

ENVIRONMENTAL ACCOUNTING IN AGRICULTURE AND FORESTRY: A STEPWISE APPROACH

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SUMMARY

This paper illustrates a stepwise enterprise approach to enterprise environmental accounting. It starts with traditional balance sheets of four agricultural and forest enterprises following traditional accounting principles. A second step separates environmental/recreational activities from conventional ones, that is timber and agricultural products. A third step outlines near market values, as perceived by the entrepreneur as hidden private values. A fourth step opens up to positive and negative public effects and externalities making possible a quantification of public welfare effects. The last step, therefore, aims at incorporating all non-market benefits and costs. Satellite accounts and *addenda*, including physical biological aspects, can also be used. The methodology, though enlarged to environmental/social issues, remains strictly based on accounting principles. So far, it has been applied to several case studies proving to be a useful tool both in managerial economics as well in environmental and social planning and decision-making in rural areas.

KEY WORDS: Environmental accounting
Stepwise approach
Agricultural forest enterprises

INTRODUCTION: OBJECTIVES AND CONTENTS

This paper presents a stepwise approach to environmental accounting of forest and agricultural enterprises. Traditional accounting principles are maintained throughout the various steps of the procedure allowing to take into account positive and negative environmental public effects (goods and bads) as well externalities linked to forestry and farming. The environment is conceived as *latu sensu* and includes nature, landscape and recreation.

The scope of the paper is to provide a viable procedure useful to both private entrepreneurs and public decision-makers. The various steps mark the passage from private to public interests and the related objective functions from the traditional net income or profit to an environmentally adjusted net income, a proxy of community welfare.

Recent development of environmental accounting at a national level is outlined, stressing how true environmental accounting needs local enterprise references. Therefore, a step-wise procedure is proposed and applied and starts with traditional accounting (balance sheet and income statement) integrated step by step with the consideration of positive and negative public effects and externalities. Specific accounts of forest and agricultural enterprises are reported. It is therefore tested how the proposed methodology is able to encompass various goods and bads as well as externalities linked to forestry and farming.

FROM MACRO (NATIONAL) TO MICRO (ENTERPRISE) ENVIRONMENTAL ACCOUNTING

Environmental accounting was first developed in the 60s - 70s at a national level in order to answer growing worry about the state of the environment and related natural resources. Nordhaus and Tobin (1972) proposed to calculate the so-called Net Economic Welfare, adjusting the national income according to the state of natural resources. Depletion/degradation of natural capital and environmental stewardship costs should have been taken into consideration (Lutz, 1993). Guidelines to adjust national accounts have therefore been provided (United Nations, 1968). A support towards environmental accounting as a tool to verify sustainable management and development has been given by Brundtland Committee (1987) and the Rio Summit (1992). More environmentally aimed approaches have been therefore proposed (Peskin and Lutz, 1993). The manual for national accounts produced by the United Nations (UN) System of National Account - SNA (UN, 1993) has been significant and has been accepted by the European Union: European System of National and Regional Accounts - ESA (EUROSTAT, 1995).

The reference to conventional enterprise accounting

Environmental accounting carried on two features and needs (to a large extent ignored up to now by national accounts): from one side the reference to local (enterprise) level, from the other, consequently, the adoption of traditional enterprise accounting methodology. Incidentally this approach was regarded as unavoidable by Daly (1988), supporting Fisher's old national dividend in opposition to Keynes calculation of national income. He stated, «had the national accounts developed in accordance with Fisher's concepts, their extension to cover environmental services and ecological and geological capital depletion would have been obvious and easy, except for valuation problems for services without market. As it is now incorporation of ecological services and natural capital must be very ad hoc, and in fact it may ultimately be necessary to adopt Fischer's approach».

Quite clearly for economic policies developed after the 30s there was a need to account primarily for economic financial aggregates like investment, production, demand and employment, overlooking the assets and particularly natural resources. When scarcity of natural resources and environment degradation/depletion became at least equally important, in the second half of 20th century, methods of accounting needed to be changed to reflect the new reality.

One such interesting attempt was made by Adger and Whitby (1991, 1993) who proposed modifying British agricultural product by adding the value of carbon fixation and other public services while deducing defensive expenditures. The overall results indicated a 20 % increase in net product. The Economist (January 18th, 1992) commented: «allow for the pleasure given by the green belt and national park, and throw in something for the effect of tree planting on mopping up global warming carbon dioxide and *presto* a sustainable net product is 25 % bigger than net product». This was rather different than the approach of other authors. A «wide range of unaccounted environmental resources is not a reason for including these benefits», they stated. What counts is significant deterioration that can be avoided or enhancement that can be encouraged (Lindall, 1995). Therefore the question is consideration of total flows and stocks, or limitation to variation, and around this problem rests the main issue of environmental accounting.

Though tentative, these attempts paid new attention to building environmental accounts in which the information flow should have followed a circle from «micro» to «macro» and then back to «micro». This was considered essential toward promoting positive and fighting negative environmental impacts at the local level, where they are produced according to the well known aphorism: «think globally, but act locally».

Enterprise environmental accounting methods also allow environmental variables to be included within the decision-making process (Bartolomeo, 1997), a need particularly felt in farming and forestry. These public policies are aimed at the quality of rural environments, while traditional financial support is conditioned on certain environmental standards, what is known as cross compliance or ecoconditionality. This logic has been stressed since the 1992 reform of the Common Agricultural Policy (CAP), even more stringently confirmed by 1999 Agenda 2000, particularly Regulation 1257/99 on Rural Development, in which premiums are considered for those adopting environmentally beneficial farming and forestry practices. Notwithstanding these developments, very little has been done for «greening» accounting methodologies in agriculture and forestry except for a few applications including those of Campos (1998), Campos and López (1998), Ciani *et al.* (1998), Caggiati *et al.* (1998), CESET-AAVV (1998) and Merlo (1996). Quite clearly they could represent, once widely accepted, the main instrument for supporting the so-called «greening» of EU agricultural and environmental policies.

