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Review of methods and evidence for economic valuation of agricultural non-commodity outputs and suggestions to facilitate its application to broader decisional contexts

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Abstract

Economic valuation provides information for the relative values of environmental and recreational spatial services and other goods such as healthy and safe food, whose promotion is now envisaged by EU in the context of a multifunctional agriculture (MFA) model. Therefore, economic valuation is a valuable tool for MFA assessment. However, the promotion of MFA at EU level necessitates the scaling up of assessment methods, particularly if the corresponding policies are to receive a sympathetic hearing by the WTO. Thus, the usefulness of economic valuation in the MFA context depends on its ability to obtain scaled-up estimates. This paper is a review of the current state of the art for the agricultural non-commodity outputs valuation methods, their application and respective value estimates. A special focus has been given to the European countries of France, Germany and Portugal, because these were the object of a relatively detailed and extensive survey of case-studies addressing valuation of agriculture-related NCOs (non-commodity outputs), undertaken in the MULTAGRI project. The main conclusions of the review were: (1) the prevalence of stated preference valuation methods; (2) the resort to crudely defined ''landscapes'' to index spatial-based environmental and recreational services; (3) the regional scope of valuation studies; (4) that most of the case-studies offered ex ante value estimates for actual or simulated changes in the provision level of agriculture-related NCOs, linked to conservation or restoration policies, projects or programmes. Furthermore, the review highlights some promising practices to improve the selection and specification of attributes, such as the option for a multi-attribute valuation approach and the resort to multidisciplinary data and modelling. These practices have been incorporated into a proposal for an integrative valuation framework to improve NCO specification at the broader scale and to respond to the end-users information demands.

Keywords: Economic valuation; Agricultural non-commodity outputs; Assessment of multifunctionality in agriculture; Stated preference techniques; Multi-attribute valuation; Valuation of land-based services; Land-use change valuation

1. Introduction

Pressure to reform the common agriculture policy (CAP), namely from successive World Trade Organisation (WTO) negotiations, has lead European Union (EU) politicians and negotiators to study the European paradigm of agricultural multifunctionality. The central assumption is that agriculture is a multifunctional activity not only producing food but also sustaining rural landscapes, protecting biodiversity, generating employment and contributing to the viability of rural areas (Potter and Burney, 2002, p. 35). The EU multifunctional agriculture (MFA) concept corresponds to a rural-development oriented approach (Aumand et al., 2001). Within this concept, agriculture provides non-commodity outputs (NCOs) which are required by consumers and society. Demand for agriculture-related NCOs has increased in recent years and is motivated by both use and passive

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consumption. This demand is mainly constituted by three inter-related clusters of goods and services: (a) healthy and safe food; (b) leisure and recreation in the rural areas; (c) nature and cultural heritage preservation.

With regard to MFA assessment, economic valuation appears as a collection of methods and techniques able to produce information on the relative value of different NCOs expressed in monetary units. Knowing these values is indispensable in efficiently managing an MFA model, because the decision-makers have repeatedly to answer questions, such as: Is it worthwhile supplying a particular bundle of NCOs? Which bundle of NCOs should be supplied in a particular area? How much of each? Also scaling up the MFA implies choosing the areas and the bundles of NCOs to be provided. The usefulness of economic valuation, namely of demand-side valuation techniques, in helping to answer those questions has been recognized by academics, experts and decision-makers at the more technical level. However, it tends to be ignored by politicians and so far valuation has not been included in the institutional frameworks applied to evaluate policy at EU level (Bonnieux and Rainelli, 1999).

Therefore, further work is needed to make estimates of the economic value of agricultural NCOs understandable and easy to handle by end-users who are not familiar with economic concepts and valuation details. The critical challenge to enhance these estimates' usefulness at policy and decision-making levels is to use them for comparable NCOs bundles indexed to comparable spatial scales. This paper addresses both questions. It makes a comprehensive review of valuation methods and the evidence of available value estimates for agriculture-related NCOs, which is then used to outline a framework to tackle valuation weaknesses related to valid specification of NCOs for broader scales and the needs of end-users.

The review of empirical evidence focuses on the survey of valuation case-studies found for the European countries, France, Germany and Portugal, previously conducted by the authors as part of an EU 6th framework research project.[1] The review also covers evidence from the literature, both for Europe and other countries and provides a three-fold assessment: (a) the content validity of NCO specified in the valuation scenarios; (b) the quality of available estimates; (c) and the applicability of available estimates to the MFA context.

