TOWARDS THE *DEHESA* TOTAL INCOME ACCOUNTING: THEORY AND OPERATIVE MONFRAGÜE STUDY CASES

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SUMMARY

There has been, from the beginning of the 1970s, a controversial debate on the income measurement of natural resource exploitation and sustainability both commercial and environmental of their economic resources. Treeless pastures and woodlands have been the focus of less research than has timber forestland. Up to today, institutional timber forestland accounting proposals have not integrated non-excludable and other non-market benefits into total income measurement of forestland. This paper shows a complete accounting system that can incorporate any economic benefit and cost that could accrue from active and passive uses of forestland, whether or not the economic effects are the result of on-site and off-site land uses. An application to the Spanish *dehesas* at Monfragüe area gives a tentative total income measurement under this new accounting proposal. The *dehesa* woodland study represents one of the most complex forestland uses system.

KEY WORDS: Forestland accounting
Total income
Environmental income
Commercial income
Dehesa

INTRODUCTION

The conventional commercial net value added (CNVA) as measured by the system of Economic Accounts for Forestry (EAF) (Eurostat, 1997) produces an incomplete annual forestland income measurement, according to the total economic value theory (Campos, 1999a and 1999b) and the hicksian income concept (Hicks, 1946).

Researchers, both European and American, and statistical international institutions have recommended that a future system of Green Economic Accounting (GEA) take into account additional commercial and environmental forestland incomes from scarce goods

and services that now are excluded from the forestry CNVA (United Nations, 1993; Van Dieren, 1995; Eurostat, 1996, 1997, 1999a, 1999b and 2000; Peyron, 1998; Nordhaus and Kokkelenberg, 1999; Bergen, 1999; Merlo and Jöbstl, 1999; Vincent, 1999; Kristrom, 1999; and Campos, 1999a and 1999b). In this context, the Eurostat Forest Task Force proposal, titled Integrated Environmental and Economic Accounting for Forests (IEEAF), extends forestry income calculations to additional flows of commercial goods and services (Eurostat, 1999a, 1999b and 2000). However, problems with non-market valuation techniques are delaying the extension of the total income concept to forestland capital gains and economic externalities (Eurostat, 1999b and 2000) and (Nordhaus and Kokkelenberg, 1999).

Whenever there is a multiple use of renewable resources, as there is in the forestland case, a new operative approach agroforestry accounting system (AAS) has been developed to incorporate into the IEEAF system the forestland environmental goods and services operating income and capital gains (Campos, 1999a and 1999b; Campos *et al.*, 2001; and Caparrós *et al.*, 2001).

Most of the *dehesa* environmental goods and services are considered quasi public/private benefits, but carbon fixation and biodiversity benefits are pure public goods. For quasi public/private environmental services, contingent valuation can be used to estimate a demand function, so that a market situation with well defined property rights can be simulated once costs involved are known (see Caparrós, Campos and Montero (2001) for a discussion of the advantages and difficulties of this approach).

The hicksian total sustainable income (TSI) of the *dehesa* measured by this research is interpreted as the monetary flow at real (or simulated) marginal market prices generated in the accounting period (one year), which totally spent within the period leaves the agents (social or private) at the end of the period with the same economic wealth (capital) as they had at the beginning in real terms.

The hicksian income concept applied to the *dehesa* does not guarantee the maintenance of each singular initial stock of natural or environmental asset. This weak ecological criterion is not an actual shortcoming of total sustainable income measured in the *dehesa* study cases because it is assumed that there are no irreversibilities in the existing trees declining on the *dehesas* of Monfragüe shire.

The main aim of this research is to measure the *dehesa* total sustainable income in four real study cases taking into account:

a) the commercial goods and services of the EAF system (Eurostat, 1996 and 1997).
b) the additional commercial goods and services incorporated by the IEEAF system (Eurostat, 1999a, 1999b and 2000).
c) the *dehesa* capital gains and a group of economic externalities including public environmental services, owners' self-consumption (final consumption) of environmental services and government expenditures on *dehesa* maintenance.

Social and private total sustainable incomes will be measured. Social income does not take into account subsidies and taxes on products. Similarly, private income does not consider public environmental consumption services and government intermediate expenditures.

The agroforestry account system (AAS) framework has been published several times (Campos, 1999a, 1999b and 1999d) and on this occasion, only the main accounting identities and the specific valuation criteria applied to the four *dehesa* study cases will be presented.

This AAS *dehesa* Mediterranean forest exercise is outlined in Section 2 with the AAS accounting identities used and the valuation criteria applied for measuring *dehesa* total sustainable income. Section 3 presents the physical and economic results measured in the four *dehesa* study case. Section 4 discusses the feasibility of AAS application within the context of EAF and IEEAF frameworks and Section 5 provides some final comments on the theoretical and practical findings of this research on greening the income offered by *dehesa* of Monfragüe shire.

AGROFORESTRY ACCOUNTING SYSTEM AND VALUATION CRITERIA

The agroforestry accounting system

The *dehesa* multiple-use total sustainable income (TSI) has been measured by the agroforestry accounting system (AAS) linking production account (Tables 2a and 2b), production in progress balance account (Table 5) and fixed capital balance account (Table 6).

In these *dehesas* studies, private commercial total production (CTP) [1] measured by AAS includes cork, firewood, grazing resources, reforestation, hunting, livestock products, crops, commercial services and own infrastructure construction (Table 2a).

Total production (CTP) is classified into intermediate production (CIP) –intermediate raw materials (IRM) and intermediate services (IS)– and final production (CFP). The final commercial goods and services produced which are separated from gross internal investments (GII), final sales (FS) and final stocks production (FSP) are aggregated as other final production (OFP).

The commercial total production (CTP) is a variable with double accounting when the whole economic benefits of the land unit are considered. It is the case for commercial intermediate production (CIP) since its value is also incorporated into the value of final production (CFP).

The private commercial total cost (PCTC) has been estimated by the sum of intermediate consumption (PIC), labour cost (LC) and fixed capital consumption (FCC) at market prices (Table 2b).

The private commercial intermediate consumption (PCIC) is classified into raw materials (RM) –own (ORM) and external (ERM)– services (SS) –intermediate (ISS) and external (ESS)– and production in progress used (PPU) in the accounting period.

The government intermediate expenditures (GIE) and the government labour cost (GLC) are two components that must be included in the accounting of the social commercial total cost (CTC). In these *dehesa* study cases it is assumed that government labour cost (GLC) is taking into account government intermediate expenditures (GIE) because they could not be separated.

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[1] The whole social commercial total production is considered private commercial total production (CTP = = PCTP).

The private commercial net operating margin (PCNOM) is the residual capital income from all the commercial economic activities belonging to or paid by the *dehesa* owners (Tables 2b and 3). Therefore, it is calculated by private commercial total production (PCTP) minus total cost (PCTC):

$$PCNOM = PCTP - PCTC$$

The private commercial operating income (PCNOM) is influenced by the operating subsidies net of taxes on products (OST) received by the owners. In fact, the livestock operating subsidies net of taxes on products (OST) play a relevant role in the *dehesa* study cases (Table 4) to obtain a positive private commercial net operating surplus (PCNOS):

$$PCNOS = PCNOM + OST$$

The private total production (PTP) estimated is commercial total production (CTP) and owners' self-consumption of environmental recreation and conservation services. These self-consumption services are joint output and do not have private cost, therefore being denoted as private environmental net operating margin (PENOM).