The consideration of *biota*: another key issue

In agriculture and forestry environmental accounting, another key issue arises from the consideration of the various *biota*. One should think about the forest-growing stock, biodiversity, fauna and flora. EUROSTAT (1995) adopting United Nations SNA (United Nations, 1993a, 1993b), tried to avoid some contradictions linked to a superficial consideration of natural and semi-natural *biota* that are, to an extent, non-renewable, as can be the case of a natural forest-growing stock. There is an explicit difference between renewable *biota* such as poplar-plantation-growing stock, and a less renewable growing stock such as natural and semi-natural forest ecosystems, managed according to close-to-nature forestry principles within protected areas. Misunderstandings remain for forests outside protected areas in which EUROSTAT separates the soil defined as a «material good» from the growing stock. This can lead to such mistakes as shown by Harrison (1993), who

states that «the manifest error in this assumption» is particularly evident «with regards to tropical rain forest».

In defining stocks and flows of *biota*, one must separate the object of cultivation into two categories: that which is renewable and that which is not renewable (or, at least, not renewable once the limits of sustainability are exceeded). This issue does not seem to have been solved satisfactorily. In addition the problem goes far beyond forest ecosystems and the related growing stock, involving the concepts of agricultural and forest soils, potentially depletable resources; and even more relevant biodiversity, much affected by agricultural and forest uses and practices.

A PROPOSAL OF ENTERPRISE ENVIRONMENTAL ACCOUNTING

As already shown, methodologies and schemes for enterprise environmental accounting in agriculture and forestry are far from being codified and unanimously accepted. Up to now they have largely consisted of experiments based on voluntary adhesion, underscoring difficulties in definition, quantification and pricing of environmental impacts of individual enterprises. As a result of these methods, even a common terminology is still lacking. There is a strongly felt need to make the various proposed schemes homogeneous for the sake of transparencies and comparability among enterprises and consistency with national environmental accounting. There is also a search for a compromise between the need to inform the external world, mainly linked to agricultural and forest policies, and the usual confidential nature of management accounting.

The methodology proposed herein is derived from conventional financial accounting and tries to integrate, step-by-step, environmental values within the accounting system. The crucial problem is how to consider the various items of the balance sheet and income statement which do not have a market price: such factors as pollution, landscape quality, biodiversity and the state of the environment, as characterised by the depletion/degradation of natural resources. These environmental values, or impacts, are far from being well defined, let alone quantified. One reason is the difficulty of determining positive or negative impact. For instance, a forest provides important positive effects if managed through continuous coverage, uneven-aged, close-to-nature systems. Also, more intensive forest systems (even-aged with clear felling) provide positive effects if compared to arable land use. However, these effects can also be interpreted as negative when compared to uneven-aged continuous coverage. It all depends on the reference points, or threshold benchmarks.

In order to solve these problems, preliminary to any possible approach to environmental accounting, the proposed methodology accepts that normal ordinary practices are sound practices. Something like this is, to a certain extent, applied by the Italian Act 146/94 adopting the so-called «Nitrate Directive» (CEE 676/91) of the EU. Article 37, following the request of the directive, introduces the concept of «Good Agricultural Practices Code», to be prepared by the Ministries of Agriculture (MIRAF, 1995) of the various EU member countries. The Italian Ministry of the Environment has made the code operative with a Decree of Decree of 19 April 1999 (Benedetti and Sequi, 1999). Notwithstanding the ambitious term «Code» it is, however, a matter of guidelines, a «process» towards an improved way of farming and forestry. All this means reference to practices, and environmental impacts, of

farmers adopting crop patterns and techniques, which are normal, ordinary, neither better, nor worse, than the average. Given, however, the widespread availability of extension services, and the environmental awareness of farmers, the criterion also supposes that «normal practices» coincide to what today are considered good practices, including provision of public goods and services, prevention of negative externalities and, in the end, conservation of natural resources. To a certain extent one can also assume that good ordinary practices should correspond to the so-called BAT (Best Available Technologies).

This does not imply that negative environmental impacts are not taking place, as it is the case, after all, of many human activities. It is rather supposed that negative impacts must be restricted to acceptable benchmarks, defining what is positive, what is negative, and what is acceptable (OECD, 1998; Gatto *et al.*, 1999; Gatto *et al.* 2000). Incidentally, this concept is well established in land appraisal where real estate is valued according to ongoing normal practices. Also, accounting practice makes reference to «generally accepted principles». One can conclude that accounting practice as a pragmatic exercise accepts and needs approximation to normality.

Figure 1 tries to outline what could be the benchmarks, making clear that different attributes of the environment should be considered, such as physical, natural and recreational. This also means that a certain practice having positive impacts on one attribute can have negative impacts on another. For instance, irrigation and fertilization can

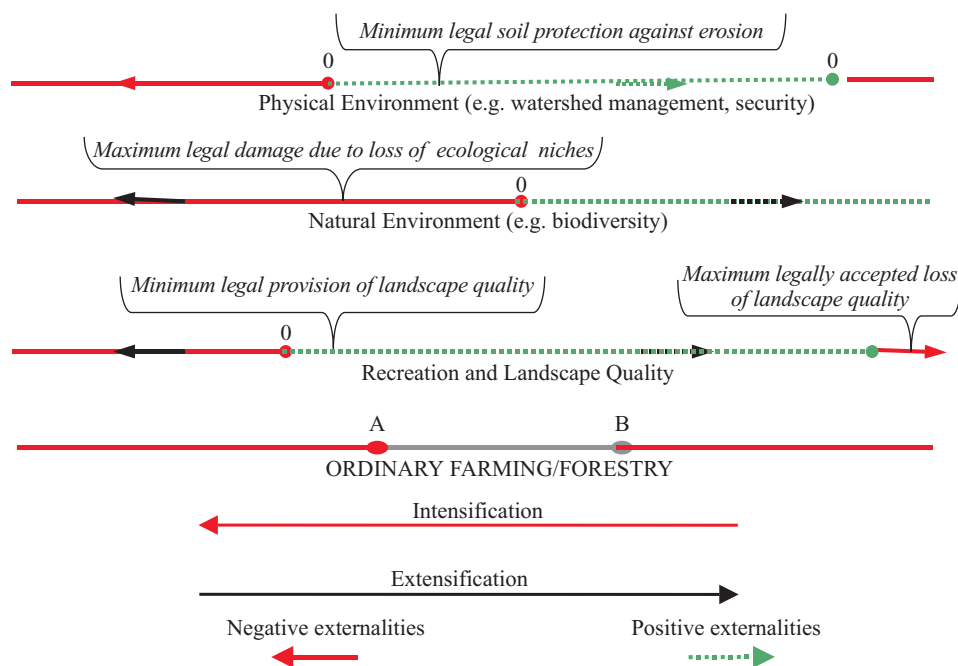


Fig. 1.—Positive and negative impacts of farming and forestry: possible benchmarks

Source: Gatto and Merlo (1999; 2000).