A valuation framework is proposed to address the specification of agriculture-related NCOs both in operational terms and with a view to making explicit the interactions between services valued (demanded) and NCO supplied, at comparable scales. Making clear these linkages helps to standardise value estimates, thereby increasing their usefulness to end-users in the broader decision-making contexts, namely the MFA assessment. Moreover, exploring those linkages should make clear what are the capabilities and limits of economic valuation and how to profit from the first and overcome the second.

The paper is organised as follows. The next section provides a review of the concepts and methods available to obtain monetary estimates for non-market goods and their respective suitability to the agriculture-related NCOs valuation. Section 3 provides a comprehensive review of the survey of available evidence for value estimates of agricultural NCOs. Section 4 discusses the valuation framework here proposed. Section 5 provides some concluding remarks.

2. Concepts and methods to value agriculture-related NCO

The growing demand for agriculture-related NCOs has rendered the market failure related to its provision into a relevant issue for policy makers. This was clearly illustrated, in 1992, by the extension of the EC agri-environmental schemes to all Member States. These schemes remunerated farmers for the environmental and landscape management services they provide for free to society. Hence, these payments exemplify the interest of pricing non-market agriculture-related good and services. If monetary estimates for their value to consumers (demand-side) are available then payments for their provision could be made according to demand.

To obtain monetary estimates of non-market goods and services derived from natural, semi-natural and cultural assets two approaches can be followed. One consists of pricing them according to their provision costs, through cost-side based methods, including methods such as replacement cost, restoration cost, relocation cost and government payments (Bateman, 1994; OECD, 2002). However, the monetary estimates created by these methods do not give information about individual demand regarding the goods and services available. Going back to the example of the agri-environmental measures, where farmers are paid for the extra-costs in providing environmental NCO, the payment (a ''government payment'') does not reflect, in general, the price that consumers are willing to pay to have that NCO. To know the economic value that consumers assign to NCOs, demand-side valuation methods are needed. These give estimates of the willingness to pay (WTP) or the consumer surplus related to a change in the provision level of a given NCO, based on two alternative approaches: the revealed preference methods and the stated preference methods.

Table 1 summarises the methods for cost-side based and demand-side valuation approaches, distinguishing the two categories of methods within the latter approach, revealed and stated preference methods.

[1] MULTAGRI—Capitalisation of research results on the multifunctionality of agriculture and rural areas (Work Package 3—Knowledge, models, techniques and tools to explain and forecast multifunctionality of agriculture), 2004–2005.

Table 1
Approaches and methods for environmental economic valuation

Valuation approach	Valuation methods	Description
Cost-side	Replacement cost	Costs of replacing environmental assets and related goods and services (e.g. replace soil fertility due to soil contamination)
	Restoration cost	Costs of restoring environmental assets and related goods and services (e.g. restore soil fertility through soil decontamination)
	Relocation cost	Costs of relocating environmental assets and related goods and services (e.g. moving existing habitats to alternative sites)
	Government payments	Government payments for the provision of environmental goods and services (e.g. agri-environmental measures)
Demand-side Revealed preference methods	Travel cost method (TCM)	Estimates the demand for a recreational site using travels costs as a proxy to the individual price for visiting the site
	Hedonic price method (HPM)	Estimates the implicit price for environmental attributes through the individuals choices for market goods which incorporate such attributes (e.g. estimate implicit price for air quality in the price of a house)
	Averting behaviour (AB)	Estimates the monetary value for an environmental good or service observing the costs individuals incur to avoid its loss (e.g. buying water filters to assure safe drinking water)
Demand-side Stated preference methods	Contingent valuation (CVM)	Hypothetical markets are constructed to allow individuals to state their willingness to pay for changes in the quantity or quality of environmental goods and services
	Conjoint analysis	Hypothetical markets are constructed to allow individuals to state their preferences for attributes entangled in goods or services present to them[a]
	Choice experiments	Hypothetical markets are constructed to allow individuals to choose their most preferred option from a set with more than two choice options, defined as attribute bundles where the price is included
	Contingent raking	Hypothetical markets are constructed to allow individuals to rank alternative options from a set with more than two alternatives, defined as attribute bundles where the price is included
	Contingent rating	Hypothetical markets are constructed to allow individuals to rate alternative options using a rating scale; the alternatives defined as attribute bundles where the price is included

[a] Conjoint analysis is above all an approach to present goods in market research, as bundles of attributes, resorting to techniques such as choice experiments, contingent raking and ratings, to elicit individuals' preferences for the attributes included in those bundles. Therefore, conjoint analysis cannot be precisely defined as a particular valuation method, it is mostly a collection of methods.

