)					28.3			204.8	233.1		21.6	17.8	41.8	31.5	5.8	89.7	208.1	441.2
7. Net value added (NVAo$_{sp}$) (TPc$_{sp}$–ICosp-WPeu-CFC)	-0.4	0.1	1.1	-0.1	32.3	1.7	8.3	204.8	247.8	24.0	26.4	17.9	41.8	35.2	9.0	89.7	244.1	491.9
8. Gross capital formation (GCF)	0.1	1.5	0.3			1.7			3.6	3.2	0.8	0.1		0.7	1.1		5.8	9.4
8.1 Manufactured (GCFm)						1.7			1.7	3.2	0.8	0.1		0.7	1.1		5.8	7.5
8.2 Natural growth (NG)	0.1	1.5	0.3						1.9									1.9
9. Manufactured intermediate consumption (ICmi)						0.6			0.6	1.0	0.2	0.0		0.2	0.4		1.8	2.5
9.1 Bought (ICmib)						0.6			0.6	1.0	0.2	0.0		0.2	0.4		1.8	2.5
9.2 Work in progress used (WPmui)																		
10. Labour cost (LCi)						1.1			1.1	2.2	0.5	0.0		0.5	0.7		4.0	5.1
11. Consumption of fixed capital (CFCi)													13.2				13.2	13.2
11.1 Manufactured capital (CFCmi)																		
11.2 Environmental (CFCe)													13.2				13.2	13.2
12. Net operating margin (NOMi)	0.1	1.5	0.3			0.0			1.9	0.0		0.0	-13.2	0.0	0.0		-13.2	-11.3
12.1 Manufactured (NOMmi)						0.0			0.0	0.0		0.0		0.0	0.0		0.0	0.0
12.2 Environmental (NOMei)	0.1	1.5	0.3						1.9				-13.2				-13.2	-11.3
12.2.1 Natural growth (NG)	0.1	1.5	0.3						1.9									1.9
12.2.2 Less carbon emission (CFCe)													13.2				13.2	13.2
13. Net value added (NVAi) (GCF-ICmi-CFCi)	0.1	1.5	0.3			1.1			3.0	2.2	0.5	0.0	-13.2	0.5	0.7		-9.3	-6.3

Table S5. Agroforestry Accounting System capital account for holm oak open woodlands in Andalusia (2010: €/ha).

Class	1. Opening capital	2. Capital entries				3. Capital withdrawals						4. Revaluation	5. Closing capital
		2.1 Bought	2.2 Own	2.3 Others	2.4 Total	3.1 Used	3.2 Sales	3.2 Destructions	3.3 Recla-sifications	3.4 Others	3.5 Total		
	(Co)	(Ceb)	(Ceo)	(Ceot)	(Ce)	(Cwu)	(Cws)	(Cwd)	(Cwrc)	(Cwo)	(Cw)	(Cr)	(Cc)
1. Capital (C=WP+FC)	9,962.8	0.4	9.4	41.8	51.7	1.0			42.4	13.2	56.7	-171.0	9,786.8
2. Work in progress (WP)	40.7		1.9		1.9	1.0			1.9		2.9	3.0	42.8
Timber (WPt)	7.5		0.1		0.1	0.2			0.1		0.3	0.6	7.9
Cork (WPc)	7.3		1.5		1.5	0.6			1.4		2.0	0.9	7.7
Firewood (WPf)	25.9		0.3		0.3	0.2			0.3		0.5	1.5	27.1
3. Fixed capital (FC)	9,922.1	0.4	7.5	41.8	49.7	0.0			40.6	13.2	53.8	-174.0	9,744.0
3.1 Land (FCl)	9,185.3			41.8	41.8				40.6	13.2	53.8	-147.3	9,026.0
Timber (FClt)	*2.8*											*0.1*	*2.9*
Cork (FClc)	*0.9*											*0.0*	*0.9*
Firewood (FClf)	*88.5*											*2.7*	*91.2*
Nuts (FCln)	*0.2*											*0.0*	*0.2*
Grazing (FClg)	*1,018.8*											*1.3*	*1,021.1*
Grass and browse(FClggb)	727.7												727.7
Acorns (FClga)	41.8											1.3	43.1
Game grazing (FClggg)	249.3												249.3
Amenity (FClea)	*3,521.6*											*-165.1*	*3,356.6*
Recreation (FCler)	*892.9*												*892.9*
Mushrooms (FClem)	*591.0*												*591.0*
Carbon (FClec)	*346.5*			*41.8*	*41.8*				*40.6*	*13.2*	*53.8*	*13.8*	*348.3*
Landscape (FClel)	*1,056.1*												*1,056.1*
Biodiversity (FCleb)	*198.0*												*198.0*
Water (FClew)	*1,467.9*												*1,467.9*
3.2 Biological resources (FCbr)	158.6											7.6	166.3
Timber (FCbrt)	0.0											0.0	0.0
Cork (FCbrc)	29.9											1.8	31.7
Firewood (FCbrf)	96.4											5.1	101.5
Nuts (FCbrn)	0.1											0.0	0.1
Grazing of acorns (FCbra)	32.2											0.7	32.9
3.3 Plantations (FCp)	10.2		1.7		1.7							-0.2	11.8
3.4 Infrastructure (FCco)	550.8		4.1		4.1							-32.6	522.3
3.5 Equipments (FCe)	2.8	0.4			0.4	0.0					0.0	-0.1	3.1
3.9 Others (FCo)	14.4		1.7		1.7							-1.4	14.6

Table S6. Agroforestry Accounting System produced and expected work in progress balance account for holm oak open woodland in Andalusia (2010: €/ha).

