Integrated Economic and Environmental Accounting for Agriculture

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Abstract

This paper presents the methodological and conceptual aspects of a framework, which extends the conventional economic accounts for agriculture with environmental issues, valued in monetary terms. This leads to Economic *and Environmental* Accounts for Agriculture (EEAA). The EEAA are based on the conventional agricultural accounts and on existing tools for valuing non-market goods and services. The private costs and benefits of the sector are integrated with external "social" ones, i.e. commodity goods and services with non- commodity ones. Emphasis is put on those external costs and benefits that are already internalised as taxes and subsidies. As both positive and negative externalities are accounted for, the EEAA allow a better monitoring and evaluation of agriculture's multifunctionality. They enable simulating impacts of policy instruments, such as a subsidy increase, not only on agricultural income, but also on societal welfare. It also becomes possible to appreciate the shares of different stakeholders (producers, public authorities, water agency, consumers, etc.) in the costs or benefits of the environmental goods and services provided by agriculture. The case of Belgium, with an intensive agriculture in a highly urbanised context is given.

1. Introduction

Evaluating the multiple functions of agriculture and monitoring the related policies requires appropriate indicators. These should comprise the sector's economic value, but also reflect environmental concerns and non-market functions. Conventional agricultural accounts allow a macro level follow-up of the economic functions, but offer no insights in the multifunctional contribution of the agricultural sector to society, nor do they reflect the true costs and benefits of agricultural production for society.

This paper presents an integrated accounting system that provides a comprehensive perspective. A linkage is made between economic data from market transactions and both the costs of environmental bads and the benefits of environmental goods.

A general framework that uses quantitative internalisation of external effects is developed. The Economic *and Environmental* Accounts for Agriculture (EEAA) are built from the conventional agricultural accounts. Non-trade concerns, valued in monetary terms, are exogenously introduced. Relative shares can then be appreciated of those environmental goods and services that are already subject to market exchanges, those

that are partially "monetarised" through public intervention and those for which there is no market or public transaction (and thus require proxies like avoidance costs).

The paper is structured as follows. The next two sections discuss the study rationale and the extension from conventional welfare oriented accounts to more comprehensive well-being approaches. Section 4 shows the frame around which the accounts are built, the steps involved in the process and emphasises the accounting of subsidies and taxes. First results for Belgium are shown in section 5. Finally, some preliminary conclusions are drawn and further research orientations are discussed.

2. Need for more comprehensive accounting

2.1. Shortcomings of the conventional Economic Accounts for Agriculture (EAA)

The conventional Economic Accounts for Agriculture [Eurostat, 2000] focus on the measurement of economic performance and growth as reflected in market activities and their evolution over time. From these accounts, indicators such as the gross value added (GVA) or agricultural income are calculated. Table 1 shows an example of the EAA for Belgium. The calculated indicators are often interpreted as the agricultural sector's contribution to society. However, the sector's contribution to the mere welfare is only one component of its significance to societal well-being. Human well-being is also influenced by other factors, such as the quality of the environment. The conventional accounts do not feature such factors and thus ignore a main part of agriculture's multifunctionality.

Table 1: The EAA for Belgium in 2001 (in million euro).

	Output value at **basic** prices (incl. subsidies and taxes on products)	7 376,33
–	Intermediate consumption b.p.	4 562,14
	Gross value added at basic prices	**2 814,19**
–	Consumption of fixed capital	606,18
	Net Value Added at basic prices	**2 208,02**
–	Compensations of employees	321,40
+	Other subsidies on production (grants for interest relief, for set-aside, agro-environmental subsidies, etc.)	127,45
–	Other taxes on production (taxes on property, vehicles, pollution, etc)	16,96
	Net operating surplus (factor income)	**2 318,51**

Even the few internalisations of environmental concerns that currently enter into the EAA are not treated univocally. Most environmental taxes are taxes on products and thus enter into the basic price of the intermediate consumption and into the GVA. Most environmental subsidies are granted for specific methods of production and thus enter into the bulk of "other subsidies on production" and not into the GVA. Some environmentally inspired subsidies, such as the grant for cessation of animal production, are not entered into the EAA at all.

To provide policy-makers and public debate with a more comprehensive assessment of sustainable growth and development, first the environmental subsidies and taxes need to be emphasised, secondly the scope and coverage of economic accounting need to

be broadened. In order to reflect agriculture's multiple functions, it becomes necessary to set off economic data (monetary values) against social and environmental data (physical values). To be able to measure the impacts and responses of a policy correctly, sociological and environmental information needs to be made consistent with the economic monitoring.