The demand-side valuation relies on the estimation of individual demand for non-market goods, using the same theoretical framework used to value market goods. In actual markets individuals choose to buy a good if its price is less than or equal to their WTP for it. Hence, if the market price is lower than the individual's WTP for a certain good he (she) experiences a gain, which is known as the consumer surplus. The consumer surplus is a measure of the gain of well-being obtained by the individual in such a situation. The aim of economic valuation of non-market goods, such as environmental or landscape-related, is precisely to measure the variations in the individual's well-being derived from changes in the quality or quantity of such goods. These changes are not generally traded in the market, thus they are not priced, and yet they affect the individual's well-being.

In the absence of markets, the consumer surplus derived from a certain level of provision of an environmental good can be recovered, in certain circumstances, through surrogate markets with the revealed preference methods. These latter rely on the interrelations between non-market goods and those traded in the market and comprise methods such as travel cost (TCM), hedonic price (HPM) and averting behaviour (AB). The TCM, for instance, uses the travel costs that individuals incur to go to certain recreational sites, such as Nature Parks or forests, as a proxy to the price that individuals are willing to pay to visit these sites. TCM refers to the individual's behaviour in actual markets to estimate the consumer surplus derived from visits to recreational sites. Such estimates are achievable because visits and goods needed for the trips are complements.

However, to value non-market goods, such as environmental, landscape or cultural assets, the resort to those hidden relations between traded and non-traded goods is not possible. This happens because the individual's WTP might be due to non-use motivations related to the well-being experienced with the knowledge of those assets preservation (non-use value). Environmental economists recognize two parcels for the economic value of environmental and other similar non-markets goods: ''use value'' and ''non-use value'' (Mitchell and Carson, 1989; Randall, 1991; Carson et al., 1999). The former encompasses the gains of well-being derived from actual or future use, including direct and indirect uses of the good and the value assigned to the option of using it in the future (''option value''). For instance, recreational sites give rise to direct use values, but can also

give rise to option values; whereas carbon sequestration by forests is an example of an indirect benefit of forest preservation giving an indirect use value to individuals. Non-use value (also referred to in the literature as passive use value) is related to motivations such as altruism to current or next generations or ''simply'' the satisfaction with the asset continuation. A significant non-use value might be expected for the preservation of assets such as agro-ecosystems and rural landscapes. Moreover, non-use values are not restricted to user populations, such as visitors. They are also available to the general population, which can make them superior to use values when aggregate to respective beneficiaries.

Therefore, resort to the revealed preference methods to value environmental goods and services might lead to a significant underestimate of respective economic benefits. Stated preference (SP) methods are the only way to estimate non-use values. These methods make use of hypothetical markets based upon carefully designed questionnaires. These hypothetical markets are used to elicit the individual's WTP to obtain, for instance, an improvement in the state of environment (or to avoid a negative change in the state of the environment). Contingent valuation (CVM) is the most popular SP method, but in recent years attribute-based choice modelling methods (ABCM) have started to replace it to some extent. ABCM includes methods such as conjoint analysis, choice experiments, contingent ranking and contingent rating.

Referring again to the example of agri-environmental measures, one sees that in most of the cases the agriculture-related NCOs supplied by farmer's benefits the users – the ''visitors'' and the ''residents'' – and the society in general, the non-users.

The economic benefits for the users can be partially estimated by the revealed preference methods. The TCM (exploring the complementary relation between visits and market goods needed for trips) and the HPM (estimating implicit prices for environmental attributes through consumers' choices regarding market goods) are often used to estimate use value for the visitors and the residents. The use values estimated include things such as recreation, life quality of the site related to its beauty and/or quietness and also indirect benefits.

However, when preservation of nature, biodiversity and cultural heritage are at stake, which often is the case with the agriculture-related NCOs, the SP approach is the only one able to provide complete estimates for economic value. This is because non-use motivations underlying valuation of those assets might be significant to the users' populations and mostly because significant well-being changes can arise for the non-users. The absence of observable linkages between non-use motivations and individual's market behaviour turns SP methods into an indispensable tool to value agriculture-related NCOs with relevant non-use value.

The importance of valuing non-use justifies the popularity of the SP approach in environmental valuation studies, compared to revealed preference methods. In the international database that compiles valuation studies, the environmental valuation reference inventory (EVRI), two in every three case-studies reporting value estimates for the environmental asset ''preservation of agricultural land'' were conducted by SP methods.