The private net value added at factor cost ($PNVA_{fc}$) is measured by the agroforestry account system (AAS) as the private total production (PTP) plus the private operating subsidies net of taxes on products (POST) and minus the private intermediate consumption (PIC). The private operating income ($PNVA_{fc}$) neither includes government intermediate expenditures (GIE) nor the public free access environmental services consumption (FENOM). Instead, the self-consumption of environmental services (PENOM) is considered (Table 7):

$$PNVA_{fc} = PTP - PIC + POST = LC\,^{2} + PCNOM + PENOM + POST$$

The *dehesa* private operating income value ($PNVA_{fc}$) is highly influenced by the self-consumption of environmental services (PENOM) and the net subsidies transferred by government (OST). The operating income distribution among labour (LC), private commercial margin (PCNOM), private environmental margin (PENOM) and subsidies depend largely on *dehesas* heterogeneity of natural environment, government subsidies and man-made capital investment.

The social net value added at market prices (NVA_{mp}) is measured by the agroforestry account system (AAS) as the total production (TP) minus intermediate consumption (IC). In addition to private commercial operating margin (PCNOM), government intermediate expenditures (GIE) and the public consumption of environmental services (FNOM) are taken into account:

$$NVA_{mp} = TP - IC = LC + NOM = LC + CNOM + ENOM$$

$$CNOM = PCNOM + GCNOM$$

$$ENOM = PENOM + FENOM$$

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[2] In the four *dehesa* study cases, it is assumed that private labour cost (PLC) is the only *dehesas* labour income, that is, PLC = LC.

Government commercial net operating margin (GCNOM) is equal to minus government intermediate expenditures (GCNOM = –GIE) and FENOM is the public free access consumption of environmental services.

For measuring the hicksian total sustainable income (Hicks, 1946) the capital revaluation (Cr) and destruction (Cd), and capital subsidies net of taxes (CST) are required. In other words, capital gains have to be incorporated into the net value added as measured by the agroforestry account system (AAS) to obtain total sustainable income (TSI).

The productions in progress balance (PPB) [3] give the current revaluation (PPr) in the accounting period from the considered stocks and flows of production in progress (Table 5):

$$PPr = PPf + (PPu + PPd + PPow) – PPi – (PPb + PPo + PPoe)$$

The private fixed capital balance (PFCB) offers the current revaluation (FCr) and destruction (FCd) in the accounting period from the natural and human-made fixed capitals (Table 6):

$$FCr = FCf + (FCs + FCu + FCd + FCo) – FCi – (FCee + FCii + FCei)$$

The social and private current capital revaluations (Cr) [4] are the aggregation of productions in progress and fixed capital revaluation:

$$Cr = PPr + FCr$$

The nominal social capital gains (SCG_n) are measured by the AAS as current capital revaluation (Cr) minus capital destruction (Cd) in addition to the fixed capital consumption (FCC) to avoid double accounting when net value added is taken into account to calculate total sustainable income (Table 7):

$$SCG_n = Cr – Cd + FCC$$

The real social capital gains (SCG_r) are measured taking into account the increase of the consumer price index (p) on the accounting period:

$$SCG_r = Crr – Cd + FCC$$

$$Crr = Cr/(1 + p)$$

The nominal and real private capital gains (PCG) are obtained in these study cases (Table 7) adding to the social capital gains (SCG) the capital subsidies net of taxes on capital goods (CST):

$$PCG_n = SCG_n + CST$$

$$PCG_r = SCG_r + CST$$

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[3] In the four *dehesas* example only private production in progress goods have been considered, and then the same notation is used for both social and private balance of production in progress.

[4] It is noticed that in these four *dehesa* study cases, social and private current capital revaluations are recorded from the same capital goods, and then they present the same value. The same notation is used for current and real social and private capital revaluations, Cr and Crr, respectively.

In the absence of new discoveries and net transfers from outside the *dehesa,* the social total sustainable income (STSI) is measured as the sum of net value added at market prices (NVA_{mp}) and social capital gains (SCG):

$$\text{nominal social total sustainable income: } STSI_n = NVAmp + SCG_n$$

$$\text{real social total sustainable income: } STSI_r = NVAmp + SCG_r$$

The private total sustainable income (PTSI) is measured adding the private capital gains (PCG) to the private net value added at factor cost ($PNVA_{fc}$):

$$\text{nominal private total sustainable income: } PTSI_n = PNVA_{fc} + PCG_n$$

$$\text{real private total sustainable income: } PTSI_r = PNVA_{fc} + PCG_r$$

The *dehesa* study cases multiple-use total sustainable income has been measured by the AAS accounts of production (PA), production in progress (PPB) and fixed capital (FCB) (Tables 2a, 2b, 5 and 6).

For comparison aims of *dehesa* profitability rates with other alternative investment assets, a homogeneous (normalised) capital figure is required. This figure is called in the AAS immobilised capital (IMC) and represents an annual mean of the agroforestry farm capital investment during the accounting period.

In the AAS application to the *dehesas* study cases practical measurements of social (SIMC) and private immobilised capital (PIMC) are estimated by the following equations:

$$SIMC = FCi + PPi,nu + 0.5\ FCee + 0.5\ FCei + 0.5\ (TC - IP - FCC)$$

$$PIMC = PFCi + PPPi,nu + 0.5\ FCee + 0.5\ FCei + 0.5\ (PTC - PIP - FCC)$$

where PPi,nu and PPPi,nu are the social and private initial productions in progress stocks, respectively, that were not used in the accounting period.

Operating, gain and total profitability rates have been obtained from the AAS criteria applied to *dehesa* study cases (Figure 1). The commercial, environmental and subsidy profitability rates show the operating profitability rate that accrues to *dehesa* owners (Table 8). The gain rates represent the capital income originated by capital revaluation net of capital destruction in the accounting year. The total profitability rate is the homogeneous rate that could be compared with an alternative investment of similar risk and uncertainty of Monfragüe *dehesas* immobilised capital.

Valuation criteria applied to *dehesa* study cases

It is essential to apply real or simulated marginal market prices in the valuation framework of AAS. These criteria allow the linkage between environmental valuation and the IEEAF system of commercial valuation.

All *dehesa* production (TP) and cost (TC) values are accounted without operating subsidies net of taxes on products (OST).