Class	1. Opening capital (Co)	2. Capital entries 2.1 Bought (Ceb)	2.2 Own (Ceo)	2.3 Others (Ceot)	2.4 Total (Ce)	3. Capital withdrawals 3.1 Used (Cwu)	3.2 Sales (Cws)	3.2 Destructions (Cwd)	3.3.Recla-sifications (Cwrc)	3.4 Others (Cwo)	3.5 Total (Cw)	4. Revaluation (Cr)	5. Closing capital (Cc)
1. Work in progress (WP)	40.7		1.9		1.9	1.0			1.9		2.9	3.0	42.8
Timber (WPt)	7.5		0.1		0.1	0.2			0.1		0.3	0.6	7.9
Cork (WPc)	7.3		1.5		1.5	0.6			1.4		2.0	0.9	7.7
Firewood (WPf)	25.9		0.3		0.3	0.2			0.3		0.5	1.5	27.1
1.1 Produced (WPp)	27.4		1.9		1.9	1.0					1.0	0.3	28.6
Timber (WPt)	3.5		0.1		0.1	0.2					0.2	0.3	3.7
Cork (WPc)	3.7		1.5		1.5	0.6					0.6	-0.7	3.9
Firewood (WPf)	20.2		0.3		0.3	0.2					0.2	0.8	21.1
1.2 Expected (WPe)	13.3								1.9		1.9	2.7	14.1
Timber (WPt)	4.0								0.1		0.1	0.4	4.2
Cork (WPc)	3.6								1.4		1.4	1.6	3.8
Firewood (WPf)	5.7								0.3		0.3	0.7	6.1

Table S7. Agroforestry Accounting System simplified accounts sequence of total income at social prices for holm oak open woodlands in Andalusia (2010: €/ha).

Class	Timber	Cork	Fire-wood	Nuts	Gra-zing	Conserv. forestry	Residen-tial	Amenity	Farmer	Fire services	Recrea-tion	Mush-rooms	Carbon	Land-scape	Bio-diversity	Water	Govern-ment	Holm oak open woodlands
	1	2	3	4	5	6	7	8	∑1-8	9	10	11	12	13	14	15	∑9-15	∑1-15
1. Total product (TP_{sp})	0.4	2.2	1.8	0.1	33.9	4.5	14.7	342.7	400.2	41.3	31.8	18.0	41.8	110.8	12.2	89.7	345.7	745.9
2 Manufactured intermediate consumption (ICm_{sp})	0.4	0.0	0.2	0.1	0.6	1.6	0.8	137.9	141.6	12.4	3.2	0.1		74.4	1.8		91.9	233.5
2.1 Bought (ICb)	0.4	0.0	0.2	0.1	0.6	1.6	0.8		3.7	12.4	1.6	0.1		1.9	1.8		17.9	21.5
2.2 Own (ICo_{sp})								137.9	137.9		1.6			72.5	0.0		74.0	211.9
3. Labour cost (LC)	2.5	0.1	0.3	0.9	3.4	2.8	3.1		13.1	26.1	4.1	0.1		4.0	3.8		38.2	51.3
4. Consumption of fixed capital (CFC)	0.0		0.0	0.0	1.1	0.1	5.6		6.8	2.8	1.6	0.0	13.2	0.7	0.6		19.0	25.8
5. Ordinary manufactured net operating margin ($NOMmo_{sp}$)	-2.9	0.0	0.8	-0.9	0.6	0.0	5.1		2.7	0.0	1.3	0.0		0.2	0.2		1.7	4.4
6. Investment environmental net operating margin (NOMei)	0.1	1.5	0.3			0.0			1.9	0.0		0.0	-13.2	0.0	0.0		-13.2	-11.3
7. Ecosystem services (ES_{sp})	0.2	0.6	0.2		28.3			204.8	234.1		21.6	17.8	41.8	31.5	5.8	89.7	208.1	442.2
7.1 Environmental work in progress used (WPue)	0.2	0.6	0.2						1.0									1.0