«green» meadows and pastures (positive landscape impact), but decrease the natural environment (negative environmental impact).

Environmental accounting methodology proposed herein, once the crucial issue of benchmarks and references is solved, is articulated in four steps, each of which deepens the accounting of environmental values. Every step, or level of accounting, should correspond to subsequent consideration, or integration, of the various enterprise outputs-inputs and state of the stock. As shown by Table 1, each step is significant of a wider consideration of enterprise objectives and impacts, starting with private aspects (profit and loss) and opening up gradually to public aspects (social income and welfare gauged by environmental quality). In other words, each level of deepening the analysis (accounting step) corresponds to an enlarged concept of profit and loss which tries to express, through a subsequent approximation, the environmental impacts of the enterprise. Both components of the accounting system, income statement and balance sheet, are considered and affected.

In practice the first step (level 1) consists of showing the total equity and the net income (profit/loss) for the year –the traditional balance sheet and income statement. The second step tries to separate the net income and equity/liability into conventional activities on the one hand and production of environmental goods and services considered by market prices on the other hand (level 2).

The third step accounts for «hidden» environmental values as perceived by the enterprise, both in terms of income and equity (level 3). Hidden values are those which have no immediate market effect but are eventually felt by the market under specific circumstances such as the collapse of natural capital (soil degradation, forest fires, etc.) linked to non-sustainable practices. The market can anticipate these effects whenever real estate is put on sale.

Table 1
The stepwise approach to enterprise environmental accounting

Steps or levels	Items included in the balance sheet	Accounting objectives	Type of profit and loss
1	Financial receipts and expenditures	Private	Financial profit and loss
2	Financial receipts and expenditures separated according to ordinary and environmental activities	Private with separation of ordinary and environmental activities	Financial profit and loss divided into ordinary and environmental activities
3	Incorporation of non-monetary costs and benefits concerning the enterprise alone	Private with consideration of hidden environmental costs and benefits	Financial profit and loss plus non-monetary private profit and loss
4	Incorporation of non-monetary costs and benefits concerning the society as a whole	Public	Social profit/welfare

The last step (level 4), certainly the most difficult to quantify, tries to integrate within the balance sheet costs and benefits consisting of public goods/bads and externalities. What is expressed through the fourth step is a kind of social income and equity, that is welfare, positively or negatively affected by agriculture and forest enterprises¹.

CASE STUDIES OF ENTERPRISE ENVIRONMENTAL ACCOUNTING

In order to show the application of the proposed methodology and its outcome within different enterprises and under various circumstances, four applications are reported:

A large public forest of the Eastern Alps where important public environmental and recreational benefits are provided in addition to traditional timber production.

A large lowland public farm with mixed output including cereals and beef plus public benefits recently developed particularly in a coastland pine wood.

A medium pre-alpine private farm where output is linked to dairy production plus agritourism and quality products.

A small lowland horticultural farm adopting organic farming and quality schemes where produce is sold directly to consumers.

Full accounting results are reported only for the first enterprise. For the remaining three only the net income at the various accounting steps is shown.

A Large Public Forest of the Eastern Alps

With 20,000 hectares it is one of the largest publicly owned and managed forest properties of the Italian Eastern Alps. The area has been designated, but not yet approved, as a Forest regime, watershed bonds and various other measures protect the area where the forest enterprise is located. In addition, it includes two nature reserves. Nature conservation (e.g. bears) and recreation (185,000 visits per year) are paramount objectives. But timber production remains essential, representing the only revenue able to support management costs. In fact, more than 10,000 hectares are still mainly devoted to timber production, representing half the area. Annual felling is 30,000 m³ while growth should be over 50,000 m³. Average growing stock, including marginal non-productive areas, is 264 m³. Local residents are entitled to a share of total timber production equivalent to roughly 10,000 m³.

¹ Quite clearly the methodology of environmental accounting proposed herein shows striking similarities with cost-benefit analysis. As stated by Little and Mirlees (1974) «the essence of a cost-benefit analysis is that it does *not* accept that actual receipts adequately measure social benefits and actual expenditures social costs. But it does accept that actual receipts and expenditures can be suitably adjusted so that the difference between them, which is therefore very closely analogous to ordinary profit, will properly reflect the social gain. The prices used, after such adjustments have been made, will be called “social accounting prices”; or for short accounting prices». Incidentally, Siniscalco (1995) has also noted these similarities.

The income statement (Table 1.1) shows how timber is the most relevant item of revenue, contributing roughly 930,000 euro to the production value. However, 363,000 of those euro are not actually received by the enterprise, but are distributed to local inhabitants. Public subsidies totalling 988,000 euro, received from the Ministry of Agriculture (MiPAF), are aimed at covering personnel salaries almost entirely². An additional 108,000 euro are contributed by MiPAF as compensation for forest fire services provided

Table 1.1
Income statement (1998-1999, average values)

CLASS	Euro
A) Revenue	2,190,340
Timber sold	566,486
Timber redistributed to local inhabitants	363,325
Subsidies from the Ministry of Agriculture (MiPAF) to support personnel salaries	988,113
Compensation from the Ministry of Agriculture (MiPAF) for forest fire services	108,232
Other compensation for environmental enhancement measures	91,448
Contribution to local inhabitants timber measurement	22,379
Rents of buildings to personnel	16,910
Rents of buildings to third parties	8,675
Mushroom-picking permits	15,494
Small wood collection and quarry concessions	6,300
Other temporary concessions (e.g. ski tracks)	1,748
Hunting and fishing concessions	1,229
B) Cost	1,317,075
Salaries and social security	1,064,196
Forest fire services	88,014
Consumables and energy	78,754
Landscape and environmental stewardship expenditures	16,165
Fauna protection and care	6,197
Forest management and stewardship	11,119
Depreciation, maintenance and insurance of equipment and machinery	41,486
Depreciation, building maintenance and insurance	8,257
Research and Development (R & D)	2,200
Public Relations (PR)	685
C) Result (A – B)	873,265
D) Other revenue and cost of production	–48,096
Financial revenue	7,360
Road maintenance costs	–13,699
Building maintenance costs	–41,757
E) Result before taxes (C + D)	825,169
G) Income taxes	–25,823
NET INCOME (PROFIT/LOSS) FOR THE YEAR (E + G)	799,346