Operating profitability rates	Capital gains rates	Total profitability rates
	Social	
Social total (p_{sto}) p_{sto} = NOM/SIMC	Nominal social (g_{sn}) g_{sn} = SCG $_n$/SIMC	Nominal social (p_{sn}) $p_{sn} = p_{sto} + g_{sn}$
Social commercial (p_{sco}) p_{sco}= CNOM/SIMC	Real social (g_{sr})	Real social total (p_{sr})
Social environmental (p_{seo}) p_{seo} = ENOM/SIMC	$g_{sr} = SCG_r/SIMC$	$p_{sr} = p_{sto} + g_{sr}$
	Private	
Private total (p_{pto}) p_{pto} = PNOS/PIMC	Nominal private (g_{pn}) $g_{pn} = PCG_n/PIMC$	Nominal private (p_{pn}) $p_{pn} = p_{pto} + g_{pn}$
Private commercial (p_{pco}) p_{pco} = PNOM/PIMC	Real private (g_{pr})	Real private (p_{pr})
Private environmental (p_{peo}) p_{peo} = PENOM/PIMC	$g_{pr} = PCG_r/PIMC$	$p_{pr} = p_{pto} + g_{pr}$
Subsidy (p_{pso}) p_{pso} = POST/PIMC		

Source: Own elaboration.

Fig. 1.–Operating, gains and total profitability rates

Commercial flows and assets have been measured by EAF and IEEAF criteria. The IEEAF system implies the use of annual commercial gross natural growth (CGNG) for calculating the annual value of reforestation and cork productions.

The commercial services are valued by the imputed rent (opportunity cost value) of workers' and owners' residences.

Demand functions for environmental services consumption have been estimated on the basis of *ad hoc* non-market valuation surveys (contingent valuation). The mean value for the public free recreation and conservation environmental services and half a median value for the owner's self-consumption of environmental services have been assumed as simulated *proxy* prices of marginal market prices.

The private fixed capital value of owners' self-consumption of environmental services is included in the market value of land. But in this market value of land, the social fixed capital value of the public consumption of environmental services does not exist, and its capital value has been estimated in this research by assuming a 2.5 % social discount rate from the mean value of the public free environmental services consumption (FNOM).

The current social and private capital revaluation coincide in the four *dehesa* study cases because the only exclusive social capital value, that is the capital revaluation of free public environmental services consumption, has not been taken into account. The real capital revaluation has been measured discounting current revaluation by Spanish annual mean increase of consumer price index in the year 1998.

The grazing resources, hay and dung, are the most important intermediate production in *dehesa.* The value of grazing resources and dung are related. The livestock grazing resources have a compound gross value constituted by the lent monetary value of grazing resources (explicit market price), and the implicit value of livestock dung. Rabbit dung has assumed the nearest market price for waste left by livestock on *dehesa* land when the animals graze or rest.

The value of annual cork production has been determined by discounting 7 % the price forecast for the future stripping year, considering also mean annual cork growth (in this case a private discount rate, incorporating risk, is used).

The below equation is applied to determine the joint value of holm oaks reforestation annual gross natural growth and reforestation revaluation:

$$V_0 (1 + i)^T + ex_t (1 + i)^{T-t} = V_T$$

where V_0 is initial reforestation investment expenditure, ex_t expenditure in year t, V_T is the market value of adult holm oak trees per hectare, and T is the year that the holm oak tree will become adult. On the left hand of the equation the reforestation capitalisation of initial investment and the following improvements done are presented.

From the above equation the discounting rate i could be estimated, and then annual holm oak reforestation natural growth and revaluation values are measured. A 3 % discounting rate is chosen due to the lack of silvicultural expenditure data for the complete reforestation cycle at the moment measuring holm oak reforestation value.

Cork oak reforestation has been annually valued considering the whole weighing of the expenditure in the complete cycle. The below equation expresses the natural gross growth estimation of cork oak reforestation ($CRNGG_t$):

$$CRNGG_t \quad \frac{ex_t X}{EX} \quad w_t \frac{RPP_T}{\sum_{t\ 0}^{T} w_t (1 \quad i)^{T\ t}}$$

where X is an instrumental variable, EX: total reforestation expenditures, ex_t: reforestation expenditures spent in the year t; $w_t = ex_t/EX$, and RPP_T: final reforestation production in progress in the year T ($RPP_T = V_T$). The discounting rate adopted for cork oak reforestation has been a rate of 3 % (it is assumed that reforestation has a lower risk than cork production, but the discount rate applied is still a private one, and not the social discount rate presented above), and then the instrumental variable X is given by the following equation:

$$X \quad \frac{RPP_T}{\sum_{t\ 0}^{T} w_t (1 \quad i)^{T\ t}}$$

The only accounted-for government expenditures are those used towards maintenance activities. It is assumed that the whole benefit of these expenditures is included in commercial and environmental production values in each study case. Government maintenance activities had a value of 9 euros per hectare in 1998.

Fixed capital consumption is accounted through lineal annual distribution of the initial cost of the capital goods price. Livestock and roads have not been factored into the measurement of fixed capital consumption.

The production of firewood includes the used fixed capital (FCu), because the number of dead trees used is unknown. There is no used tree withdrawal value accounted in the balance of fixed capital. In *dehesas* F3 and F4 fixed capital used (FCu) is under-valued, since adult trees cut were accounted as firewood from maintenance pruning because firewood data had not been separated.

Red deer margins in mixed holm and cork oaks *dehesas* F2 and F4 are measured taking into account *montería* output (meat value and hunting services paid by hunters) and *montería* expenditures. Red deer are uncontrolled in the open *dehesas* F2 and F4, therefore the consumption of grazing resources as well as capital balances in those areas were not estimated in this research. The applied hunting valuation criteria undervalue the grazing resources margins of *dehesas* F2 and F4 (Table 3).

Free public access to Monfragüe Natural Park amounts to five visits per hectare each year. It could be considered a conservative use of one public visit per hectare for the whole Monfragüe *dehesas* shire. A 1994 Monfragüe contingent valuation survey (Campos, 1996a) placed the mean value of a free public visit at 16.8 euros, according to 1998 prices. Half of this value is the public recreational value and the other half is conservation value (a mixed value of option and existence value). Contingent valuation of *dehesa'* owners final consumption (self-consumption) of environmental services gave a median value of 73.9 euros per hectare. A conservative value of half of the median of 36.96 euros per hectare has been assumed. Given the above, the two chosen environmental services values could be considered conservative measurements of their proxy market marginal values.

As currently stands in *dehesas,* owners generally have the right to deny the public free access. This is permitted so that *dehesas* owners can enjoy their own consumption of environmental services. This same privilege of self-consumption of environmental services has also been extended to the *dehesa* F1, which is owned by a private non-profit organisation (NPO).

ACCOUNTING RESULTS OF THE *DEHESA* STUDY CASES

A group of AAS physical and economic results are selected in order to describe Monfragüe *dehesas* study cases applications.

Physical indicators

A group of *dehesa* physical indicators is already presented in other specific study cases (Campos, 1996b; Campos *et al.*, 2001a). Table 1 shows a reduced number of physical indicators associated with the four Monfragüe *dehesa* study cases. The dehesas F1 and F3 have holm oak woodlands while only F2 and F4 have cork oak woodlands. Estate size varies from 300 to 4,000 hectares, work is carried out by employees, except for goatherd

management. F1 belongs to a non-profit organisation (NPO) while the rest of the estates, F2, F3 and F4, are privately owned.