2.2. Literature review on economic accounting for the environmental outputs

Efforts towards combining economic and environmental data up to now differ in exhaustiveness, but a full integration has not yet been reached. Physical accounting is abundantly done in various monitoring reports, e.g. the European Environmental Agency's annual report. More integrating systems are Material Flow Accounting, Input-Output Analysis [Goodlass *et al*. 2001], Asset Accounting and Ecological Footprinting methods [Rees and Wackernagel, 1996; Wackernagel *et al*., 1997; Hubacek and Giljum, 2003]. The mere physical data can already be linked to economic data in the so-called hybrid accounts. These allow deriving aggregate and ratio indicators, e.g. eco-efficiency indicators. Examples are the Material Input Per Service concept [Factor 10 Club, 1997] and the National Accounting Matrix including Environmental Accounts [NAMEA, De Haan and Keuning, 2000].

The main problem in balancing all costs and benefits is the conversion of various physical data to the same units as the economic accounts. Up to now several attempts have been made to assign monetary values to the negative externalities of agriculture, e.g. pesticide use [Pimentel *et al*., 1992; Waibel *et al*., 1999; Foster and Mourato, 2000; Pretty *et al*., 2000; Kærgård *et al*., 2002]; nutrient leaching [Bailey *et al*., 1999; Pretty *et al*., 2002] or erosion [Pimentel *et al*., 1995; Pretty *et al*., 2000]. Environmental economists have also developed methods for valuing environmental service functions, such as willingness-to-pay techniques [Freeman, 1993; Carson and Bergstrom, 2003]. Unfortunately, these have rarely been applied in comprehensive studies evaluating the aggregate positive side effects of agriculture. In Belgium, research by Vanslembrouck [2002], gives an economic assessment of landscape amenities provided by farmers. Difficulties in valuing the positive externalities of agriculture are undoubtedly the reason why they are often under-emphasized in economic assessments.

Until recently the environmental costs and benefits of agriculture had not been integrated into a comprehensive framework linking them with monetary dimensions at macro or sector-wide level. In contrast, some whole-economy attempts to integrate economic and environmental information were made, such as SERIEE [Système Européen de Rassemblement des Informations Economiques de l'Environnement; Kestemont, 1999; Eurostat, 2002]. However these systems lack sufficient detail to deal with the different agricultural productions and they are limited to those environmental aspects that can directly be expressed in monetary terms.

Breakthroughs are realised by our own research [Verhaegen *et al*., 2002, 2003] and by the "Framework for environmental accounts for agriculture" recently published by eftec [Atkinson *et al*., 2004]. Both accounting systems are based on the whole-economy

System for Environmental and Economic Accounts [UN, 2000]. This framework complements and expands the System of National Accounts [UN, 1993] to include environmental assets, non-commodity assets are monetised and both physical and monetary measures are integrated.

The eftec study provides monetary estimates of both the positive environmental services provided by agriculture and the negative flows resulting from over-use of natural assets. Distinction is made between impacts on other sectors and impacts on society's welfare in general The first, are valued trough market data, like purification costs, damage to roads from soil erosion, damage from flooding, etc. The latter are valued through non-market data derived from household willingness to pay (WTP). However, no effort is made to integrate these values into the economic accounts.

Eftec's starting points are similar to ours, except that they put the environment in the centre of the framework and thus account for agriculture's effect on different environmental compartments (water, air, soil, landscape, habitats and species, waste and nuisance). Our framework puts agricultural production in the centre and links the environmental outputs as closely as possible to the agricultural activities. This has the advantage that the accounts might be split up in different sub-sectors, by which means the activities where alterations need to be made can be identified more easily.

In or opinion, the mean weakness of the eftec approach is the lack of articulation between the classical economic accounts and the monetary estimations of environmental impacts. Because the income accounts are kept as a "black box" and the monetised externalities as satellite accounts, interpretation possibilities for the results are rather limited. For instance, the way in which agro-environmental subsidies and taxes are dealt with has to be stressed, as will be seen in section 4.2.