Balance Sheet

ASSETS	Euro
A) Fixed assets	120,885,135
Soils and growing stock (forests, meadows, pastures and other land)	117,269,841
Buildings	3,164,848
Technical equipment and machinery	450,446
B) Depreciation accruals	-2,013,623
Net assets (A + B)	118,871,512
Cash	4,356
Receivables	2,582
Total	118,878,451
EQUITY AND LIABILITY	
Debts	4,930
Total	4,930
Total equity	118,873,521
Of which net income (profit/loss) for the year	799,346
Total equity and liability	118,878,451

by enterprise personnel. Some 91,000 euro, meanwhile, are received for undertaking environmental enhancements. Concessions and rents also contribute to total revenue.

One can certainly say that the proportion of the various revenues is consistent with the general objectives of the enterprises: seeking a balance between conservation and timber production so as to support management costs while also providing raw materials for the local processing industry.

The total revenue less cost, which is the enterprise result from operation, amounts to 873,000 euro, while the net income is positive for a remarkable 799,000 euro. One should, however, not overlook the role played by subsidies and compensation, to a certain extent fictitious revenue, amounting to 1.18 million euro, aimed at covering personnel salaries, fire control, and environmental maintenance and enhancements. Without these public transfers the enterprise would register a heavy loss. One should also account for the timber redistributed to local inhabitants, a value that is far from negligible at 363,000 euro. The assets balance sheet of Table 1.1 again shows the total value of equity and liability amounting to more than 118,000 euro, a value determined mostly by real estate and

² The enterprise is managed by the Forest Service, whose personnel salaries are paid by the State. This subsidy is considered justifiable due to various public benefits it provides and, therefore, it has been included within the revenue as a cost.

forest in particular. This value is largely hypothetical, as the land is public property, bound by law to remain in public hands and not be sold.

A more realistic description of enterprise management is represented in Table 1.2. The second step of environmental accounting highlights revenue and cost linked to con-

Table 1.2
Income statement disaggregated between conventional and environmental market productions (1998-1999, average values)

CLASS	Euro
A) Revenue of conventional production	1,694,537
Timber	566,486
Timber redistributed to local inhabitants	363,325
Subsidies from the Ministry of Agriculture (MiPAF) to support personnel salaries	710,462
Contribution to local inhabitants timber measurement	22,379
Rents of buildings to personnel	16,910
Rents of buildings to third parties	8,675
Small wood collection and quarry concessions	6,300
B) Cost of conventional production	771,742
Salaries and social security	691,516
Consumables and energy	49,615
Depreciation, maintenance and insurance of equipment and machinery	24,723
Depreciation, maintenance and insurance of buildings	5,202
Public Relations	685
1) RESULT OF CONVENTIONAL PRODUCTION (A – B)	922,795
C) Revenue of environmental production	495,803
Subsidies from the Ministry of Agriculture (MiPAF) to support personnel salaries	277,651
Compensation from the Ministry of Agriculture (MiPAF) for fire services	108,232
Other compensation for environmental enhancement measures	91,448
Mushroom-picking permits	15,494
Other temporary concessions (e.g. ski tracks)	1,748
Hunting, fishing concessions	1,229
D) Cost of environmental production	545,333
Salaries and social security	372,679
Fire services	88,014
Consumables and energy	29,139
Depreciation, maintenance and insurance of equipment and machinery	16,762
Landscape and environmental stewardship expenditures	16,165
Forest management and stewardship	11,119
Fauna protection and care	6,197
Depreciation, maintenance and insurance of buildings	3,055
Research and Development (R & D)	2,200
2) RESULT OF ENVIRONMENTAL PRODUCTION (C – D)	-49,530
3) AGGREGATED PRODUCTION RESULT (1 + 2)	873,265

CLASS	Euro
E) Other revenue and cost of production	-48,096
Financial revenue	7,360
Roads maintenance cost	-13,699
Building maintenance cost	-41,757
F) Result before taxes (3 + E)	825,169
G) Income taxes	-25,823
NET INCOME (PROFIT/LOSS) FOR THE YEAR (F + G)	799,346

Balance Sheet

ASSETS	Euro
A) Fixed assets	120,885,135
Soils and growing stock (forest, meadows, pastures and other land)	117,269,841
Buildings and other constructions	3,118,367
* Ecological Museum	46,481
Equipment and machinery	450,446
B) Depreciation's Accruals	-2,013,623
Net assets (A + B)	118,871,512
Cash	4,356
Receivables	2,582
Total	118,878,451
EQUITY AND LIABILITY	
Debts	4,930
Total	4,930
Total equity	118,873,521
Of which net income (profit/loss) for the year	799,346
Total equity and liability	118,878,451

ventional production (timber) on one hand and revenue and cost linked to environmental activities reflecting market prices on the other. The conventional production result is positive for roughly 922,000 euro, while the environmental production result of -49,000 euro 95 is negative. This loss would be much higher without subsidies and other payments from MiPAF justified, however, by the performance of the important public functions already mentioned. One can see that environmental productions arise, in any case, a nega-

tive result, while conventional timber production can generate a profit whenever the timber redistributed to local inhabitants is accounted for.

Total equity and liability value of the balance sheet, equal to roughly 118 million euro, is fully attributed to conventional productions. It is a simplification given the multi-functionality of forests, clearly stated by Italian legislation. A small part of total fixed assets marked with * in Table 1.1, equal to 46,000 euro, is nevertheless given by an ecological museum, a cultural initiative quite linked to environmental and recreational management of the property.