Table 1

Selected physical indicators of Monfragüe *dehesas* study cases (Annual data from 1997/1998)

Class	Holm oaks		Mixed holm and cork oaks	
	F1	F3	F2	F4
Land uses (%)	100	100	100	100
Woodlands	*50*	*85*	*16*	*67*
Grasslands	*36*	*5*	*13*	
Shrublands			*71*	*31*
Croplands	*14*	*10*		*2*
Woodlands density (adult trees/ha)	10	30	80	36
Instantaneous stocking rate (ewe equivalent unit [1] per hectare)	2.20	2.39	0.77	1.14
Total livestock feeding (kg/ha of equivalent hay)	825	1,530	215	356
Livestock grazing extractions (% of total feeding)	*74*	*46*	*25*	*70*
Livestock productivity				
Cattle	*0.4*	*1.1*		*0.6*
Sheep	*1.2*	*1.0*		*1.3*
Goats			*0.8*	*0.7*
Pigs		*9.3*		
Total employment (hours/ha)	25.1	15.4	9.5	7.5
Employee (%)	*94*	*100*	*8*	*55*
Activities employment (% of total employment)	100	100	100	100
Forestry	*18*	*1*		*7*
Livestock	*49*	*64*	*100*	*68*
Crops		*5*		*4*
Commercial services	*7*	*2*		
Others	*26*	*28*		*21*

[1] Ewe equivalent unit represents a Spanish *merino* breeding ewe grazing in the *dehesa* at the beginning of the accounting period.
Source: Own elaboration.

One important peculiarity of agroforestry systems such as the *dehesas* is that grazing and cereal cropping can take place over woodlands. Additionally, treeless shrublands, grasslands and croplands are also found in *dehesa* estates and are equally grazed by controlled livestock and game (Table 1).

Oak woodlands occupy just over a third of total *dehesa* area in Spain (Díaz *et al.*, 1997). If looking at a particular estate, in all of the analysed cases except F2, oak woodlands are present at higher levels than in Spanish *dehesas* (Table 1). Land use distribution depends upon soil fertility for hay production and cereal cropping, so that today's oak woodlands are over soils whose fertility levels are not sufficient for cereal and treeless rough grassland production.

Management practices have been aimed at optimising grazing resources and, consequently, the tree density of oak woodlands may vary from 10 to 100 trees per hectare. Density is typically higher in cork oak woodlands (Table 1).

Livestock pressure over *dehesa* grazing resources impedes woodland sustainability and the effect worsens when Iberian pigs graze acorns, such as in estate F3. Total consumption for *dehesa* grazing resources varies from 215 to 1,530 kg/ha of equivalent hay in each of the *dehesa* study cases. Their grazing resource supply falls from 25 % to 74 % of metabolizable energy total livestock demand with no guarantee of natural tree generation (Table 1).

Current labour demand in *dehesa* study cases mainly comes from livestock-rearing activities with the exception of estate F1, where the NPO is incorporating new activities into its management practises. The non-profit offers free environmental education and recreational services to visitors (Tables 2a and 2b). *Dehesa* workers are labour employees (LE) as well as self-employed labourers (LSE). Across the *dehesas,* employees constitute the main supply for labour demand. In F2 and F4 there are relatively low levels of employees due to the presence of goat herds, which are owned by herd keepers and hence, labour associated to herd management is considered self-employment.

Extensive management practises and large-scale property, two representative *dehesa* features, justify comparatively low values of labour demand per hectare. Nonetheless, presented study cases have from high to low levels of labour demand if compared with other *dehesa* estates dedicated to livestock rearing. In these cases, annual labour demand may reach maximum levels of 25 hours per hectare (Campos, 1996b). F2 and F4's relatively low levels of employment are due to the presence of shrublands, and whose labour associated to cork stripping did not take place in the accounting period of 1997/98 (Table 1).

Economic indicators

Net value added

The production account (Tables 2a and 2b) shows in this occasion the private commercial net value added at market prices ($PCNVA_{mp}$) originated in the accounting period by the economic activities of *dehesa* F3.

If there is an interest in making comparison in a *dehesa* among individual goods and services or activities, then total production values are required and not final production values. The holm oaks *dehesa* F3 forestry activity shows a commercial total value of 64.17 euros per hectare, and only 2.9 of these euros are final production of firewood (Table 2a).

Livestock rearing in the *dehesa* generates more than 50 % of its commercial total production, and its dung is the second intermediate production value after grazing resources (Table 2a). For instance, in *dehesa* F3 livestock intermediate production contributes with 17.8 % of total intermediate production.

Other commercial total productions in *dehesa* are less important or occasional. Crops, for instance, play a cultural role by helping maintain rough grass productivity, which tends to be a marginal activity. Commercial services include workers' houses and the use by owners of residential services. The construction of infrastructure by own resources is a circumstantial fact in the *dehesa.* The three less important activities –crops, commercial services and own infrastructure construction– represent the 15 % of *dehesa* F3 commercial total production (Table 2a).

Table 2a

Private commercial production account of Monfragüe holm oaks *dehesa* F3: commercial total production (Annual data from 1997/1998; euros per 100 hectares)

Class	CTP	CIP	IRM	IS	CFP	GII	FS	FSP	OFP
Forestry	6,417	6,127	6,127		290		248	42	
Grazing resources	6,265	6,127	6,127		137		137		
Others	152				152		110	42	
Animals	41,313	1,747	1,747		39,566	2,419	18,680	18,467	
Livestock	41,078	1,747	1,747		39,331	2,419	18,445	18,467	
Cattle	*12,043*	*685*	*685*		*11,358*	*1,475*	*4,966*	*4,917*	
Sheep	*5,581*	*558*	*558*		*5,023*	*944*	*3,000*	*1,079*	
Pigs	*23,380*	*504*	*504*		*22,875*		*10,419*	*12,456*	
Horses	*75*				*75*		*59*	*16*	
Hunting	235				235		235		
Crops	1,838	1,308	1,308		531			531	
Services	1,936	639		639	1,297		1,008		289
Infrastructure	4,686				4,686	1,955		2,731	
Total	56,190	9,821	9,182	639	46,369	4,374	19,935	21,771	289

CTP: commercial total production; CIP: commercial intermediate production; IRM: intermediate raw materials; IS: intermediate services; CFP: commercial final production; GII: gross internal investments; FS: final sales; FSP: final stocks production; OFP: other final production.
Source: Own elaboration.

In the *dehesa* study cases, private commercial total cost (PCTC) practically accounts for total cost (TC). The government intermediate expenditures (GIE) are the only additional cost incorporated into the private commercial cost (PCTC). In *dehesa* F3 livestock cost represents more than 80 % of total cost. In this *dehesa* Iberian pigs are fattened, feeding mainly on external foods (ERM). The fattened pig is more dependent on external food than other livestock in the *dehesas.* The *dehesa* F3 forestry costs are the sum of dung and pruning costs. The crops, commercial services and construction of infrastructure altogether represent more than 15 % of *dehesa* F3 total cost (Table 2b).

The *dehesa* F3 own raw materials (ORM) coincides with intermediate raw materials (IRM), since there has not been consumption of own raw materials produced in *dehesa* F3 before the present accounting period.