SP methods show a great flexibility in specifying the good to be valued because they refer to constructed markets. Hence, goods can be specially designed to shape ex ante changes in the state of environmental or other non-market assets. This feature is particularly important when valuation is needed ex ante so as to provide an input into cost-benefit analysis or to assist evaluation of policies, projects or programmes addressing nature and landscape preservation or its change or disappearance due to given development options.

Completeness and flexibility enlarge considerably the usefulness spectrum of SP methods compared to revealed preference ones, which are, in general, only applicable to value ex post changes. Empirical reviews confirm its widespread application when valuation addresses potential changes in land use (Eftec, 2002).

However, the completeness and flexibility of SP methods comes at a price. The hypothetical nature of the transactions, and often of the goods traded, creates room for perception and strategic errors. These are likely to happen due to the lack of the individual's familiarity with environmental goods transaction. The absence of actual market transactions hinders the task of defining individual values in the hypothetical markets and deprives researchers of alternative valid measures for the individual WTP, such as the prices paid in the case of the market goods. The lack of criteria to establish external validity of SP estimates make it more vulnerable to criticism and more controversial compared to the revealed preference ones, which are obtained through the indirect observation of consumer behaviour in actual markets.

Bjornstad and Kahn (1996) suggest that an ideal test to establish the validity of SP estimates would be a standard obtained with the revealed preference methods. That would make it possible to compare the WTP stated by the individuals in the hypothetical markets, with an amount actually paid in a real market. One way of doing this is testing convergent validity between estimates from SP and from revealed preference methods. Convergent validity can be tested when different valuation methods are applied to value the same object. Carson et al. (1996) evaluate the convergent validity of TCM and CVM for more than 616 estimate comparisons (offered by 83 studies), and their tests provide support to the convergence validity hypothesis.

However, convergent validity between revealed preference methods and CVM (and other SP methods) can only be tested for the measurement of use values. Hence, the shortcoming of SP methods concerning external validity remains hard to overcome. The resort to the individual votes in real-life referenda is sometimes suggested as way to achieve criteria to external validity of SP estimates, but these

are very rare for the problems involved in economic valuation, namely in the European countries.

External validation of SP estimates remains an open issue in economic valuation, and it represents a drawback to its application in the decision-making arenas related to the provision of agriculture-related NCOs with significant non-use value. Assessment of value estimates gathered through the SP methods must rely on evaluation of content and theoretical validity and analysis of convergent validity, if the information is available. The ability of hypothetical markets to provide valid and reliable value estimates depends on assuring, as Carson et al. (2001, p. 196) underline, ''that the good to be valued is clearly explained, its delivery to the public made plausible, and a realistic expectation of payment created''.

3. Empirical estimates for agriculture-related NCOs

This section relies on the data obtained in the survey of agriculture-related NCOs valuation case-studies conducted for the MULTAGRI project, which focussed on the French, German and Portuguese empirical evidence. The critical assessment of data from this survey is its main purpose. Four discussion lines were chosen: (a) the economic values addressed by NCOs and the chosen valuation methods to measure them; (b) NCO specification; (c) quality of estimates; (d) the applicability of estimates to the MFA context. The additional review of empirical evidence that has been conducted for this paper is referred to in this section, where it helps the discussion of questions raised by the agriculture-related NCOs valuation.

3.1. NCO values and valuation methods

Suitable methods for economic valuation of the most significant agriculture-related NCOs are displayed in Table 2.

Table 2 confirms that for some groups of goods and services related to agricultural NCOs revealed preference methods or even a cost-side approach might be the appropriate options. Use of rural space and amenities for recreational and leisure activities can be valued through TCM or with HPM. The review of the French evidence shows some estimates obtained by HPM resorting to available information on rents of rural cottages (Le Goffe, 2000; Mollard et al., 2006). The EVRI consultation (June, 2005) for the environmental asset ''open space'' shows an intensive use of TCM, particularly in its more advanced formats which employ random utility models (RUM) to enable ex ante multi-site choice by individuals. However, a survey of the literature on valuation related to agricultural NCOs shows little use of revealed preference methods to value recreational use. Studies that attempt to value it (e.g. Bishop, 1992; Hanley and Knight, 1992; Pruckner, 1995) employ CVM. The preference for CVM, and more recently for ABCM (Hanley et al., 1998a), is associated with its flexibility in terms of definition of the valued object and how it is presented to individuals. This flexibility allows the delivery of information to design ex ante management plans for land-based recreational uses. The SP approach seems also to be preferred to value healthy and safe food, compared to revealed preference methods, such as AB and HPM (e.g. Latouche et al., 1998; Armand-Balmat, 2002).