7.2 Ordinary environmental net operating margin (NOMeo)					28.3			204.8	233.1		21.6	17.8	41.8	31.5	5.8	89.7	208.1	441.2
8. Net value added (NVA_{sp}) (TP_{sp} – ICm_{sp} - WPue CFC)	-0.2	1.6	1.4	-0.1	32.3	2.9	8.3	204.8	250.8	26.2	27.0	17.9	28.6	35.7	9.8	89.7	234.8	485.6
8.1 Labour cost (LC)	2.5	0.1	0.3	0.9	3.4	2.8	3.1		13.1	26.1	4.1	0.1		4.0	3.8		38.2	51.3
8.2 Net operating margin (NOM_{sp})	-2.7	1.5	1.1	-0.9	28.9	0.0	5.1	204.8	237.7	0.0	22.9	17.8	28.6	31.7	5.9	89.7	196.6	434.3
8.2.1 Manufactured net operating margin ($NOMm_{sp}$)	-2.9	0.0	0.8	-0.9	0.6	0.0	5.1		2.7	0.0	1.3	0.0		0.2	0.2		1.7	4.4
8.2.2 Environmental net operating margin ($NOMe_{sp}$)	0.1	1.5	0.3		28.3			204.8	235.0		21.6	17.8	28.6	31.5	5.8	89.7	194.9	429.9
9. Capital gain (CG)	0.7	1.3	8.9	0.0	2.4	-0.1	-21.2	-165.1	-173.1	-1.4	0.2	-0.1	-26.8	0.4	0.0		-27.7	-200.8
9.1 Manufactured (CGm)	0.0	0.0	0.0	0.0	0.4	-0.1	-21.2		-20.9	-1.4	0.2	-0.1		0.4	0.0		-0.9	-21.7
9.2 Environmental (EAg)	0.6	1.3	8.9	0.0	2.0			-165.1	-152.2				-26.8				-26.8	-179.1
9.2.1 Environmental asset revaluation (EAr)	0.7	2.7	9.3	0.0	2.0			-165.1	-150.4				13.8				13.8	-136.6
9.2.2 Environmental asset adjusted for growth and carbon (EAad)	-0.1	-1.4	-0.3		0.0				-1.9				-40.6				-40.6	-42.4
10. Total income (TI_{sp})	0.4	2.8	10.3	-0.1	34.7	2.7	-13.0	39.7	77.7	24.7	27.2	17.9	1.7	36.1	9.8	89.7	207.1	284.8
10.1 Compensation of employees (LC)	2.5	0.1	0.3	0.9	3.4	2.8	3.1		13.1	26.1	4.1	0.1		4.0	3.8		38.2	51.3
10. 2 Capital income (CI_{sp})	-2.1	2.7	10.0	-0.9	31.3	-0.1	-16.1	39.7	64.6	-1.4	23.1	17.8	1.7	32.1	5.9	89.7	168.9	233.5
10.2.1 Manufactured capital income (CIm)	-2.8	0.0	0.8	-0.9	1.0	-0.1	-16.1		-18.2	-1.4	1.5	0.0		0.6	0.2		0.8	-17.3
10.2.2 Environmental income (EI_{sp})	0.7	2.8	9.3	0.0	30.2			39.7	82.7		21.6	17.8	1.7	31.5	5.8	89.7	168.1	250.8
10.2.2.1 Ecosystem services (ES_{sp})	0.2	0.6	0.2		28.3			204.8	234.1		21.6	17.8	41.8	31.5	5.8	89.7	208.1	442.2
10.2.2.2 Change in net worth adjusted for WPeu (CNWead)	0.5	2.2	9.0	0.0	2.0			-165.1	-151.3				-40.1				-40.1	-191.4
10.2.2.2.1 Change of environmental net worth (CNWe)	0.7	2.8	9.3	0.0	2.0			-165.1	-150.3				-40.1				-40.1	-190.4
10.2.2.2.1.1 Investment environmental net operating margin (NOMei)	0.1	1.5	0.3						1.9				-13.2				-13.2	-11.3
10.2.2.2.1.2 Environmental asset gain (EAg)	0.6	1.3	8.9	0.0	2.0			-165.1	-152.2				-26.8				-26.8	-179.1
10.2.2.2.2 Less WPeu	0.2	0.6	0.2						1.0									1.0