The intermediate services (ISS) are machinery services used to generate livestock and crop productions. By definition the same ISS value is taken into account in intermediate production and consumption (Table 2a and 2b).

The production in progress used (PPu) in the *dehesa* study cases accounting period come from reforestation, initial and bought controlled replacement or kid animals, adult pigs changing from reproductive to fattened ones, and crop works in course. For instance, *dehesa* F3 presents animals and crop production in progress (Table 2a and 5).

The variation in labour costs (LC) across different *dehesa* estates depends on the intensity of environmental services and livestock activities. The labour cost has relatively less value than intermediate consumption (PIC), and for *dehesa* F3 it represents a 17.2 % of total cost (PCTC).

The fixed capital consumption (FCC) is generally low according to *dehesa* man-made investment, and as is shown in Table 2b, it consumes 6.2 % of private commercial gross operating margin (PCGOM):

$$PCGOM = PCNOM + FCC$$

The private commercial net operating margin (PCNOM) is negative in the NPO *dehesa* study case F1 and the three other *dehesa* study cases have moderated positive private commercial total margin. Table 3 presents the PCNOM originated in the main activities on the *dehesa* study cases. Cork production, grazing resources and hunting are the most important sources of positive margin in contrast to livestock, which produces a large negative margin.

The operating variable of higher interest for ownership is the commercial net operating surplus (PCNOS). As an illustrative example, Table 4 shows the commercial livestock surplus (PCNOS) among different species. Pigs are the only profitable livestock species at market prices (Table 4).

Considering margin and net subsidies only *dehesa* F3 has positive livestock net operating surplus. The high grazing resources demand by *serrano* cattleholders has originated a fast increase of annual grazing resources prices. When livestock intermediate consumption takes into account the own cost of grazing resources forestry surplus rises at the same value as livestock surplus decreases.

The *dehesa* F1 is an NPO, whose main interest is to conserve endemic livestock *(blanca cacereña* cow and *merina negra* sheep) that generates commercial losses. This livestock management improves environmental *dehesa* wild flora and fauna in danger of extinction, and additionally it helps produce free educational environmental services to the public. These activities are financed by private transfers and government subsidies. In

Table 2b

Private commercial production account of Monfragüe holm oaks *dehesa* F3: commercial total cost and net operating margin
(Annual data from 1997/1998; euros per 100 hectares)

Class	PCTC	PCIC	RM	ORM	ERM	SS	ISS	ESS	PPu	LC	FCC	PCNOM
Forestry	1,801	1,752	1,747	1,747		5		5		48		4,616
Grazing resources	1,747	1,747	1,747	1,747								4,518
Others	54	5				5		5		48		99
Animals	41,705	35,986	20,359	7,435	12,924	1,191	96	1,094	14,437	5,602	117	–392
Livestock	41,470	35,751	20,123	7,200	12,924	1,191	96	1,094	14,437	5,602	117	–392
Cattle	*11,861*	*10,789*	*5,880*	*3,733*	*2,147*	*447*	*66*	*381*	*4,462*	*1,034*	*37*	*182*
Sheep	*6,721*	*3,885*	*2,710*	*2,133*	*577*	*194*	*10*	*184*	*981*	*2,830*	*6*	*–1,140*
Pigs	*22,710*	*20,981*	*11,462*	*1,316*	*10,146*	*525*	*10*	*515*	*8,994*	*1,654*	*75*	*670*
Horses	*179*	*96*	*72*	*18*	*54*	*24*	*10*	*14*		*83*		*–104*
Hunting	235	235	235	235								
Crops	1,885	1,240	69		69	651	544	107	520	645		–47
Services	1,329	881	563		563	318		318		250	198	607
Infrastructure	4,686	2,375	2,135		2,135	240		240		2,310		
Total	51,406	42,235	24,873	9,182	15,692	2,404	640	1,764	14,957	8,855	315	4,784

PCTC: private commercial total cost; PCIC: private commercial intermediate consumption; RM: raw materials; ORM: own raw materials; ERM: external raw materials; SS: services; ISS: intermediate services; ESS: external services; PPu: production in progress used; LC: labour cost; FCC: fixed capital consumption; PCNOM: private commercial net operating margin.
Source: Own elaboration.

Table 3

Private commercial net operating margin of Monfragüe *dehesas* study cases (Annual data from 1997/1998; euros per 100 hectares)

Class	Holm oaks		Mixed holm and cork oaks	
	F1	F3	F2	F4
Cork			4,031	2,818
Grazing resources	2,582	4,518	800	1,722
Livestock	–5,710	–392	–2,160	–1,912
Hunting			4,628	1,520
Crops	–225	–47		–37
Commercial services	1,991	607	181	–47
Others	–1,162	99	–3	–713
Net operating margin (PCNOM)	–2,523	4,784	7,477	3,350

Source: Own elaboration.

the accounting period 1997/98 the *dehesa* F1 received operating subsidies (OST) accounting for 69 % of its private operating income ($PNVA_{fc}$). In this *dehesa* F1 operating subsidies over-compensated for a commercial margin loss of –7 % of private net value added at factor cost (Table 7).

The holm oaks F3 and mixed holm and cork oaks F4 *dehesas* have representative resources management for the whole *dehesa* area. In these cases labour income is the main singular operating income with more than one third of $PNVA_{fc}$. The private commercial (PCNOM) and environmental (PENOM) margins have similar values in *dehesas* F3 and F4, and they contribute above 17 % of private operating income ($PNVA_{fc}$). Subsidies on hectares based measurement present a low index for large *dehesa* estates [5] in comparison with the smallest ones. For example, subsidies account for 16 % and 8 % of F3 and F4 operating income, respectively (Table 7).

The mixed holm and cork oaks *dehesa* F2 represents a low livestock (goats) use. By contrast, it has a high red-deer-grazing-resources consumption in Monfragüe Natural Park. The *dehesa* F2 presents one of the highest relative contributions of cork production to owner commercial margin, and in this case the PCNOM reaches more than 50 % of private operating income (Table 7).

The *dehesa* social operating income value per hectare is low compared with the highest natural soil fertility of croplands in Monfragüe shire. The operating income distribution among labour, commercial margin and environmental margin depends on *dehesa* heterogeneity of natural environment and man-made capital investment. Labour income (LC) accounts for 18 % to 83 % of social operating income (NVA_{mp}). The commercial net operating margin (CNOM) contributes in the four *dehesa* study cases from –29 % to 45 % of the social net value added (NVA_{mp}). And the operating margin from environmental services (ENOM) accounts for 30 % to 46 % of the social operating income (Table 7).

[5] Dehesas F3 and F4 have more than 2,000 and 4,000 hectares, respectively.