3. Building blocks and finalities of multifunctional accounting

Our accounting framework starts from the conventional Economic Accounts for Agriculture [EAA; Eurostat, 2000]. The non-commodity outputs are internalised into the EAA, which thus becomes extended to Economic *and Environmental* Accounts (EEAA). These "multifunctional" accounts are fully expressed in monetary terms and integrate on the one hand the costs of negative and on the other hand the value of positive externalities with the value added of agricultural production. The EEAA produces a "multifunctional value added", enabling a complete evaluation of sustainability over time.

This study goes beyond most of the "green accounting" efforts, as it internalises not only the negative environmental effects, but also the service or amenity function of agriculture. Building the EEAA involves three main research topics:

1. Definition of the system boundaries: not all externalities of agriculture activities need to be taken into account, either while their links with the activities are rather vague or too indirect (e.g. the depletion of natural resources for tractor manufacturing) or while estimation difficulties outweigh relevance (e.g. consumer's avoidance costs in relation with pollution, like the choice to drink only bottled water).

2. Association of flows of identified environmental goods and services and flows of pollutant emissions with monetary flows. Monetary values are derived from proxies like subsidies, taxes, treatment and restoration costs, etc. and from indirect valuation ("willingness to pay" approaches).
3. Integration these values with direct (market) flows into a single framework and calculation of aggregate indicators, such as a "multifunctional GVA".

From the EEAA, two types of analyses can be implemented. First, it becomes possible to appreciate the overall impact of multifunctional aspects of agriculture at national or regional level. This allows simulating scenarios (e.g. increasing agri-environmental subsidies), taking into account either the impact on agricultural income (through the effect on production level and the premium itself) or on societal welfare. Secondly, it allows evaluating the share of different actors (producers, public authorities, water agency, consumers, etc.) in the costs or benefits of environmental goods and services provided by agriculture. For example, the proposed framework emphasizes some aspects that are already internalised in the conventional accounts, like agro-environmental subsidies and taxes. In the conventional EAA, agriculture's income increases when subsidies increase. However, these subsidies are costs for society. In the EEAA the two effects are linked and can be compared. Thus, this approach allows for a better way to deal with financial transfers from society to farmers and conversely.

4. General framework and methodology

4.1. The accounting framework

While building the EEAA framework, the environment is considered to provide three functions to agriculture and to the economy and mankind in general: *source*, *sink* and *service* functions [UN, 2000]. Furthermore the agricultural system is evaluated according to the *driving force – pressure – state – impact* and *response* or DPSIR cause-effect chain [EEA, 1999]. The P- and S-indicators are typically measured in physical values. The I-indicators might be valued in monetary terms, through avoidance or restoration costs for the source and service functions or through revealed or stated preference techniques (WTP) for the service functions.

The R-indicators, the responses from the government, often consist in subsidies paid to (or taxes imposed on) farmers for adopting (or abandoning) certain (less) sustainable practices. Some, but not all of them already enter into the EAA. As subsidies and taxes form an exceptional type of benefits and costs, the way they are accounted for will be discussed in detail in section 4.2.