Table S8. Refined System of National Accounts ordinary and investment production accounts at basic prices applied to holm oak open woodlands in Andalusia (2010: €/ha).

Class	Timber	Cork	Fire-wood	Nuts	Grazing	Conserv. forestry	Residen-tial	Amenity	Farmer ∑1-8	Fire services	Recrea-tion	Mush-rooms	Carbon	Land-scape	Bio-diversity	Water	Govern-ment ∑9-15	Holm oak open woodlands ∑1-15
	1	2	3	4	5	6	7	8	∑1-8	9	10	11	12	13	14	15	∑9-15	∑1-15
1. Total product consumption (TPc$_{bp}$)	0.3	0.7	1.5	0.1	33.9	2.8	14.7	14.7	68.5	38.1	8.1	18.0		76.4	5.2	76.2	222.0	290.5
1.1 Intermediate product (IP$_{bp}$)					33.9	2.8	14.7		51.3	38.1							38.1	89.4
1.2 Final product consumption (FPc$_{pp}$)	0.3	0.7	1.5	0.1				14.7	17.2		8.1	18.0		76.4	5.2	76.2	183.9	201.1
2. Intermediate consumption (ICo$_{bp}$)	0.4	0.0	0.2	0.1	0.6	1.0	0.8	14.7	17.7	11.4	3.0	0.0		72.1	1.5		87.9	105.7
2.1 Bought (ICmob)	0.4	0.0	0.2	0.1	0.6	1.0	0.8		3.1	11.4	1.4	0.0		1.7	1.5		16.0	19.1
2.2 Own (ICmo$_{bp}$)								14.7	14.7		1.6			70.4	0.0		71.9	86.6
3. Labour cost (LCo)	2.5	0.1	0.3	0.9	3.4	1.7	3.1		12.0	23.9	3.6	0.1		3.6	3.1		34.2	46.3
4. Consumption of fixed capital (CFCmo)	0.0		0.0	0.0	1.1	0.1	5.6		6.8	2.8	1.6	0.0		0.7	0.6		5.7	12.6
5. Manufactured net operating margin (NOMmo$_{bp}$)	-2.9	0.0	0.8	-0.9	0.6	0.0	5.1		2.7	0.0		0.0		0.0			0.1	2.8
6. Ecosystem services (ES$_{bp}$)	0.2	0.6	0.2		28.3				29.3			17.8				76.2	94.0	123.3
6.1 Environmental work in progress used (WPeu)	0.2	0.6	0.2						1.0									1.0
6.2 Environmental net operating margin (NOMeo)					28.3				28.3			17.8				76.2	94.0	122.3
7. Net value added (NVAo$_{bp}$) (TPc$_{bp}$–ICosp-WPeu-CFC)	-0.4	0.1	1.1	-0.1	32.3	1.7	8.3		43.0	24.0	3.6	17.9		3.6	3.1	76.2	128.3	171.3
8. Gross capital formation (GCF)	0.1	1.5	0.3			1.7			3.6	3.2	0.8	0.1		0.7	1.1		5.8	9.4
8.1 Manufactured (GCFm)						1.7			1.7	3.2	0.8	0.1		0.7	1.1		5.8	7.5
8.2 Natural growth (NG)	0.1	1.5	0.3						1.9									1.9
9. Manufactured intermediate consumption (ICmi)						0.6			0.6	1.0	0.2	0.0		0.2	0.4		1.8	2.5
9.1 Bought (ICmib)						0.6			0.6	1.0	0.2	0.0		0.2	0.4		1.8	2.5
10. Labour cost (LCi)						1.1			1.1	2.2	0.5	0.0		0.5	0.7		4.0	5.1
11. Consumption of fixed capital (CFCi)																		
11.1 Manufactured (CFCmi)																		
11.2 Environmental (CFCe)																		
12. Net operating margin (NOMi)	0.1	1.5	0.3						1.9	0.0							0.0	1.9
12.1 Manufactured (NOMmi)										0.0							0.0	0.0
12.2 Environmental (NOMei)	0.1	1.5	0.3						1.9									1.9
12.2.1 Natural growth (NG)	0.1	1.5	0.3						1.9									1.9
12.2.2 Less carbon emission (CFCe)																		
13. Net value added (NVAi) (GCF-ICmi-CFCi)	0.1	1.5	0.3			1.1			3.0	2.2	0.5	0.0		0.5	0.7		4.0	7.0