The third step of environmental accounting also takes into consideration private hidden values (marked with § in Table 1.3). Such a consideration extends the net income of 369,000 euro. It is a positive variation due to the increase of growing stock (a sort of natural capital) left in the forest. This product is counted yearly in the income statement and then consolidated in the balance sheet. Environmental risks due to natural hazards (avalanches, landslides, wind damage and fires) partially due also to past management are accounted as annual quota in the income statement –around 12,000 euro yearly– and then consolidated in an accrual of 400,000 euro. Even if it is not set aside each year, this cost expresses the risk carried on by current management. For instance, in the last 50 years fires have destroyed hundreds of hectares of forest. The yearly quota covering the various risks depends upon return time of hazards. The effects of accounting for all «hidden private values» are felt positively on the income statement given the remarkable savings of growing stock and negatively on the balance sheet given the weight of accruals.

The fourth step of environmental accounting takes into consideration all public impacts of the enterprise (Table 1.4) estimated, whenever necessary, using environmental economic techniques like contingent valuation and travel costs able to deduce consumer surpluses or benefits variations. Positive items, recreation and watershed management, are considered in specific *addenda* to the income statement. Hunting, fishing and carbon-fixation are also included. In order to avoid duplication, the public subsidies and compensation for these benefits are deducted. Among environmental damages of the enterprise, the effect of forest fires is accounted for. The net flow of non-market benefits less damages amounts to around 805,000 euro; therefore, the total private and social profit of the enterprise is around 1,9 million euro.

In the assets balance sheet the environmental variables are considered in satellite accounts, which show natural resources received by the enterprise. These variables are not priced, but quantified in physical terms whenever possible.

As a synthesis of the various steps of environmental accounting methods, Figure 1.1 shows the evolution of net income at the various accounting steps and how environmental consideration almost doubles the total income from 799,000 euro to 1,9 million euro.

Table 1.3
Income statement with incorporation of private non-monetary values
(1998-1999, average values)

CLASS	Euro
A) Revenue of conventional production	1,694,537
B) Cost of conventional production	771,742
1) Result of conventional production (A – B)	922,795
C) Revenue of environmental production	495,803
D) Cost of environmental production	545,333
2) Result of environmental production (C – D)	–49,530
3) Aggregated production result (1 + 2)	873,265
E) Other revenue and cost of production	–48,096
F) Result before taxes (3 + E)	825,169
G) Income taxes	–25,823
4) Net income (profit/loss) for the year (F + G)	799,346
L) Growing stock increase	369,602
M) Quota risky stands (avalanches/landslides)	–1,695
N) Quota unstable risky stands (wind)	–4,238
O) Quota risky stands of pinewood (fires)	–6,197
NET INCOME (PROFIT/LOSS) FOR THE YEAR ADJUSTED FOR PRIVATE HIDDEN VALUES (4 + L + M + N + O)	1,156,817

Balance Sheet

ASSETS	Euro
A) Fixed assets	120,885,135
B) Accruals	–2,013,623
Net assets (A + B)	118,871,512
Growing stock increase	369,602
Cash	4,356
Receivables	2,582
Total	119,248,053
EQUITY AND LIABILITIES	
Debts	4,930
Stands risk accrual (avalanches/land slides)	169,540
Stands risk accrual (wind)	169,540
Stands of pine wood accrual (fires)	61,975
Total	405,985
Total equity	118,842,068
Of which net income (profit/loss) for the year adjusted for private hidden values	1,156,817
Total equity and liability	119,248,053

Table 1.4
Income statement with incorporation of public non-monetary environmental
values as Addenda and Satellite accounts
(1998-1999, average values)

CLASS	Euro
A) Revenue of conventional production	1,694,537
B) Cost of conventional production	771,742
1) Result of conventional production (A – B)	922,795
C) Revenue of environmental production	495,803
D) Cost of environmental production	545,333
2) Result of environmental production (C – D)	–49,530
3) Aggregated production result (1 + 2)	873,265
E) Other revenue and cost of production	–48,096
F) Result before taxes (3 + E)	825,169
G) Income taxes	–25,823
4) Net income (profit/loss) for the year (F + G)	799,346
L) Growing stock increase	369,602
M) Quota risky stands (avalanches/landslides)	–1,695
N) Quota unstable risky stands (wind)	–4,238
O) Quota risky stands of pinewood (fires)	–6,197
4) NET INCOME (PROFIT/LOSS) FOR THE YEAR ADJUSTED FOR PRIVATE HIDDEN VALUES (4 + L + M + N + O)	1,156,817

Socio economic environmental Addenda

P) Recreational environmental benefits (unpaid)	816,701
Recreation (185,500 visits per year: 3.098 euro per visit)	574,817
Watershed management services	391,345
Hunting surpluses	232,406
C-fixation	95,433
Fishing	15,494
Compensation for environmental services	–492,793
Q) Environmental damages - Pinewood fires	–10,957
Loss of fixed C	9,947
Loss of watershed management services	516
Loss of landscape quality	493
R) Result of environmental cost/benefit non-monetary (P + Q)	805,744
NET INCOME (PROFIT/LOSS) FOR THE YEAR ADJUSTED FOR PUBLIC ENVIRONMENTAL IMPACTS (5 + R)	1,962,561

Balance Sheet

ASSETS	Euro
<i>A) Fixed assets</i>	120,885,135
<i>B) Accruals</i>	-2,013,623
<i>Net assets (A + B)</i>	118,871,512
Growing stock increase	369,602
Cash	4,356
Receivables	2,582
<i>Total</i>	11,924,8053
EQUITY AND LIABILITIES	
Debts	4,930
Stands risk accrual (avalanches/landslides/pests and other natural hazards)	169,540
Stands risk accrual (wind)	169,540
Stands risk of pine wood accrual (fires)	61,975
<i>Total</i>	405,985
<i>Total equity</i>	118,842,068
Of which net income (profit/loss) for the year adjusted for private hidden values	1,156,817
<i>Total equity and liability</i>	119,248,053
Assets Satellite accounts	
<i>Fixed assets of natural capital</i>	
Protection non-forest area ha 614	...
Protection forest area ha 2.490	...
Nature reserves (protected biotope) ha 42	...
<i>Flora</i>	
Rare species: e.g. <i>Cypripedium calceolus</i>	...
Endemic species: e.g. <i>Wulfenia carinthiaca</i> , <i>Astrantia carniolica</i> , <i>Papaverum julicum</i>	...
<i>Fauna (n.º of heads)</i>	
Deer (<i>Cervus elaphus</i>)	1,000
Roe (<i>Capreolus capreolus</i>)	1,000-1,200
Chamois (<i>Rupicapra rupicapra</i>)	1,600
Steamboat (<i>Capra ibex</i>)	80
Grouses (<i>Tetrao urogallus</i>)	250-300
Black cock (<i>Lyrurus tetrix</i>)	200
Small grouse (<i>Tetrastes bonasia</i>)	240-400
Ptarmigan (<i>Lagopus mutus</i>)	100
Lynx (<i>Felis lynx</i>)	3-4
Brown bear (<i>Ursus arctos</i>)	2-3
Equity and liability Satellite accounts	
Net public assets including all environmental assets given to the enterprises by the society (protection and recreation forests, flora and fauna assets, etc.)	...
of which <i>flow of public environmental benefits</i>	805,744