The survey of case-studies regarding valuation of agriculture-related NCOs conducted in the MULTAGRI project, for the countries France, Germany and Portugal, showed the dominance of SP methods. This is confirmed in Table 3, which displays a summarised description of the MULTAGRI survey.

The case-studies described in Table 3 report mainly valuation for the services ''nature and cultural heritage preservation''. Hence, the dominance of the SP methods, in particular CVM, can be explained by its ability to provide complete estimates of economic value. However, the flexibility of this valuation approach to specify the valuation object is also shown by these case-studies. Most of them refer to valuation experiments designed to assist ex ante evaluation of policies or programmes addressing nature and landscape preservation or its quantity and quality restoration. Hence, the MULTAGRI project survey highlights completeness and flexibility as being the determinant features for the supremacy of SP methods in valuing agriculture-related NCOs.

3.2. NCO specification

The discussion in Section 2 regarding the validity of estimates obtained through the SP approach has highlighted the definition of object(s) to be valued as a critical aspect for their quality. This explains why researchers, in their surveys, make such detailed descriptions of the changes in environmental or cultural assets under valuation. Major concerns are to choose attributes and settle baseline and

Table 2
Goods and services supplied by agriculture-related NCOs and respective economic value components

Goods and services	Motivations for economic value	Suitable methods for economic valuation
Healthy and safe food	Direct use	AB; HPM; CVM; ABCM
Leisure and recreation	Direct use	TCM; HPM; CVM; ABCM
Beneficial processes	Indirect use	Cost-side methods; AB; CVM; ABCM
Nature and cultural heritage preservation	Non-use	CVM; ABCM

AB: averting behaviour; HPM: hedonic price method; CVM: contingent valuation method; ABCM: attribute-based choice modelling; TCM: travel cost method.

Table 3
Description of agriculture-related NCOs valued in the case-studies surveyed by the MULTAGRI project

Author(s)	Description of NCO valued	Valuation method	Area valued		Temporal scale (years)
			Spatial scale	ha	
Mollard et al. (2006)	Proportion of different cultures in the communal surface area for several French districts, France	HPM	Multi-regions	Variable, according commune area	Not-considered by method
Dachary-Bernard (2004)	Preservation of hedgerows and the integration of farm buildings in the landscape of a Nature Park, France	CE	Nature Park	43,000	n.a.
Siriex (2004)	Maintaining farm activity to preserve open landscapes	CVM	Region	300,301	n.a.
Le Goffe (2000)	Proportion of different cultures in the communal surface area and livestock density in the region of Britain, France	HPM	Region	Variable, according commune area	Not-considered by method
Noublanche (1998)	Restoration of chestnut landscape in the region of Cévennes, France	CVM	Region	1000	n.a.
Bonnieux and Le Goffe (1997)	Preservation of hedgerows in a Nature Park, France	CVM	Nature Park	225,000	Restoration programme (n.a. scale in years)
Colson and Stenger-Letheux (1996)	Restoration of hedgerows in a French district, France	CVM	District	n.a.	Restoration programme (n.a. scale in years)
Fischer et al. (2003)	A case study within the Northeim (area) project on regional plant diversity, hedges as ecological merit goods, Germany	CVM	Region	n.a.	n.a.
Schmitz et al. (2003)	Valuation of landscape functions in Eschenburg and Hohenahr (Gießen), Germany	CE	Regions	n.a.	n.a.
Karkow (2003)[a]	Visitors valuation of arable land rich in herbs (10%), Germany	CVM	Regions	29	Conservation programme (n.a. scale in years)
Meyerhoff and Dehnhardt (2002)	Biological diversity in the floodplains of the river Elbe	CVM	Multi-regions	Rivershed habitats	n.a.
Bräuer (2001)[a]	Floodplain protection and renaturalization of beavers, Spessart, Germany	CVM	Region	n.a.	Restoration programme (n.a. scale in years)
Wronka (2001)	Economically and ecologically integrated valuation of land-use in less favoured areas, Lahn-Dill mountain area	CA, CVM	Region	n.a.	n.a.
Enneking (1999)[a]	Development of nature protection area Steinhuder See, Germany	SP	Region	1000	n.a.
Degenhardt and Gronemann (1998)	Reconstruction of biodiversity of extensive grasslands in Erlbach/Vogtland; Wangen Allgäu I and Allgäu II, Germany	CVM	Regions	9925	Restoration programme (n.a. scale in years)
Degenhardt and Gronemann (1998)	Nature conservation in Altmühltal (1) and southeast Rügen (2), Germany	CVM	Regions	n.a.	Conservation programme (n.a. scale in years)
Rommel (1998)	Development of the biosphere reserve in Chorin (Brandenburg), Germany	CVM	Multi-regions	n.a.	Restoration programme (n.a. scale in years)
Madureira (2001)	Preservation of traditional landscape or its replacement by afforested land in the Douro region, Portugal	CVM, CE	Region	20,000	Conservation programme 20–30 years
Nunes (2000)	Protection of wilderness area from tourism development in a Nature Park, Portugal	CVM	Nature Park		Protection programme (n.a. scale in years)
Santos (1997)	Preservation of traditional landscape in a National Park, Portugal	CVM	National Park	7025	Conservation programme 10–15 years