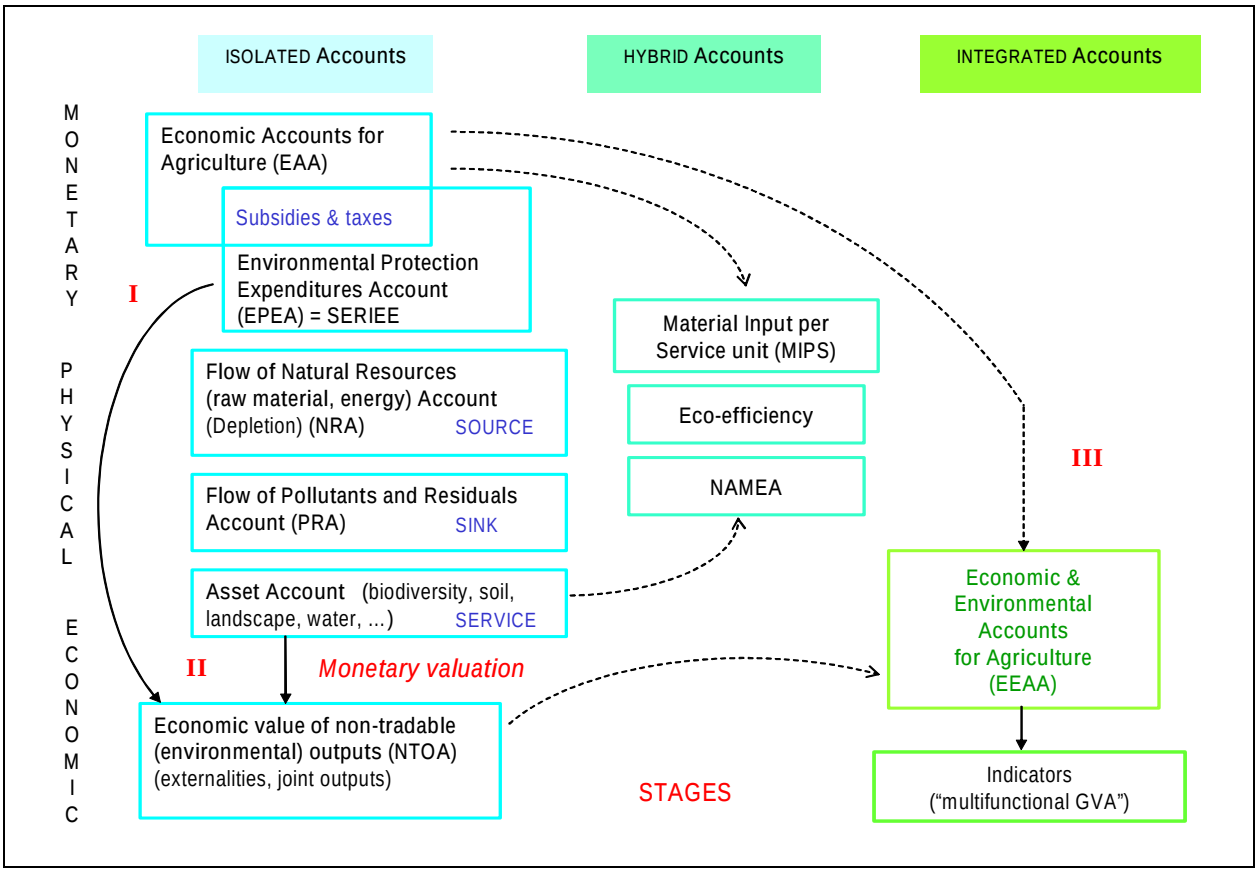
The general framework, with the different accounts proposed, is represented in figure 1. The EEAA are built in three stages.

The first stage comprises the monetary and physical accounts. The starting point is the conventional EAA, with the monetary driving factors (GVA etc.) and already including some subsidies and taxes (table 1). From the EAA and external information on

subsidies and taxes that are not yet internalised, the Environmental Protection Expenditures Account (EPEA) is derived. It reveals all the expenditures and investments concerning the environment, especially the public ones.

Next to the monetary accounts, satellite physical accounts are drawn up. They contain information on both pressure and state indicators and are differentiated into 3 accounts in order to reflect the 3 environmental functions. For example, the Pollutants and Residuals Account, reflecting the sink function, contains things like the nutrient surplus on the soil balance and the nitrate concentration in surface water. The Asset Account, reflecting the service function, contains for example the number of endangered animals/plants being kept/cultivated on farms.

Figure 1: General framework of the Economic and Environmental Accounts for Agriculture (EEAA).



In the second stage, monetary values are assigned to the positive and negative externalities in the physical accounts. Previously elaborated valuation methods are applied to the non-tradable by-products of agriculture. Together with the EPEA, these monetary values form the Non-Tradable Output Account (NTOA), which represents the economic value, i.e. the costs and benefits of the environmental goods and bads. The eftec study [Atkinson *et al*., 2004] stops at this point.

In the third and final stage, the NTOA is combined with the conventional EAA. At that point the complete DPSIR cause-effect chain is integrated into a single accounting system and the Economic and Environments Accounts for Agriculture (EEAA) arise. From these accounts indicators allowing a more “social” policy evaluation, such as the “multifunctional value added”, can be calculated. . In contrast to the current EAA, which only records private costs and benefits, the expanded EEAA also include the external environmental costs and benefits, i.e. the cost and benefits the rest of society. Table 2 gives an example for pesticide use (with negative externalities) and for landscape amenities (positive externalities).