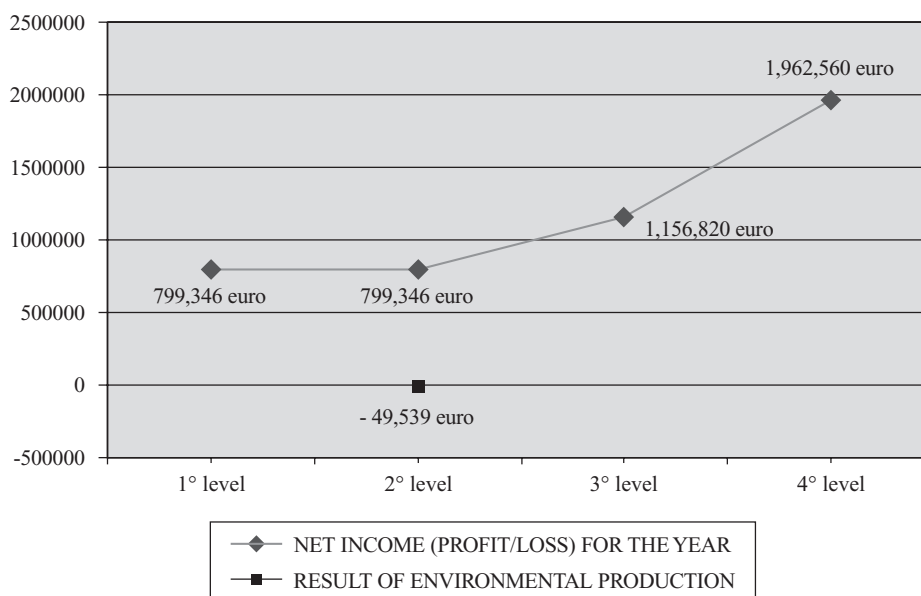


Fig. 1.1.–Income statement at the various steps of environmental accounting - Large Public Forest of the Eastern Alps

A Large Lowland Public Farm

The second application of environmental accounting refers to a large public enterprise along the Adriatic coast where conventional cereal and animal production create a certain negative environmental impact. Public management, however, also favours the production of environmental recreational services supporting the local tourist industry. Recent efforts have been carried out to prevent negative impact. Therefore, both conventional production and public environmental recreational activities are pursued. The latter are helped by a pinewood, other forest formations and wetlands, which improve the environment quality of the property. Also conventional agricultural production are assuming environmental connotations thanks to organic farming, quality products and the adoption of environmentally friendly techniques such as «cover crops», extensification, hedgerows and set-aside land acting as buffer strips to capture released nutrients. In particular, forestland is being improved thanks to close-to-nature management. The same applies to wetlands, habitats, hedgerows and conservation of traditional countryside landscape.

As shown in Figure 1.2, the conventional net result from the income statement is positive for some 150,000 euro, thanks to compensatory payments by the CAP equal to 180,000 euro. A remarkable level of conventional revenue must also be noted: animal productions account for 1.575 million euro while cereals and other crops produce 445,000 euro. Other compensation should also be accounted, such as organic farming (20,000

euro) and environmental enhancement including the buffer strips, the coastland pinewood the hedgerows (28,000 euro), etc.

At the second step of environmental accounting (Figure 1.2), it is interesting to see the distinction between the profit attributed to the conventional production equal to 163,000 euro and the environmental one, amounting to a mere 23,000 euro. Among the latter are included various subsidies and compensation for environmentally friendly farming, such as premiums for organic farming, which commands higher prices compared to conventional production. Meanwhile, the cost takes into account environmentally friendly practices, the management of the buffer strips to prevent the release of nutrients, other stewardship practices beyond ordinary management, the cleaning the pinewood frequented by visitors, etc.

The third step accounts for green manure practices, damage by deer, depreciation and insurance quotas and the effects of past negative impacts of certain farming practices. Therefore, the net income shows slightly how past intensive farming has created a certain environmental risk (Figure 1.2), reducing the net income to 117,000 euro. Once the public benefits of the farm are considered, the increase of income (social) is remarkable: 464,000 euro (Figure 1.2). These benefits include recreation, positive environmental impact of buffer strips felt outside the property and the enhanced quality of the landscape due to conservation measures. All these values are added to the income statement as *addenda*, amounting, net of the related compensation, to 343,400 euro. Obviously, it is a matter of estimation, however undertaken following the most suitable techniques developed by environmental economics.