n.a.: not available (or not-mentioned).
[a] Case-studies were reviewed in Hampicke et al. (2000), Elsasser and Meyerhoff (2001), and Hampicke (2003).

objective scenarios to define comprehensive, relevant and plausible change(s) in the respondent's mind. These two aspects seem to have been properly handled in the case-studies presented in Table 3. Furthermore, the review confirms the adequateness of researchers' choices concerning the source responsible for the change(s) to be valued. This source is, in most cases, related to agri-environmental measures or regional programmes for conservation or restoration of particular attributes in nature and the landscape. National or regional governments are usually the entities chosen to assure the respective implementation.

However, the content validity of the valuation object depends also on a proper delimitation of changes in both the spatial and temporal scales. Added to these two formal aspects, it is also necessary to establish the predictable level of certainty in accomplishment of the changes to be valued (Fischhoff and Furby, 1988).

With regard to these latter formal valuation details, the information provided in the case-studies described in Table 3 reflects the researcher's care regarding spatial delimitation. The main strategy is to anchor it to geographical or institutional delimitations that are familiar to respondents: a region, a district, a Nature Park. Hence, in general, the areas displayed in valuation scenarios correspond to the geographical scales to which valuation has been indexed. However, often these broader areas do not overlap the smaller physical areas addressed by the valuation scenarios, which are often not quantified to respondents. This latter option might be understandable from the perspective of not overloading individuals with information, but creates room for individual's misperception regarding the valuation scale.

The multi-attribute valuation approach, which is designed to value changes in particular attributes instead of general changes in the state of the landscape or nature (Santos, 1997; Madureira, 2001; Fischer et al., 2003), seems to help to overcome the problem of individual misperception of the valuation scale. Within this option the physical areas can be more easily related to the attributes valued by the individuals in the hypothetical markets. Thus, the multi-attribute valuation approach provides a way of improving the accuracy of spatial scales applied to value land-based services, such as preservation, recreation and also the beneficial processes dependent on agricultural NCOs supply. Accurate specification of attributes looks helpful to confine the broader supply scales of agriculture-related NCOs, such as the landscape or the agro-ecosystem, to the scales perceived from the demand side.

In addition to problems with spatial scales, major problems with the required valuation details arise from temporal scales. These are rarely explicit in valuation scenarios, being implicit in the accomplishment or maintenance of policies or programmes which assure the supply of the services valued (see Table 3). Difficulties in detailing temporal scales are mainly due to a lack of information both of the bio-physical and political aspects involved in the predictable evolution of NCO provision which is often presented in contexts characterized by marked natural and socio-political uncertainties. They underline the importance of including accessible information on bio-physical and political aspects in the design of accurate valuation scenarios.

Application of revealed preference methods, such as HPM, alleviates problems in specifying the valuation object. However, introducing environmental variables into a hedonic equation poses problems of measurement. Empirical concerns currently relate to the way of measuring these variables in order to obtain a sound estimate of the characteristics really perceived by individuals. In general, the researcher does not have a direct physical measurement of these variables. The first way of introducing environmental variables is to develop GIS-hedonic pricing with a view to defining the environmental characteristics of each property (house or building) as a distance from the environmental amenities of given farm activities (Ready and Abdalla, 2005). If a GIS database is not available, a second method is to adopt the procedure used by Le Goffe (2000) or Mollard et al. (2006) who take land-use variables (proportion of grassland in the commune area, proportion of cereal in the commune area, etc.) as proxy for agricultural landscape quality. In both cases, these variables used as proxies are valuing agricultural NCOs separately and ignoring the interactions between them, which also are determinant in defining NCOs as perceived by consumers. Therefore, the simplicity of this valuation method in terms of the specification of agriculture-related NCOs, such as spatial amenities is more apparent than real. Nevertheless HPM can prove an appropriate tool for valuing other agricultural amenities by using the price of certain foodstuffs that are defined in terms such as organic product or protected origin denomination (Maria and McCluskey, 2000). However this method is currently at an early stage of development.