4.2. Accounting for subsidies and taxes

Should agro-environmental subsidies and taxes be taken into account in the EEAA? In the eftec framework, they are not included. Atkinson *et al*. [2004] argue that the value of environmental impacts should be recorded regardless of the fact that they may be "internalised” through subsidies or taxes. Their primary rationale is to account for changes in natural assets, regardless of the policy measures in place, since it is not currently clear if taxes “over”- or “under”-regulate environmental impacts. Taxes can not be assumed “optimal” in the sense of internalising an externality consistent with the economic optimum; on the contrary, they represent a rather arbitrary form of “internalisation”. However, even if it is unlikely that subsidies and taxes reflect society’s true WTP, they are an important factor affecting the amount of an environmental function that is produced by the agricultural sector. When for instance nutrient surpluses are strictly taxed, the sector will try to abate its nutrient production or when small landscape elements are heavily subsidised, this is an incentive towards providing this service to society.

So there certainly is a linkage (even if very difficult to establish) between damage costs or WTP for a better environment and subsides and taxes. When the community accepts to pay farmers for less intensive agricultural practices, the damage and restoration costs for society will probably decrease, but the avoidance costs (here, contribution to the agricultural policy budget) increases. Government’s WTP should be considered as much as private (household) WTP. Precisely because it is not clear if any tax or subsidy internalises environmental impacts in a economic optimal way, we argue it is very useful and important to highlight these transfers between farmers and rest of the society and to record them together with other costs and benefits (table 2), when comparing environmental agricultural accounts in different spaces or time.

From an accounting point of view, subsidies increase farmer's Net Value Added and decrease the financial means of public authorities for preventing or repairing environmental degradation (and consequently increase taxation of citizens). In the EEAA, environmental subsidies and taxes appear only as transfers from one part (External social costs) to the other (Private costs and benefits). Therefore the agro-environmental subsidies and taxes are recorded twice, once with a positive and once with a negative sign.

Table 2: Examples of the EEAA for pesticide use and landscape amenities.

	Pesticide use		Landscape amenities	
	Private costs and benefits of the agricultural sector (EAA)			
	–	Output value of plant production Intermediate pesticide consumption, including tax on some pesticides	–	Total output value Total Intermediate consumption
	–	Gross Value Added at basic prices Consumption of fixed capital	–	Gross Value Added at basic prices Consumption of fixed capital
	+	Net Value Added at basic prices Environmental subsidies: organic farming, integrated fruit production, mechanical weed killing, etc.	+	Net Value Added at basic prices Environmental subsidies: Installation and/or maintenance of small landscape elements
	–	Environmental taxes: contribution for recycling recipients	/	
	+	(other subsidies – other taxes) on production	+	(other subsidies – other taxes) on production
	–	External social cost	+	External social benefits
	–	Environmental subsidies	–	subsidies
	+	Environmental taxes		
internalised	Avoidance cost	cost of reducing production or pesticide use	+	Value attached to landscape by society: value of living in the countryside, value of surroundings for rural tourism, recreational value, etc. ⇨ Mostly non-market values ⇨ valuation trough "willingness to pay" approaches: hedonic price analysis travel cost methods etc.
proxies	Abatement cost	cost of reducing environmental impact, e.g. by new products or new technology		
proxies	Treatment cost	end-of-pipe costs of decreasing the discharge of pollutants in the environment, e.g. cost of retrieving recipients		
proxies	Restoration costs	expenditures by third parties for restoring degraded natural systems cost for drinking water purification		
valuation methods	Damage costs	costs linked to over-use of environmental sinks, e.g. biodiversity loss, health problems		
	=	Multifunctional net value added		

valuation methods

The principal interest of the EEAA is not as much the absolute value of each section, but their relative weight and the overall evolution of their share over time. Therefore agro-environmental subsidies and taxes explicitly appear, despite their neutral effect on the total. One of the main purposes of the EEAA is to be able to monitor in long run which sections' importance is decreasing and which one is increasing.

5. Results

The physical accounts are drawn up as in classical environmental reporting. The next step is to elaborate the Environmental Protection Expenditures Account (EPEA). This elucidates the transfers between the government and the agricultural sector and overcomes inconsistencies in the conventional accounts mentioned above. The EPEA contains all environmental subsidies and taxes, irrespective of whether they already are in the EEA. For Belgium in 2001, the total environmental subsidies amount to 59 million euro, the total taxes to 19 million euro. Thus the net government expenditures amount to 40 million euro, i.e. 1.8 % of the net value added of the agricultural sector.