Table S9. Refined System of National Accounts simplified accounts sequence of total income at basic prices for holm oak open woodlands in Andalusia (2010: €/ha).

Class	Timber	Cork	Fire-wood	Nuts	Gra-zing	Conserv. forestry	Residen-tial	Amenity	Farmer	Fire services	Recrea-tion	Mush-rooms	Carbon	Land-scape	Bio-diversity	Water	Govern-ment	Holm oak open woodlands
	1	2	3	4	5	6	7	8	∑1-8	9	10	11	12	13	14	15	∑9-15	∑1-15
1. Total product (TP$_{bp}$)	0.4	2.2	1.8	0.1	33.9	4.5	14.7	14.7	72.2	41.3	8.9	18.0		77.0	6.3	76.2	227.8	300.0
2 Manufactured intermediate consumption (ICm$_{bp}$)	0.4	0.0	0.2	0.1	0.6	1.6	0.8	14.7	18.3	12.4	3.2	0.1		72.3	1.8		89.8	108.1
2.1 Bought (ICb)	0.4	0.0	0.2	0.1	0.6	1.6	0.8		3.7	12.4	1.6	0.1		1.9	1.8		17.9	21.5
2.2 Own (ICo$_{bp}$)								14.7	14.7		1.6			70.4	0.0		71.9	86.6
2.3 Manufactured work in progress used (WPmu)																		
3. Labour cost (LC)	2.5	0.1	0.3	0.9	3.4	2.8	3.1		13.1	26.1	4.1	0.1		4.0	3.8		38.2	51.3
4. Consumption of fixed capital (CFC)	0.0		0.0	0.0	1.1	0.1	5.6		6.8	2.8	1.6	0.0		0.7	0.6		5.7	12.6
5. Ordinary manufactured net operating margin (NOMmo$_{bp}$)	-2.9	0.0	0.8	-0.9	0.6	0.0	5.1		2.7	0.0		0.0		0.0			0.1	2.8
6. Investment environmental net operating margin (NOMei)											0.0						0.0	0.0
7. Ecosystem services (ES$_{bp}$)	0.2	0.6	0.2		28.3				29.3			17.8				76.2	94.0	123.3
7.1 Environmental work in progress used (WPue)	0.2	0.6	0.2						1.0									1.0
7.2 Ordinary environmental net operating margin (NOMeo)					28.3				28.3			17.8				76.2	94.0	122.3
8. Net value added (NVA$_{bp}$) (TP$_{bp}$ – ICm$_{bp}$ - WPue CFC)	-0.2	1.6	1.4	-0.1	32.3	2.9	8.3		46.0	26.2	4.1	17.9		4.0	3.8	76.2	132.3	178.3
8.1 Labour cost (LC)	2.5	0.1	0.3	0.9	3.4	2.8	3.1		13.1	26.1	4.1	0.1		4.0	3.8		38.2	51.3
8.2 Net operating margin (NOM$_{bp}$)	-2.7	1.5	1.1	-0.9	28.9	0.0	5.1		32.9	0.0		17.8		0.0		76.2	94.1	127.0
8.2.1 Manufactured net operating margin (NOMm$_{bp}$)	-2.9	0.0	0.8	-0.9	0.6	0.0	5.1		2.7	0.0		0.0		0.0			0.1	2.8
8.2.2 Environmental net operating margin (NOMe$_{bp}$)	0.1	1.5	0.3		28.3				30.2			17.8				76.2	94.0	124.2
9. Capital gain (CG)	0.7	1.3	8.9	0.0	2.4	-0.1	-21.2	-165.1	-173.1	-1.4	0.2	-0.1		0.4	0.0		-0.9	-174.0
9.1 Manufactured (CGm)	0.0	0.0	0.0	0.0	0.4	-0.1	-21.2		-20.9	-1.4	0.2	-0.1		0.4	0.0		-0.9	-21.7
9.2 Environmental (EAg)	0.6	1.3	8.9	0.0	2.0			-165.1	-152.2									-152.2
9.2.1 Environmental asset revaluation (EAr)	0.7	2.7	9.3	0.0	2.0			-165.1	-150.4									-150.4
9.2.2 Environmental asset adjusted for growth and carbon (EAad)	-0.1	-1.4	-0.3		0.0				-1.9									-1.9
10. Total income (TI$_{bp}$)	0.4	2.8	10.3	-0.1	34.7	2.7	-13.0	-165.1	-127.1	24.7	4.3	17.9		4.4	3.8	76.2	131.4	4.3
10.1 Compensation of employees (LC)	2.5	0.1	0.3	0.9	3.4	2.8	3.1		13.1	26.1	4.1	0.1		4.0	3.8		38.2	51.3
10. 2 Capital income (CI$_{bp}$)	-2.1	2.7	10.0	-0.9	31.3	-0.1	-16.1	-165.1	-140.2	-1.4	0.2	17.8		0.4	0.0	76.2	93.2	-47.0
10.2.1 Manufactured capital income (CIm)	-2.8	0.0	0.8	-0.9	1.0	-0.1	-16.1		-18.2	-1.4	0.2	0.0		0.4	0.0		-0.8	-19.0
10.2.2 Environmental income (EI$_{bp}$)	0.7	2.8	9.3	0.0	30.2			-165.1	-122.0			17.8				76.2	94.0	-28.0
10.2.2.1 Ecosystem services (ES$_{bp}$)	0.2	0.6	0.2		28.3				29.3			17.8				76.2	94.0	123.3
10.2.2.2 Change in net worth adjusted for WPeu (CNWead)	0.5	2.2	9.0	0.0	2.0			-165.1	-151.3									-151.3
10.2.2.2.1 Change of environmental net worth (CNWe)	0.7	2.8	9.3	0.0	2.0			-165.1	-150.3									-150.3
10.2.2.2.1.1 Investment environmental net operating margin (NOMei)	0.1	1.5	0.3						1.9									1.9
10.2.2.2.1.2 Environmental asset gain (EAg)	0.6	1.3	8.9	0.0	2.0			-165.1	-152.2									-152.2
10.2.2.2.2 Less WPeu	0.2	0.6	0.2						1.0									1.0