Table 4

Private livestock commercial net operating surplus of Monfragüe dehesas study cases (Annual data from 1997/1998; euros per 100 hectares)

Class	Holm oaks						Mixed holm and cork oaks					
	F1			F3			F2			F4		
	PCNOM	OST	PCNOS	PCNOM	OST	PCNOS	PCNOM	OST	PCNOS	PCNOM	OST	PCNOS
Cattle	–1,715	2,379	663	182	2,746	2,928				–1,094	899	–195
Sheep	–3,995	2,559	–1,435	–1,140	1,234	94				–647	220	–427
Goats							–2,160	605	–1,554	–23	252	229
Pigs				670	–6	664						
Horses				–104	43	–62				–148		–148
Livestock	–5,710	4,938	–772	–392	4,017	3,625	–2,160	605	–1,554	–1,912	1,371	–540

PCNOM: private commercial net operating margin; OST: operating subsidies net of taxes on products; PCNOS: private commercial net operating surplus.
Source: Own elaboration.

Capital gains

In the holm oaks *dehesa* F3 there is no initial forestry production in progress (PPB). This situation occurs frequently in current *dehesa* tree management because trees lack natural regeneration and ageing. In the accounting period, the PPB of F3 presents initial and final stock-and-flow movements of livestock, crops and infrastructure (Table 5). There is no current production in progress revaluation (PPr) in Table 5. By definition, in this *dehesa* F3 study case all the goods accounted for in the private productions in progress balance (PPB) have instantaneous accounting in the private production account (PPA) or private fixes capital balance (PFCB) (Tables 2, 5 and 6).

In *dehesas* a real 5 % rate increase of land prices is a permanent fact since the 1970s (Campos, 1999c). And after a field survey on *dehesa* market transactions, a 10 % increase in land prices was recorded in the accounting period 1997/98. Table 6 shows that the increase of land price is the main source of private fixed capital revaluation.

For example, in *dehesa* F3 current capital revaluation (Cr) is equal to fixed capital revaluation (FCr) and becomes a considerable amount of 198 euros per hectare (Table 6). The Spanish 1998 mean increase of the consumer price index was 2.4 points in the accounting period, which produced a real capital revaluation value (Crr) of 193 euros per hectare in the *dehesa* F3.

The social and private capital gains are the same in all of the *dehesa* study cases, except for *dehesa* F4, which has received capital subsidies (CST). The capital gains in the accounting period have a similar contribution to total sustainable income as operating income (Table 7).

Social and private total sustainable income

The *dehesa* study case results show that capital income in the accounting period contributes between 80 and 90 % of nominal total sustainable income (Table 7). The *dehesa* is perceived as an extremely scarce good, as shown by the amounts of annual estate sales. During the last decades in Spain, the upper group income has experimented a quick increase and it is believed that *dehesa* buyers have high preferences on *dehesa* self-consumption of environmental services, generating a persistent growth of *dehesa* land prices since the 1970s (Campos, 1999c).

Immobilised capital

Capital value of public environmental service consumption and government intermediate expenditures (GIE) are the only additional items incorporated into private capital in order to measure the social immobilised capital. In the *dehesa* case studies, the PIMC contributes between 65 % and 80 % of the SIMC (Table 7).

Profitability rates

Private and social nominal profitability rates are presented in Table 8 for Monfragüe *dehesa* study cases. The commercial rates are moderated, except for cork oaks with low livestock grazing and red-deer-hunting management as is the case of *dehesa* F2. The environmental rates show more similar contributions to the total profitability rate than the commercial ones do. Subsidy rates are less important than commercial and environmental

Table 5

Private commercial production in progress balance of Monfragüe holm oaks *dehesa* F3 (Annual data from 1997/1998; euros per 100 hectares)

Class	Initial Stock (PPi)	Entrance			Withdrawal			Final Stock (PPf)	Current Revaluation (PPr)
		Bought (PPb)	Own (PPo)	Others (PPoe)	Utilised (PPu)	Extraordinary Destruction (PPd)	Others (PPow)		
Forestry			42					42	
Regeneration			42					42	
Livestock	14,388	49	18,395		14,437			18,395	
Cattle	4,451	12	4,917		4,462			4,917	
Cattle replacement	*3,393*		*639*		*3,393*			*639*	
Calves	*1,058*	*12*	*4,277*		*1,070*			*4,277*	
Sheep	944	37	1,079		981			1,079	
Sheep replacement	*708*	*37*	*854*		*745*			*854*	
Lambs	*236*		*224*		*236*			*224*	
Pigs	8,994		12,456		8,994			12,456	
Fat hogs	*7,727*		*8,122*		*7,727*			*8,122*	
Weaned pigs	*1,267*		*4,334*		*1,267*			*4,334*	
Horses			16					16	
Colt/young mare			*16*					*16*	
Crops	520		531		520			531	
Oats	520		531		520			531	
Infrastructure			2,731					2,731	
Private house			2,731					2,731	
Total	14,908	49	21,698		14,957			21,698	

Source: Own elaboration.

Table 6

Private fixed capital balance of Monfragüe holm oaks *dehesa* F3
(Annual data from 1997/1998; euros per 100 hectares)

Class	Managed Land 1	Infrastructure 2	Livestock 3	Machinery 4	Total Fixed Capital 5 = 1 + 2 + 3 + 4
1. Initial Fixed Capital (FCi)	194,175	36,999	17,694	2,350	251,218
2. Fixed Capital Entrance (FCe)		1,988	2,756	244	4,988
2.1. Existing external stock (FCee)		29	337		366
2.2. Gross investment (FCgi)		1,958	2,419	244	4,622
2.2.1. Internal gross investment (FCii)		*1,955*	*2,419*		*4,374*
2.2.2. External gross investment (FCei)		*4*		*244*	*248*
3. Fixed Capital Withdrawal (FCw)			273		273
3.1. Sales (FCs)			9		9
3.2. Use (FCu)			63		63
3.3. Destruction (FCd)			201		201
3.4. Other withdrawal (FCo)					
4. Final Fixed Capital (FCf)	213,592	40,682	19,025	2,466	275,766
Current Revaluation (FCr)	19,418	1,695	–1,152	–128	19,833

Source: Own elaboration.

Table 7

Income and capital of Monfragüe *dehesas* study cases (Annual data from 1997/1998; euros per 100 hectares)

Class	Holm oaks		Mixed holm and cork oaks	
	F1	F3	F2	F4
		Social		
Net value added at price market (NVA_{mp})	11,709	18,117	14,624	12,466
Commercial ($CNVA_{mp}$)	6,330	12,738	9,245	7,087
Labour cost (LC)	*9,754*	*8,855*	*2,669*	*4,638*
Net operating margin (CNOM)	*–3,425*	*3,883*	*6,576*	*2,448*
Environmental services (ENOM)	5,379	5,379	5,379	5,379
Capital gains (SCG_n)	20,582	19,948	13,351	25,608
Total sustainable income (STSI)	32,291	38,065	27,975	38,074
		Private		
Net value added at factor cost ($PNVA_{fc}$)	35,041	20,703	13,546	12,830
Commercial ($PCNVA_{mp}$)	7,231	13,640	10,146	7,988
Labour cost (LC)	*9,754*	*8,855*	*2,669*	*4,638*
Net operating margin (PCNOM)	*–2,523*	*4,784*	*7,477*	*3,350*
Self-consumption services (PENOM)	3,696	3,696	3,696	3,696
Operating subsidies (POST)	24,114	3,367	–296	1,146
Capital gains (PCG_n)	20,582	19,948	13,351	26,063
Total sustainable income (PTSI)	55,623	40,651	26,897	38,893
		Immobilised capital		
Social immobilised capital (SIMC)	345,561	339,473	194,356	305,044
Private immobilised capital (PIMC)	278,248	272,159	127,042	237,731

Source: Own elaboration.

rates, except for the NPO *dehesa* F1. The current social operating profitability rates vary in the case studies from 0.6 to 6.2 %, and the private operating rates oscillate between 3.4 % and 9.1 % (Table 8).