Still one step further, filling in the external social cost and benefits part of the EEAA necessitates valuation of external data. This is relatively easy for those environmental effects where market transactions are involved. But for those externalities, for which there is no market, people's willingness to pay (WTP) for amenities or to avoid damage needs to be assessed. However, implementing economic valuation for every environmental effect of agriculture is beyond the scope of our study. This means that WTP estimates have to be taken from literature. Unfortunately very few valuation studies have been undertaken at the Belgian level, so often the assumption will have to be made that WTP in Belgium is similar to that in other European countries. Table 3 shows the example of pesticide use and what the elements of the EEAA might look like.

Table 3: Elements of the EEAA for pesticide use.

	Private costs and benefits	euro	Comment
	Output value of plant production	3 217.58	
–	Intermediate pesticide consumption, including tax on some pesticides	- 180.15 (incl. – 1,0)	A tax of 2,5 euro/kg applies to 5 pesticides that are most often found in surface and ground water
+	Environmental subsidies	+ 3.86	Organic farming, integrated fruit production, management agreements for input reduction
–	Environmental taxes	n.a.	Waste tax on recipients not applicable, as > 80 % are retrieved
–	External social cost		
–	Environmental subsidies	- 3.86	EPEA
+	Environmental taxes	+ 1.00	
–	Avoidance cost	Costs for agriculture already internalised	Costs incurred following restrictions on or withdrawal of products ⇨ internalised via production value ↓
–	Abatement cost		Cost of adopting new technology ⇨ internalised via intermediate consumption (new products) or investment cost (e.g. adjusted sprayers)
–	Treatment cost	(- 8.75)	Operating cost of Phytofar Recover for retrieving recipients ⇨ to be entered in chemical, rather than agricultural account
–	Restoration costs	- 7.92	Cost of drinking water purification (in Flanders)
–	Damage costs	Need to be valued	Sources of valuation methods: - Biodiversity loss: Foster & Mourato [2000] - Human health: Waibel *et al*. [1999], Pretty *et al*. [2000] - Production loss in other sectors (e.g. fisheries)

6. Conclusions

We propose an integrated accounting framework that internalises on the one hand the costs of natural resource depletion and the use of the environment as a sink for negative externalities and on the other hand the value of agriculture's service functions. Filling in this framework in consecutive steps highlights society's expenses; the ratio of the physical values in the satellite environmental accounts to the conventional monetary values and the economic values of the non-tradable outputs; to finally get to the fully integrated Economic *and Environmental* Accounts for Agriculture (EEAA). As the integrative framework is built from the conventional economic accounting core (EAA) and is gradually built up through sub-accounts, the EEAA obtains a strong analytical power. Unfortunately, data collection is still ongoing and overall results, such as the

"multifunctional value added" are still missing. However, the principal interest of the EEAA is not as much the absolute value of each section or indicator, as their relative weight and the overall evolution of their share in total cost/benefit over time.

References

Atkinson, G.; Baldock, D.; Bowyer, C.; Newcombe, J.; Ozdemiroglu, E.; Pearce, D. and Provins, A. (2004), "Framework for environmental accounts for agriculture", London, Economics for the Environment Consultancy (eftec).

Bailey, A.P.; Rehman, T.; Park, J.; Keatunge, J.D.H. and Trainter, R.B. (1999), "Towards a method for the economic evaluation of environmental indicators for UK integrated arable farming systems", Agriculture, Ecosystems and Environment, vol. 72, pp. 145-158.

Carson, R.M. and Bergstrom, J.C. (2003), "A review of ecosystem valuation techniques", University of Georgia, Department of Agricultural and Applied Economics, Faculty Series 03-03.

De Haan, M. and Keuning, S. (2000), "The NAMEA as Validation Instrument for Environmental Macro-economics", Nota di Lavoro 90.2000, Milano, Fondazione Eni Enrico Mattei.

EEA (1999), "Environmental indicators: typology and overview", Technical report n° 25, Copenhagen, European Environment Agency, http://reports.eea.eu.int/TEC25/en/tech_25_text.pdf.

Eurostat (2000), "Manual on the economic accounts for agriculture and forestry EAA/EAF 97 (Rev. 1.1)", Luxemburg, European Communities.

Eurostat (2002), "SERIEE. Environmental Protection Expenditure Accounts – Compilation Guide", EC Methods and Nomenclature, theme 2: Economy and finance, Luxemburg, Eurostat.

Factor 10 Club (1997), "The International Factor 10 Club's Statement to Government and Business Leaders: a ten-fold leap in energy and resource efficiency" (1997 Carnoules Statement of the Factor 10 Club), Wuppertal, Factor 10 Club, http://www.factor10-institute.de.