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Table S10. Agroforestry Accounting System and refined System of Nationals Accounts measurements at producer, basic and social prices of ecosystems services and incomes for holm oak open woodlands in Andalusia (2010: €/ha).

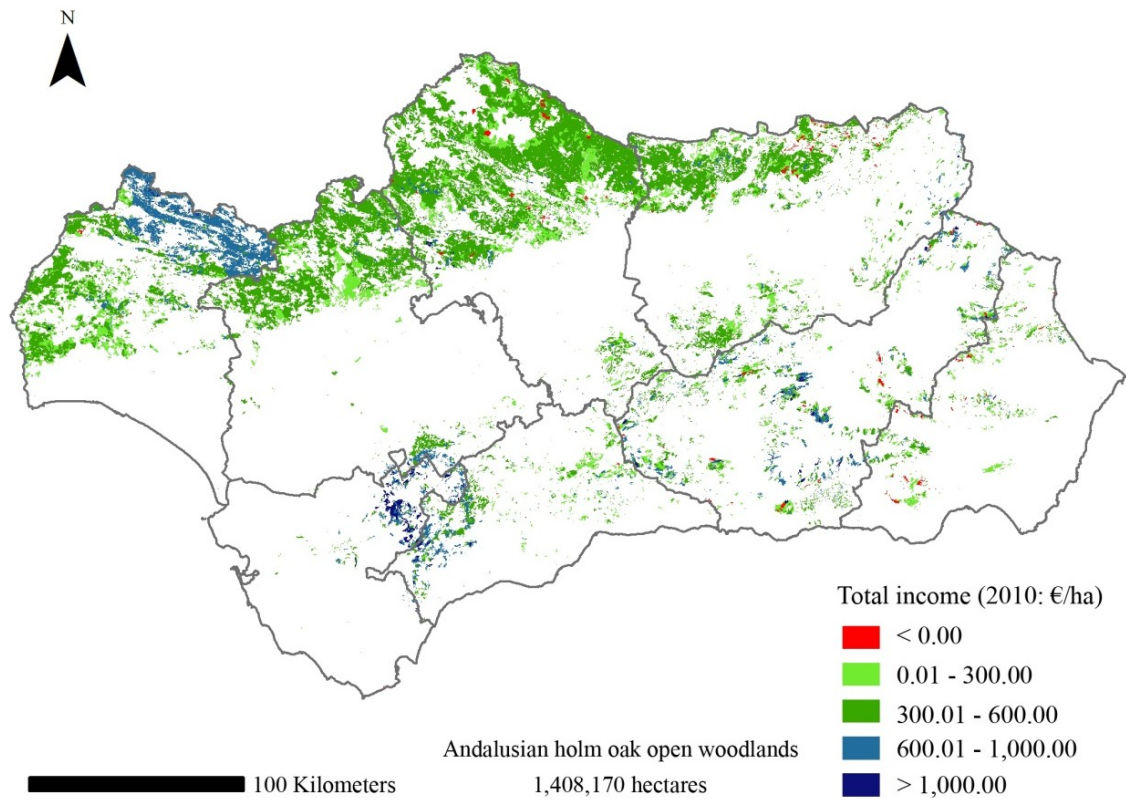| Class	Timber	Cork	Fire-wood	Nuts	Gra-zing	Conserv. forestry	Residen-tial	Amenity	Farmer	Fire services	Recrea-tion	Mush-rooms	Carbon	Land-scape	Bio-diversity	Water	Government	Holm oak open woodlands
	1	2	3	4	5	6	7	8	$\sum$1-8	9	10	11	12	13	14	15	$\sum$9-15	$\sum$1-15
Agroforestry Accounting System																		
AAS *at social prices*																		
Ecosystem services (ES$_{sp}$)	0.2	0.6	0.2		28.3			204.8	234.1		21.6	17.8	41.8	31.5	5.8	89.7	208.1	442.2
Gross value added (GVA$_{sp}$)	-0.2	1.6	1.4	-0.1	33.3	2.9	13.9	204.8	257.6	28.9	28.6	18.0	41.8	36.4	10.4	89.7	253.8	511.4
Gross operating margin (GOM$_{sp}$)	-2.7	1.5	1.1	-0.9	30.0	0.1	10.7	204.8	244.5	2.8	24.5	17.9	41.8	32.4	6.6	89.7	215.6	460.1
Environmental income (EI$_{sp}$)	0.7	2.8	9.3	0.0	30.2			39.7	82.7		21.6	17.8	1.7	31.5	5.8	89.7	168.1	250.8
AAS *at basic prices*																		
Ecosystem services (ES$_{bp}$)	0.2	0.6	0.2		28.3			328.1	357.3		21.6	17.8	41.8	31.5	5.8	89.7	208.1	565.5
Gross value added (GVA$_{bp}$)	-0.2	1.6	1.4	-0.1	33.3	2.9	13.9	328.1	380.9	28.9	28.6	18.0	41.8	38.5	10.4	89.7	255.9	636.8
Environmental income (EI$_{bp}$)	0.7	2.8	9.3	0.0	30.2			163.0	206.0		21.6	17.8	1.7	31.5	5.8	89.7	168.1	374.1
AAS *at producer prices*																		
Ecosystem services (ES$_{pp}$)	0.2	0.6	0.2		28.3			328.1	357.3		21.6	17.8	41.8	31.5	5.8	89.7	208.1	565.5
Gross value added (GVA$_{pp}$)	-0.2	1.6	1.4	-0.1	33.3	2.9	13.9	328.1	380.9	28.9	28.6	18.0	41.8	69.6	10.4	89.7	286.9	667.8
Environmental income (EI$_{pp}$)	0.7	2.8	9.3	0.0	30.2			163.0	206.0		21.6	17.8	1.7	31.5	5.8	89.7	168.1	374.1
Refined System of National Accounts																		
rSNA *at basic prices*																		
Ecosystem services (ES$_{bp}$)	0.2	0.6	0.2		28.3				29.3			17.8				76.2	94.0	123.3
Gross value added (GVA$_{bp}$)	-0.2	1.6	1.4	-0.1	33.3	2.9	13.9		52.8	28.9	5.7	18.0		4.8	4.5	76.2	138.0	190.9
Gross operating margin (GOM$_{bp}$)	-2.7	1.5	1.1	-0.9	30.0	0.1	10.7		39.7	2.8	1.6	17.9		0.7	0.6	76.2	99.8	139.6
Environmental income (EI$_{bp}$)	0.7	2.8	9.3	0.0	30.2			-165.1	-122.0			17.8				76.2	94.0	-28.0
rSNA *at producer prices*																		
Ecosystem services (ES$_{pp}$)	0.2	0.6	0.2		28.3				29.3			17.8				76.2	94.0	123.3
Gross value added (GVA$_{pp}$)	-0.2	1.6	1.4	-0.1	33.3	2.9	13.9		52.8	28.9	5.7	18.0		4.8	4.5	76.2	138.0	190.9
Environmental income (EI$_{pp}$)	0.7	2.8	9.3	0.0	30.2			-165.1	-122.0			17.8				76.2	94.0	-28.0