The gain rates of *dehesa* study cases are higher than the operating rates. The current social and private gain rates present figures of over 6 % in the accounting period (Table 8). The minimum real social and private gain rates are 5.7 and 7.1 % in the accounting period, respectively. In the last three decades, land prices of the *dehesas* could have increased at an annual real accumulative rate of over 5 % (Campos, 1999c).

The current social and private total rates are extraordinarily higher than the rates that could be obtained from alternative asset investments (Table 8). The minimum real social and private total profitability rates of the *dehesa* study cases are 6.3 and 11.4 % in the accounting period, respectively.

Table 8

Profitability rates of Monfragüe *dehesas* study cases (Annual data from 1997/1998)

Class	Holm oaks		Mixed holm and cork oaks	
	F1	F3	F2	F4
		Social (%)		
Operating rate (p_{sto})	0.6	2.7	6.2	2.6
Commercial (p_{sco})	–1.0	1.1	3.4	0.8
Environmental (p_{seo})	1.6	1.6	2.8	1.8
Gain rate (g_{sn})	6.0	5.9	6.9	8.4
Total profitability rate (p_{sn})	6.5	8.6	13.0	11.0
		Private (%)		
Operating rate (p_{pto})	9.1	4.4	8.6	3.4
Commercial (p_{pco})	–0.9	1.8	5.9	1.4
Self-consumption (p_{peo})	1.3	1.4	2.9	1.6
Subsidy rate (p_{pso})	8.7	1.2	–0.2	0.5
Gain rate (g_{pn})	7.4	7.3	10.5	11.0
Total profitability rate (p_{pn})	16.5	11.7	19.1	14.4

Source: Own elaboration.

DISCUSSION

The previous sections have shown that, by linking the three agroforestry accounting systems (AAS), the social and private total sustainable income could be obtained. Then, the *dehesa* incomes measured with the application of EAF and IEEAF accounting systems do not offer a correct *dehesa* income figure, according to the total economic value and hicksian income approaches.

Table 9 presents an income measurement comparison among the above-mentioned accounting systems. A theoretical inconsistency is seen in the *dehesa* income results obtained from the EAF and IEEAF accounting systems. For measuring total sustainable income, the consumption of environmental services, capital revaluation and capital destruction are required. Therefore, only if the complete economic flow-and-stock variations in the accounting period are considered it is possible to calculate total sustainable income. This was the purpose of the AAS approach in the measurement exercise done in the *dehesa* study cases.

It is not infrequent in the *dehesa* management of Monfragüe shire that landowner and cattleholder are different owners. Even more infrequently do goats belong to landowners. In *dehesas* F2 and F4 goats are owned by self-employed goatholders. In contrast, the present situation is that cattle, sheep and pigs generally belong to the *dehesa* owners. It is

Table 9

Social total sustainable income of Monfragüe holm oaks *dehesa* F3
Comparison of EAF, IEEAF and AAS systems measurements
(Annual data from 1997/1998; euros per 100 hectares)

Class	Commercial			Environmental	Total
	Measured by EAF (1)	Additions of IEEAF (2)	Additions of AAS (3)	Additions of AAS (4)	AAS 5 = 1 + 2 + 3 + 4
Total production	CTP 56,190	CGNG	CGTP	ENOM 5,379	TP 61,569
Intermediate consumption	CIC 27,278	CPPu 14,957	CGIC 902	EIC	IC 42,235
Gross value added	CGVA 28,912	CGNG-CPPu –14,957	CGTP-CGIC –902	EGVA 5,379	GVA 19,334
Fixed capital consumption	CFCC 315			EFCC	FCC 315
Net value added	CNVA 28,597	CGNG-CPPu –14,957	CGTP-CGIC –902	EGVA 5,379	NVA 18,117
Capital revaluation			CCr 19,833	ECr	Cr 19,833
Capital destruction			CCd 201	ECd	Cd 201
Capital gains			CCG 19,948	ECG	CG 19,948
Total sustainable income	CNVA 28,597	CGNG-CPPu –14,957	CGTP-CGIC+CCG 19,046	ENVA+ECG 5,379	TSI 38,065

Source: Own elaboration.

rare that only a single species grazes in a *dehesa* estate, but it is the case for *dehesa* F2 where only goats belonging to a goatholder graze the *dehesa.*

How does one explain the normal situation that landowner income from grazing resources is higher than income from one's own livestock? This happened in *dehesa* F3, in which grazing resources owner income was 45.18 euros per hectare compared to 36.25 euros of livestock owner income after subsidies (Tables 2b and 4). This livestock investment failure could be explained within the context of the owners' self-consumption of environmental services. If *dehesa* owners have strong preferences to consume their own recreational, legacy and existence livestock values, they will give up a relevant amount of commercial income from livestock. It is not the «lack of profit motive» (Torrell *et al.*, 2001) that explains *dehesa* owner livestock losses. Rather, higher self-consumption of environmental services nowadays could be the biggest interest of owners and potential *dehesa* buyers.

An increase in land prices real revaluation of the *dehesa* at an annual rate of more than 5 % might be an important economic reason behind the owners' self-consumption environmental services revaluation during the last few decades. It is believed that new successful business and professional people have strong incentives for livestock rearing and big hunting, and that these potential new *dehesa* buyers could provoke an increase in *dehesa* land prices simply to satisfy their self-consumption motive of environmental services, as was stated in the case of lidia cattelholders (Rouco *et al.*, 1997).

CONCLUSIONS

The selected AAS physical and economic basket of indicators presented shows the complexity of social and private results in *dehesa* management. Public visitors, policy makers and *dehesa* owners could find systematic and relevant management variables from the AAS to facilitate the decision making process.

Livestock rearing is a major nature conservation issue in *dehesa.* Current livestock management by the *dehesa* owner does not try to avoid the loss of trees by seeking out livestock grazing restrictions. The difficulties in perceiving the short-term irreversibility of the decline of *dehesa* trees is compounded by a lack of incentive in the long-term market as well as government failures. The market driving force spurs the conversion of *dehesa* woodlands into treeless land while government livestock subsidies accelerate this trend, increasing the overgrazing of natural tree regeneration.

The shortcomings of official statistical income records with regard to Mediterranean non-wood forest, as illustrated in the *dehesa* case, have been presented. It is time for the European Commission to implement a new system of forest economic accounting with economic externalities included. From this perspective the Eurostat commercial proposal IEEAF is a first necessary stage, but it must extend its scope in order to produce simulated proxy market environmental income from the wood and non-wood European forest.