Foster, V. and Mourato, S. (2000), "Valuing the multiple impacts of pesticide use in the UK: a contingent ranking approach", Journal of Agricultural Economics, vol. 51, n° 1, pp. 1-21.

Freeman, A.M. (1993), "The measurement of environmental and resource values, Theory and Methods", Washington D.C., Resources for the Furture, 516 pp.

Goodlass, G.; Halberg, N. and Verschuur, G. (2001), "Study on Input/Output Accounting Systems", CLM 489, Utrecht, Centre for Agriculture and Environment.

Hubacek, K. and Giljum, S. (2003), "Applying physical input-output analysis to estimate land appropriation (ecological footprints) of international trade activities", Ecological Economics, vol. 44, pp. 137-151.

Kærgård, N.; Fransen, S.E.; Jøgensen, A.W.; Ørum, J.E.; Jacobsen, L.B. and Dubgaard, A. (2001), "The economics of pesticides in Danish Agriculture", Proceedings from the Seminar on the Multifunctionality of Agriculture, University of Bergen, 16-18 February 2001.

Kestemont, B. (1999), "Le compte des dépenses de protection de l'environnement en Belgique, Première évaluation suivant la méthode SERIEE", ACCT-EXP/99/4.2.1, Luxembourg, Eurostat, 84 pp. http://www.ulb.ac.be/ceese/STAFF/bkest/421FR.pdf

Pimentel, D.; Acguay, H.; Biltonen, M.; Rice, P.; Silva, M.; Nelson, J.; Lipner, V.; Giordano, S.; Harowitz, A. and d'Amore, M. (1992), "Environmental and economic cost of pesticide use", Bioscience, vol. 42, n° 10, pp. 750-760.

Pimentel, D.; Harvey, C.; Resosudarmo, P.; Sinclair, K.; Kunz, D.; McNair, M.; Crist, S.; Shpritz, L.; Fitton, L.; Saffouri, R. and Blair, R. (1995), "Environmental and economic costs of soil erosion and conservation benefits", Science, vol. 267, pp. 1117-1123.

Pretty, J.N.; Brett, C.; Gee, D.; Hine, R.E.; Mason, C.F.; Morison, J.I.L.; Raven, H.; Rayment, M.D. and van der Bijl, G. (2000), "An assessment of the total external costs of UK agriculture", Agricultural Systems, vol. 65, pp. 113-136.

Pretty, J.N.; Mason, C.F.; Nedwell, D.B. and Hine, R.E. (2002), "A preliminary assessment of the environmental costs of the eurtrophication of fresh waters in England and Wales", Centre for Environment and Society (CES), University of Essex, Occasional Paper 2002-1, Essex, CES.

Rees, W. and Wackernagel, M. (1996), "Our ecological footprint. Reducing human impact on the earth" Gabriola Islands, British Columbia, New Society Publishers.

United Nations, International Monetary Fund, Commission of the European Communities, OECD and World Bank (1993), "System of National Accounts", New York, United Nations.

United Nations, World Bank, OECD and Eurostat (2000), “System of Environmental and Economic Accounting”, New York, United Nations, http://www4.statcan.ca/citygrp/london/london.htm
Vanslembrouck I. (2002), “Economic assessment of landscape amenities provision by farmers”, PhD thesis, Ghent University.
Verhaegen, E.; Campens, V.; Wustenberghs, H.; Lauwers, L. and Nutelet, R. (2002), “TAPAS 2001 (5), Environmental Aspects of Agricultural Accounts, Execution report”, Brussels, Centre for Agricultural Economics.
Verhaegen, E.; Wustenberghs, H. and Lauwers, L. (2003), “Elements for “green accounts” for the agricultural sector”, TAPAS 2002, Environmental Aspects of Agricultural Accounts, Execution report, Brussels, Centre for Agricultural Economics.
Wackernagel, M.; Onisto, L.; Callejas Linares, A.; Lopéz Falfán, I.S.; Méndez García, J.; Suárez Guerrero, A.I. and Suárez Guerrero, G. (1997), “Ecological footprints of Nations. How much nature do they use? How much nature do they have?”, International Council for Local Environmental Initiatives (ICLEI), http://www.ecouncil.ac.cr/rio/focus/report.
Waibel, H.; Fleischer, G. and Becker, H. (1999), “The economic benefits of pesticides: a case study from Germany”, Agrarwirtschaft, vol. 48, n° 6, pp. 219 230.