Supplementary figures for

Incomes and ecosystem services comparisons of refined national and agroforestry accounting frameworks: application to holm oak open woodlands in Andalusia-Spain
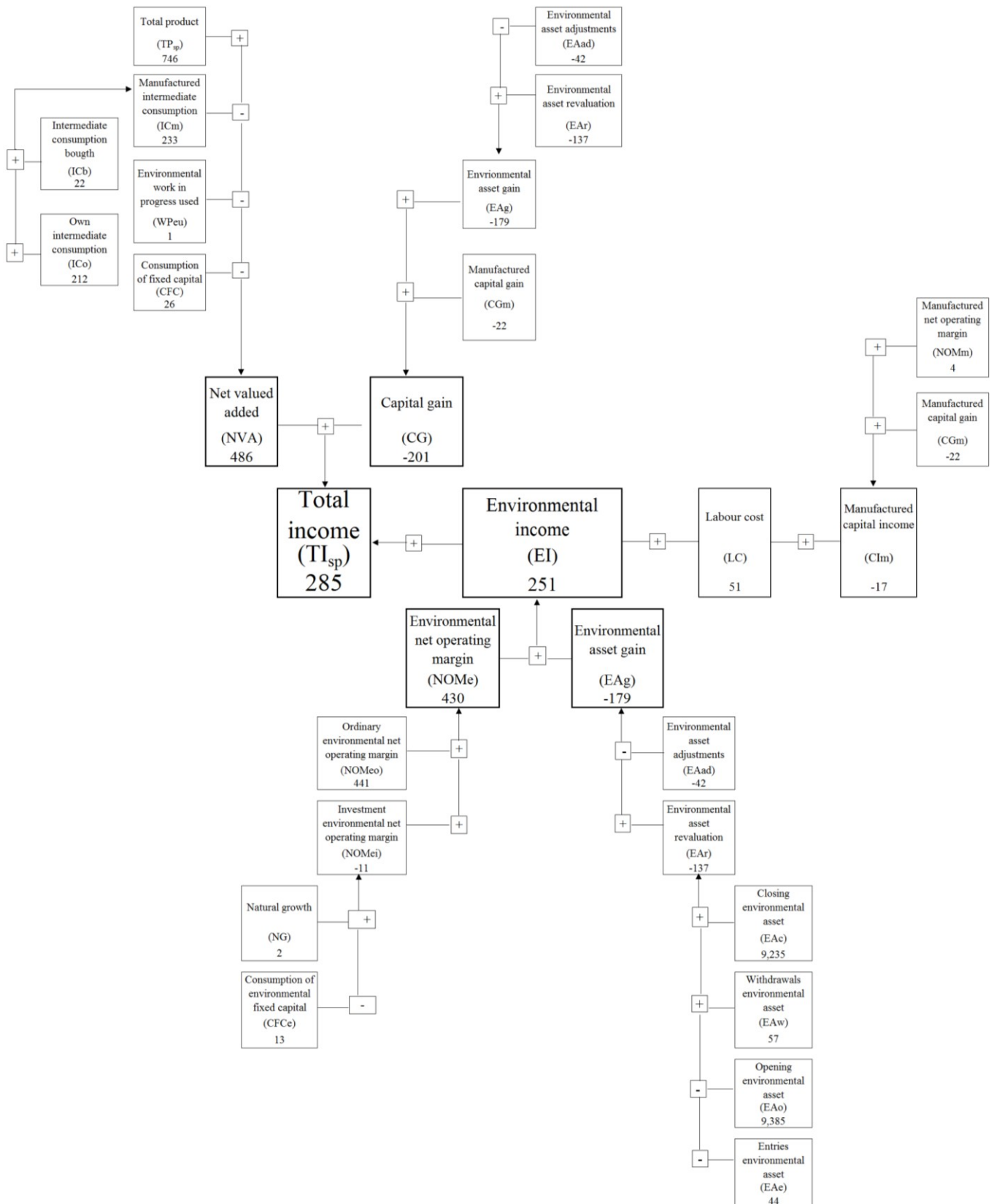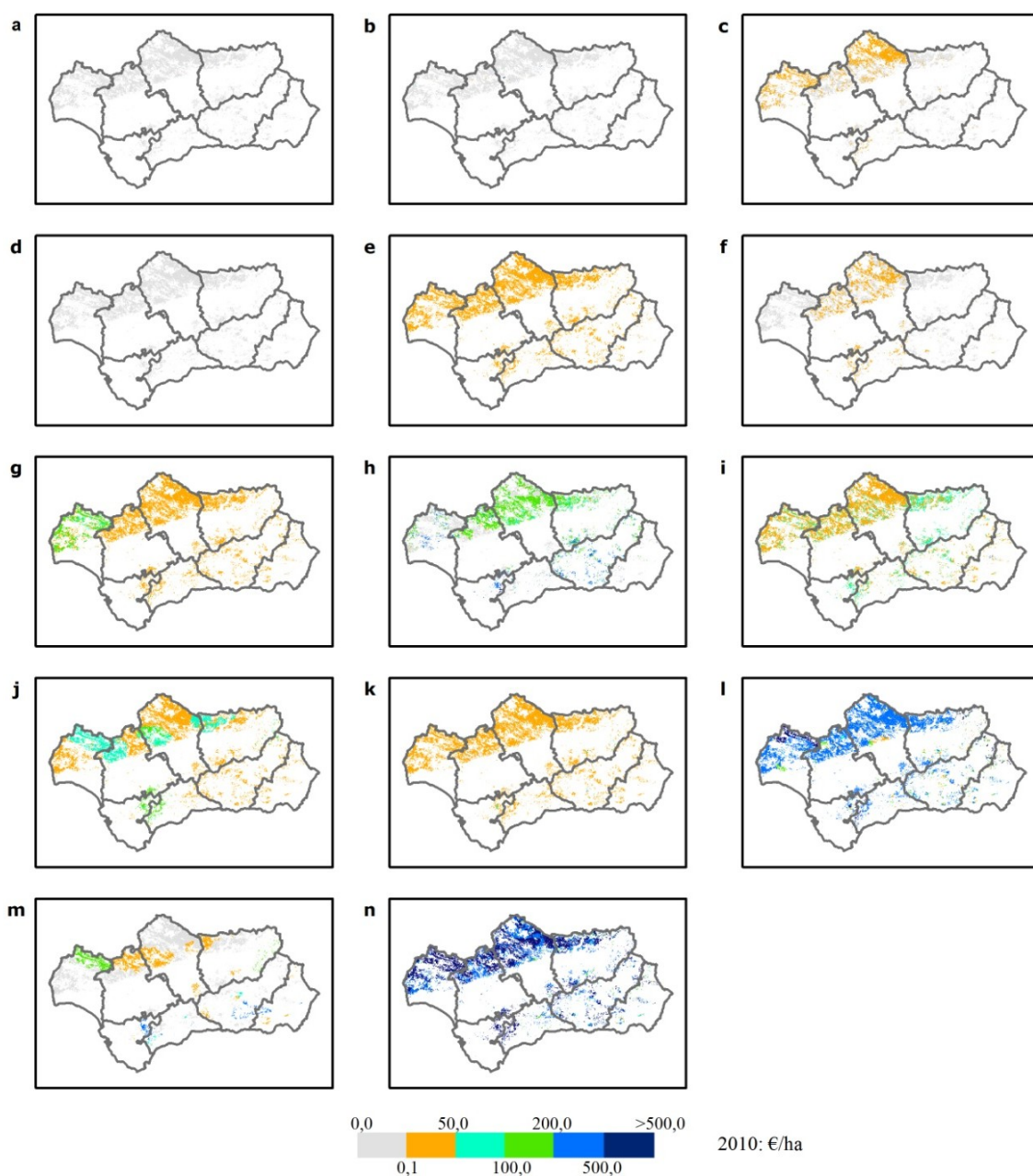
Figure S1. Agroforestry Accounting System simplified accounts sequence of total income factorial distribution at social prices for holm oak open woodlands in Andalusia-(2010: €/ha).