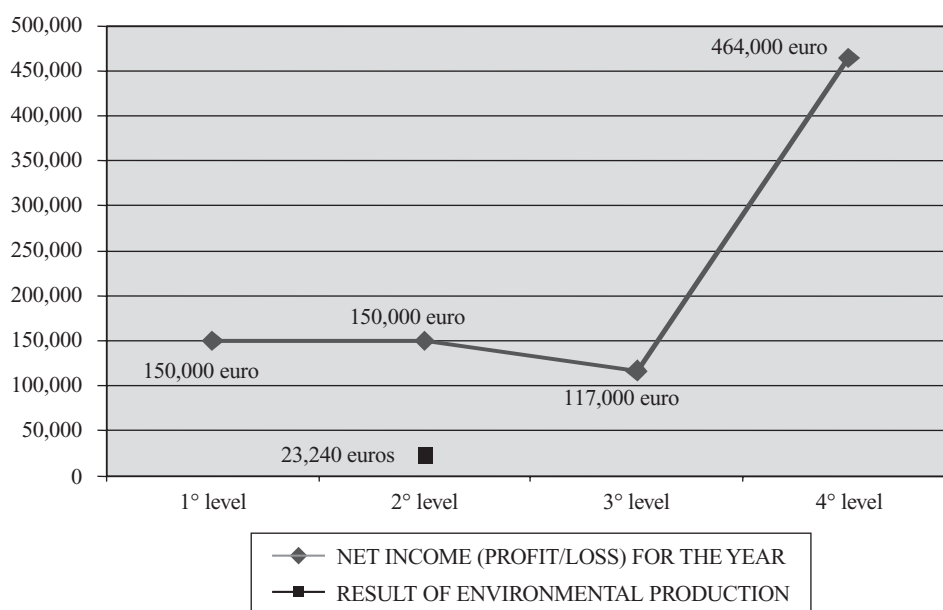


Fig. 1.2.—Income statement at the various steps of environmental accounting - Large Lowland Public Farm

A Medium Pre-Alpine Private Farm

The third application is represented by a medium size dairy farm run as a family enterprise. It is located in the pre-Alps: one part on the slope (90 hectares at an altitude of around 1000 m) and another on the bottom of the valley (10 hectares at an altitude of around 200 m) near a riverbed. In general, soil productivity of the area is rather low: Meadows and pastures are often abandoned, but not in the case-study farm. The soil near the riverbed is rather stony and permeable, and as a result less favoured for farming. But thanks to good management, the financial result is rather positive. Agritourism, quality milk and cheese processed on the farm, all in all, allow an acceptable income as shown in Figure 1.3. The weakest point of the farm is represented by intensive cereal production in the lowland. It is necessary for providing the forage base. However, given the permeability of the soil, the intensive fertilisation and irrigation, a great release of nutrients has to be mentioned, including nitrogen in particular.

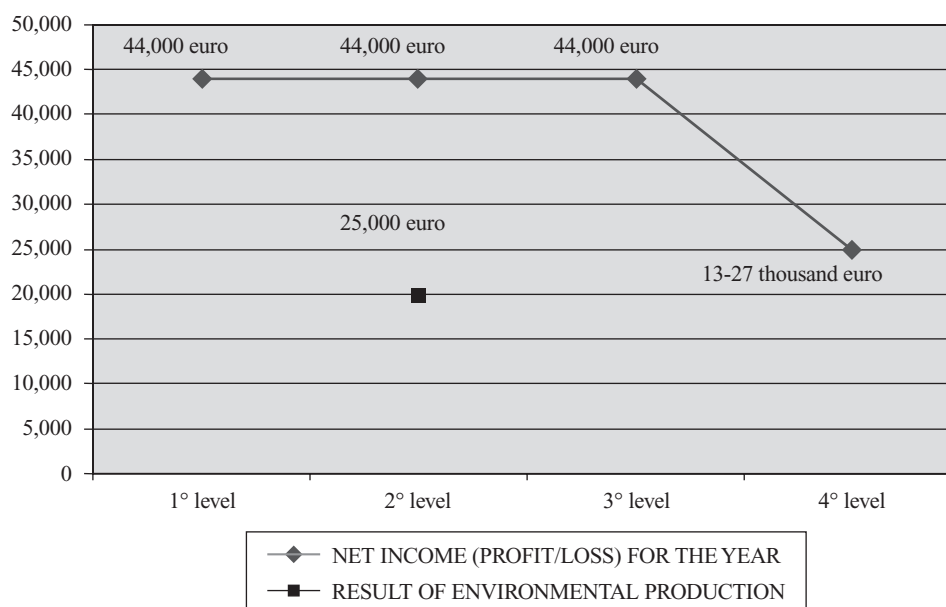


Fig. 1.3.—Income statement at the various steps of environmental accounting - Medium Pre-Alpine Private Farm

In other words the farm has two different features, a sort of Dr. Jeckyll/Mr. Hyde. On the one hand it allows cultivation and stewardship of Alpine slopes providing very positive environmental landscape impact; on the other hand it severely pollutes the environment in the 10 hectares of lowland near the riverbed. The situation, far from an isolated case, is rather common in pre-alpine farming as underscored recently by the Rural Development Programme (2000).

It is remarkable how the farm is able to internalise positive externalities thanks to an active agritourism industry including hospitality and marketing of farm products and recreational activities. Meanwhile, the negative externalities are left to the public, creating a kind of tragedy of the commons, given an ill-defined «right to pollute» the environment.

The all story is well visualised by Figure 1.3 showing a conventional net income of around 44,000 euro. The greatest size of the revenue is due to dairy (around 88,000 euro), followed by agritourism –hospitality, meals and direct selling of cheese (33,000 euro)– then also other produces like ham (4,600 euro) and compensation of stewardship.

The difference between conventional and recreational environmental products (second step) is as follows: Conventional products allow a revenue of 95,000 euro, covering costs totalling 76,000 euro and yielding a result of 19,000 euro (Figure 1.3). Recreational environmental revenue amounts to 66,000 euro with costs equal to 41,000 euro, yielding yet another remarkable result of 25,000 euro. And yet, the distinction between conventional and innovative recreation environmental products is difficult because the two are so interdependent. It is clear that dairy is key for multipurpose management that supports other activities: agritourism (33,000 euro), quality cheese price premium value (20,000 euro of revenue), quality ham premium (4,650 euro), compensation of *stewardship* (5,160 euro) and sport facilities (1,550 euro).

The fourth step highlights the serious environmental problems created by the farm (Figure 1.3). The farmer declares to be using 500 kg of nitrogen per hectare plus liquid manure. Recent analysis of Gren (1993 and 1999) estimated the cost of cleaning polluted water to be around 5.5 euro per kg. Estimating a *release* of 300 kg per hectare (may be also higher), the total one amounts to 3,000 kg, that is a total cost around 31,000 euro. This public cost, to be considered as *addenda* to the income statement, severely affects the social income reduced to some to 13,000 euro (Figure 1.3).

A Small Horticultural Farm with High-Quality Products

It is a small lowland enterprise, where wine and horticulture are the main activities. Grapes are mainly conferred to a local co-operative cellar producing quality *appellation d'origine* wine. The majority of fruits grown on the farm, including apple, *nasci* and kiwi, as well as honey and bottled wine, are directly sold to consumers in a farm shop.