Collaborating in this exciting and difficult task has been the purpose of the agroforestry accounting system. The *dehesa* case was a suitable laboratory in which the AAS found a fertile environment to develop.

Only *dehesa* F1 shows the private total income higher than the social one. The reason for these over-subsidies is government reforestation compensation. The rest of *dehesas*

present similar social and private total sustainable incomes. From the economic point of view in the context of no presence of irreversibility, it could be an efficient policy to prevent private income from exceeding social income. In this case, economic efficiency must not be the criterion, but the precautionary principle.

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RESUMEN

Hacia la medición de la renta total de la dehesa: teoría y estudios de caso en Monfragüe

Desde la década de los años setenta, la medición de la renta derivada del uso de los recursos naturales y la sustentabilidad tanto comercial como ambiental de sus resultados económicos ha sido motivo de controversia entre los economistas. Los pastizales desarbolados y las dehesas arboladas no han sido objeto del mismo interés científico que los bosques madereros. Hasta ahora las propuestas institucionales de sistemas contables de bosques madereros no han incorporado los beneficios de libre acceso y otros beneficios no-comerciales en la medición de la renta total de los bosques. Este trabajo presenta un sistema de cuentas completo que recoge todos los costes y beneficios económicos derivados de los usos activos y pasivos de los sistemas agroforestales, tanto si los beneficios son percibidos *in situ* como si tienen efecto fuera del lugar en el que se originan. Este nuevo marco metodológico contable se ha aplicado a un grupo de dehesas de la comarca de Monfragüe (Cáceres) con el propósito de presentar una medición, ampliada a las externalidades, de la renta total de uno de los sistemas agroforestales más complejos del uso múltiple de una tierra.

PALABRAS CLAVE: Cuentas agroforestales
Renta comercial
Renta ambiental
Dehesa

REFERENCES

BERGEN V., 1999. Framework and empirical content of forestry reporting in Germany. In: The living forest: Non-market benefits of forestry. Roper, C. S. and Park, A. (ed.), Forestry Commission, London, pp. 387-392.

CAMPOS P., 1996a. Encuesta de valoración contingente a los visitantes del parque natural de Monfragüe. In: The measurement and achievement of sustainable development. Pearce, D. W. (coord.), European Union DGXII EP-CT94-367. CSERGE-CSIC, London, Unpublished.

CAMPOS P., 1996b. Análisis técnico y económico de sistemas de dehesas y de montados. Informe final. CSIC/UTL(Lisboa) /SIDT(Badajoz)/ UNEX(Cáceres), Madrid, Spain, 116 pp.

CAMPOS P., 1999a. An agroforestry economic accounting system. In: Institutional aspects of managerial economics and accounting in forestry. Merlo M., Jöbstl H. and Venzi L. (ed.), Viterbo, IUFRO, pp. 9-19.
CAMPOS P., 1999b. Hacia la medición de la renta de bienestar del uso múltiple de un bosque. Investigación Agraria: Sistemas y Recursos Forestales, 2, 407-422.
CAMPOS P., 1999c. Alcornocales del suroeste ibérico. In: Los Montes y su Historia. Una perspectiva política, económica y social. Marín, F., Domingo J. and Calzado A. (ed.), Universidad de Huelva, Huelva, pp. 245-285.
CAMPOS P., 1999d. Un sistema de cuentas microeconómicas del uso múltiple de un espacio natural de interés ambiental. In: Lecturas de economía y medio ambiente. Casado, J.M. and Azqueta, D. (Compiladores), Consejo General de Colegio de Economistas de España, Madrid, pp. 71-98.
CAMPOS P., RODRÍGUEZ Y., CAPARRÓS A., 2001. Medición de la renta total sustentable en los sistemas agrarios de uso múltiple. IV Workshop Spanish-Portuguese on Rural Studies: La multifuncionalidad de los espacios rurales de la península Ibérica. AEEA/SPER/IDEGA, Santiago de Compostela, 7-8 June 2001, 20 pp.
CAPARRÓS A., CAMPOS P., MONTERO G., 2001. An operative framework for total hicksian income accounting: application to a multiple use forest. EAERE Annual Conference 2001, 28-30 June 2001, Southampton, 33 pp.
DÍAZ M., CAMPOS P., PULIDO F.J., 1997. The Spanish dehesas: a diversity in land-use and Wildlife. In: Farming and Birds in Europe. The Common Agricultural Policy and its Implications for Bird Conservation. Pain, D.J and Pienkowski, M.W, (eds), Academic Press, London, UK pp. 178-209
EUROSTAT, 1996. European system of accounts ESA-1995. European Communities, Luxembourg, 383 pp.
EUROSTAT, 1997. Manual on economic accounts for agriculture and forestry (Rev.1), European Communities, Luxembourg, 155 pp.
EUROSTAT, 1999a The European framework for integrated environmental and economic accounting for forests: results of pilot applications. European Communities, Luxembourg, 57 pp.
EUROSTAT, 1999b. The European Framework for Integrated Environmental and Economic Accounting for Forests (IEEAF). European Communities, Luxembourg, 106 pp.
EUROSTAT, 2000. Valuation of European forests. Results of IEEAF test applications. European Communities, Luxembourg, 106 pp.
HICKS J., 1946 (second edition). Value and capital. Oxford University Press, Oxford, 340 pp.
KRISTRÖM B., 1999. On the incorporation of non-market outputs of forests into national accounting systems. In: The living forest: non-market benefits of forestry. Roper, C.S. and Park, A. (ed.), Forestry Commission, London, pp. 400-409.
MERLO M., JÖBSTL H., 1999. Incorporating non-market values into the accounting systems of publicly and privately-owned forest enterprises: an operative stepwise approach. In: The living forest: non-market benefits of forestry. Roper, C.S. and Park, A. (ed.), Forestry Commission, London, pp. 341-372.
NORDHAUS W.D., KOKKELENBERG E.C. (ed.), 1999. Nature's Numbers: Expanding the national economic accounts to include the environment. National Academic Press, Washington D.C, 250 pp.
PEYRON J.L, 1998. Élaboration d'un sytème de comptes économiques articulés de la forêt au niveau national. ENGREF, Nancy, 364 pp.
ROUCO YANEZ A., RUIZ L., CALAHORRRA F.J., ROUCO PÉREZ P.F., 1997. Análisis financiero y de viabilidad de ganadería de lidia. II Congreso Mundial Taurino de Veterinaria. Córdoba, 27-29 de noviembre, pp. 133-141.
TORREL L.A, RIMBEY N.R, TANAKA J.A, BAILEY S.A., 2001. The lack of profit motive for ranching: implications for policy analysis. In: Current issues in rangeland resource economics. Torrel L.A, Bartlett, E.T and Larrañaga, R. (eds). New México State University, New Mexico, pp. 47-58.
UNITED NATIONS, 1993. Integrated environmental and economic accounting. United Nations, New York, 182 pp.
VAN DIEREN W. (ed.), 1995. Taking nature into account: A report to the Club of Rome. Springer-Verlag, New York, 332 pp.
VINCENT J.R., 1999. A framework for forest accounting. Forest Science 45(4), 552-561.