Total income (2010: €/ha)

- < 0.00
- 0.01 - 300.00
- 300.01 - 600.00
- 600.01 - 1,000.00
- > 1,000.00

100 Kilometers

Andalusian holm oak open woodlands

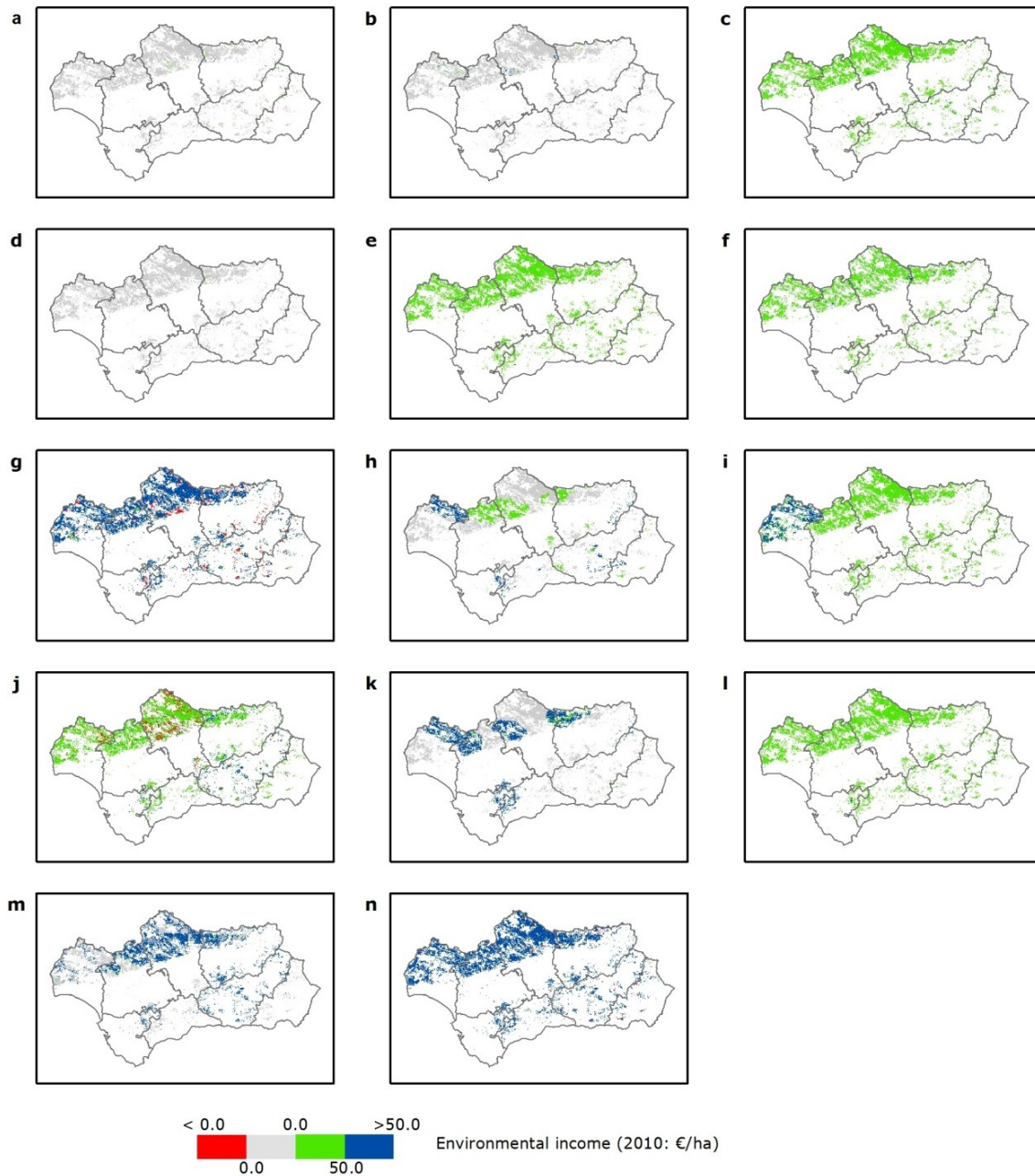1,408,170 hectares

Source: Eloy Almazán based on the [24]

Figure S2. Agroforestry Accounting System total income at producer prices for holm oak open woodlands in Andalusia (2010: €/ha).

Source: Eloy Almazán based on the [24]

Figure S3. Map of Agroforestry Accounting System ecosystem services at producer prices by products and total for holm oak open woodlands in Andalusia.

Abreviations: (a) timber; (b) cork; (c) firewood; (d) nuts; (e) livestock grazing; (f) game grazing; (g) mushrooms; (h) water; (i) carbon; (j) landscape; (k) biodiversity; (l) amenity; (m) recreation; (n) total ecosystem services consumed in Holm oak woodlands.

Source: Eloy Almazán based on the [24]

Figure S4. Agroforestry Accounting System environmental income at producer prices per activity and total for holm oak open woodlands in Andalusia.

Abreviations: (a) timer; (b) cork; (c) firewood; (d) nuts; (e) livestock grazing; (f) game grazing; (g) amenity; (h) recreation; (i) mushrooms; (j) carbon; (k) landscape; (l) biodiversity; (m) water; (n) total environmental income in Holm oak woodlands.