3.3. Quality estimates

The quality of estimates has to be evaluated through two "filters": validity and reliability. An estimate can be considered valid when it provides appropriate measurement for the concept being measured. A reliable estimate is a robust measurement of that concept, such that estimates are not excessively sensitive to changing measurement conditions.

The principal problem with estimates obtained through SP valuation is, as has been discussed in Section 2, the absence of external validity criteria. Researchers occasionally resort to convergent validity tests, comparing estimates obtained through different valuation methods. These tests are seen in a small number of the case-studies surveyed (Madureira, 2001; Wronka, 2001; Fischer et al., 2003), and are only employed between alternative SP methods (usually CVM versus choice experiments and CVM versus conjoint analysis).

The limitation to testing the convergence between these and revealed preference is that it only allows comparison of use values. Nevertheless, this can be used to demonstrate the validity of estimates for politicians and decision-makers. The French survey gives an opportunity to perform those tests, through SP surveys designed to deliver estimates for recreational use value compared with the available HPM estimates.

Therefore, the assessment of the quality of estimates obtained through the SP approach has to rely on the internal validity tests. This can be done through the evaluation of valuation scenarios quality (content validity) and by checking if theoretical validity was assessed by researchers.

Content validity (or face validity) is about assuring that the ''researcher and the subjects share common definitions for the good valued'' as emphasized by Bjornstad and Kahn (1996, p. 269). The literature supplies some guidance to design valid valuation scenarios (Fischhoff and Furby, 1988). Theoretical validity (or construct validity) means that estimates are in fact measures of the concept to measure (the WTP in this case). A current procedure to assess the theoretical validity of estimates obtained with CVM involves estimating valuation functions, which includes explanatory variables that are expected to have a particular relation with WTP (such as income or change size).

Assessment of content validity for the case-studies surveyed shows that the principal drawbacks are the weak definition of spatial scale, omission of temporal scales and degree of certainty in the delivery of the change(s) offered. The conclusions regarding content validity of the valuation objects (valuation scenarios) presented for the case-studies listed in Table 3 are: (a) substance aspects, such as attributes to be changed or the source responsible for that, seem to be reasonably assured; (b) but imperfections are detected in the formal specifications, such as the valuation time scale and certainty associated to the changes concretisation.

With regard to theoretical validity, most of the studies listed in Table 3 test the impact of individual (or respective household) income on WTP. Some go a little further and estimate valuation functions which show if the impact of certain variables, such as income, attributes quantity and individual attitudes towards environment, agree with the theoretical expectations (Colson and Stenger-Letheux, 1996; Santos, 1997; Madureira, 2001; Wronka, 2001; Meyerhoff and Dehnhardt, 2002; Fischer et al., 2003).

Testing reliability implies a re-test measurement with small variations in the measuring instrument. This test-retest procedure is proposed for CVM by Schuman (1996) as the appropriate way to assess the reliability of estimates. Since this is costly both in time and financial resources it is rarely done. Reliability assessment is usually based on goodness of fit indicators for regression models (like the coefficient of determination R^2 or the likelihood ratio) and on the calculation of confidence intervals for WTP estimates. To decide whether a particular estimate is reliable enough in terms of inter-individual estimated variance, the values obtained by the goodness of fit indicators for the regression models estimated with CVM data can be compared to the ones obtained in other studies (Bowker and Stoll, 1988; Cameron, 1988; Mitchell and Carson, 1989; Garrod and Willis, 1995; Santos, 1998). Regarding sampling-variance, measured through confidence intervals (CI), the best practice is to work with larger samples because this will improve CI precision.

To decide if an estimate is good enough to be used in decision-making contexts, its content and theoretical validity as well as the size of the respective CI must be checked. Required quality depends on the respective information use: lower, if it is only for design or just for assisting decision-making; higher, when estimates are used to provide aggregate benefits for cost-benefit analysis used as a decision tool. However, there are no available standards to assist the quality assessment of SP value estimates.