Buyers are well aware of the application of organic methods and can verify the veracity while shopping, so there is a willingness to pay a premium price for products that they consider higher quality and safer to eat. Figure 1.4 shows a conventional net income of 38,000 euro - revenue of 139,000 euro and costs of about 89,000 euro.

The second step illustrates how conventional farming yields a sharply lower net income (4,000 euro with revenue of 81,000 euro and at a cost of 77,000 euro). Meanwhile, environmental management of the enterprise (organic farming) allows the largest share of net income (48,000 euro with revenue of 58,000 euro at a cost of 10,000 euro). There are various reasons for the striking difference in net income between conventional and environmental farming. Nevertheless, it is clear that the higher revenue for organic methods is due to the image of the farm, the confidence of the consumers and their willingness to pay for the added value with a price premium directly to the farmer (Figure 1.4). In other words, the success is largely due to the capability to produce in an environmentally friendly way and to communicate this to the consumers buying products in the farm shop.

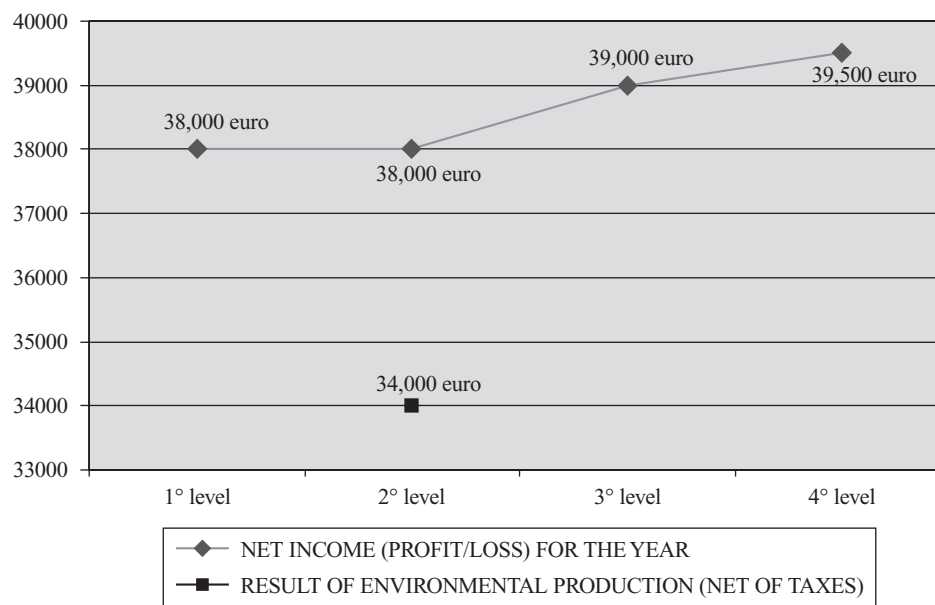


Fig. 1.4.—Income statement at the various steps of environmental accounting - Small Horticultural Farm with high quality products

It is interesting to see that the third and fourth steps do not significantly change the results, proving that the environmental qualities of the farm have already been internalised within the market.

CONCLUSIONS

Conclusions concern from one side the validity of the proposed method, from the other its capability to show and highlight the environmental effects of enterprise management.

The proposed methodology has certainly shown its capability to integrate environmental aspects into balance sheets and income statements. The stepwise approach allows a clear distinction between conventional and environmental productions as well as off-site and off-market effects. Private and public values can also be separated, making possible the development of an accounting method that reflects recent developments of environmental economics in which the Total Value is distinct in both, market and non-market values such as use, option and non-use values.

As far as the outcome of the proposed method is concerned, it should be stressed that only major environmental effects typically related to agriculture and forestry have been accounted for. One can see that use values, in particular, have been incorporated within the various steps. Other values, meanwhile, and particularly option and non-use values, have been rather neglected. Biodiversity, for instance, has not been accounted for. Never-

theless, the method allows accounting for these values when, and if, considered relevant and quantifiable.

One of the most relevant outcomes has been the possibility to show the major typical impact of forestry and farming under different situations and circumstances. For instance, in the alpine forest property environmental accounting illustrates that many benefits are produced without market remuneration. In the coast farm, accounting shows the production of both positive and negative impacts, but with substantial overall success thanks to the adoption of modern environmentally friendly practices now gradually becoming the established norm in farming and forestry. The pre-alpine dairy farm shows how benefits can be internalised through appropriate management, while also demonstrating a large dangerous production of negative impacts that could be reduced under more careful management and local authority control. Finally, the horticultural farm shows how positive impacts can be internalised thanks to appropriate management and marketing of quality products commanding a price premium and, at the same time, reducing negative impacts. All these effects, being internal, show that financial accounting produces results similar to those of economic (cost-benefit) accounting.

RESUMEN

Contabilidad ambiental en la agricultura y la selvicultura: un enfoque por etapas

Este artículo presenta un enfoque empresarial aplicado de contabilidad ambiental de la agricultura y la selvicultura por etapas. Este parte de los balances de cuatro empresas agrícolas y forestales, siguiendo los principios contables tradicionales. Un segundo paso es la separación de las actividades recreativas y otras ambientales de las convencionales, representadas por productos agrícolas y forestales. El tercer paso consiste en estimar los valores privados ocultos, percibidos por los empresarios a través de valores de mercado cercanos. En el cuarto paso se integran bienes/males públicos y otras externalidades, haciendo posible la cuantificación de su efecto sobre el bienestar público. El último paso, consiste en incorporar todos los beneficios y costes de no-mercado. Las cuentas satélite o addenda que incluyen aspectos físicos y biológicos también pueden ser utilizadas. Esta metodología contable por etapas sucesivas, que está pensada para incluir factores ambientales y sociales, se basa estrictamente en los principios contables. En tanto que ésta ha sido aplicada en varios estudios de casos, ha probando ser una herramienta útil tanto en economía empresarial como en planificación ambiental y social, y en la toma de decisiones en áreas rurales.

PALABRAS CLAVE: Contabilidad ambiental
Enfoque por etapas
Empresas agrícolas y forestales

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