Concluding this discussion regarding the quality of estimates surveyed, one may observe that the evidence reviewed is mixed. As already mentioned, researchers are cautious about the substantive aspects of valuation scenarios that may determine the validity of its content. The recommended tools to aid the design of valuation scenarios, such as focus groups and pilot surveys, are reported in several case-studies (Bonnieux and Le Goffe, 1997; Santos, 1997; Nunes, 2000; Madureira, 2001; Wronka, 2001; Fischer et al., 2003; Siriex, 2004). However, shortcomings were found in the specification of formal aspects, as referred previously. Theoretical validity seems to have been achieved in the majority of the estimates presented. Convergent validity testing is an almost wholly unexplored approach as far as the available empirical evidence in the countries surveyed is concerned. Estimates reliability appear also to be quite variable from one case-study to the other. Most of them surveyed random and relatively large samples using face-to-face interviews (Bonnieux and Le Goffe, 1997; Santos, 1997; Nunes, 2000; Madureira, 2001; Dachary-Bernard, 2004). However, in some cases the reliability of estimates was limited, due either to sample bias, resulting from a postal survey (Colson and Stenger-Letheux, 1996) or small samples (Siriex, 2004, in the survey of visitors).

Information regarding estimates quality should be integrated into economic valuation databases, particularly if they intend to address end-users. For instance, this issue is not taken into account by the standard economic valuation database EVRI, while it is by other smaller databases, such as Envalue. However, in general, these latter offer a poor coverage of valuation studies conducted in European countries and are often out of date.

3.4. Estimates applicability to MFA context

Economic valuation offers monetary estimates for the benefits (or costs) people perceive from a non-market good (or ''bad''). This is clearly useful information in the context of MFA assessment, whenever the definition of MFA is

Table 4
WTP estimates for attribute-related to the landscape valued by residents in the MULTAGRI project survey (only case-studies from France and Portugal)

Author(s)	Valuation method	Attribute valued	Payment vehicle	Mean WTP estimates[a] (€, 2000 prices)	Area valued	Spatial scale
Dachary-Bernard (2004)	CE	Hedgerows	Local tax	22 €/year	Landscape protected area	Region
		Farm buildings in the landscape		37 €/year		
Siriex (2004)	CVM	Open landscape	Income tax	15 €/year	Regional landscape	Region
Noublanche (1998)	CVM	Chestnut groves	Income tax	32 €/year	Local landscape	Region
Bonnieux and Le Goffe (1997)	CVM	Hedgerows	Local tax	34 €/year	Landscape protected area	Region
Colson and Stenger-Letheux (1996)	CVM	Hedgerows	Local tax	18 €/year	Regional landscape	Region
Madureira (2001)	CVM—multi-attribute	Almond groves (0–100%)	Income tax	0–137 €/year	Regional landscape attributes	Region
		Woodland (0–100%)		0–58 €/year		

[a] Values per household.

undertaken. Valuation studies can be conducted in both directions: to measure economic costs of environmental negative impacts related to agricultural NCOs (e.g. nutrient runoffs to water, landscape changes due to farming intensification); and to value beneficial effects such as preservation or restoration of typical landscapes and semi-natural habitats. At what level this information can be useful depends on the one hand on its quality and, on the other, on the needs of its end-users. It is evident that such estimates of economic benefits derived from ''healthy and safe food'' or ''nature and cultural heritage preservation'' are useful for MFA assessment at the EU level. In the EU perspective the MFA is a concept politically oriented to the promotion of rural development, which encompasses valuing the environmental goods and services that farmers cannot sell in the markets, but that society demands.

This politically oriented perspective is present in the case-studies reviewed (see Table 3), which made the provision of valued environmental and landscape services dependent on public projects, programmes or policies. On the other hand, these case-studies establish plausible links between services valued by people (the demand-side) and agricultural NCOs (the supply-side), making explicit the role of farmers as the providers of nature and landscape.

Table 4 displays WTP estimates of landscape or related attributes associated with the economic benefits of agricultural NCOs as perceived by residents in France and Portugal.

In these case-studies there is an evident link between the services valued and a particular agriculture-related NCO (the ''landscape''). Yet, in most of them landscape is presented to respondents in very broad terms, with mixed attributes valued at a regional level. Nevertheless, the fact that these estimates report values for populations living near the valuation site, and who are therefore more familiar with the valued object, may have helped to overcome the lack of accuracy in its specification. The closeness of individuals to the valued object may simplify its specifications, but limits the usefulness of the correspondent estimates to MFA assessment at a broad level.

The application of ABMC approach makes it possible to estimate marginal values for landscape attributes (Madureira, 2001; Dachary-Bernard, 2004). Monetary values can be expressed per hectare, increasing the estimate's perceptibility and its usefulness to politicians and decision-makers. But, even so, the estimates surveyed provide information relating only to the local/regional level.

The survey of the German WTP estimates for residents populations, presented in Table 5, shows a valuation of the preservation of nature and biodiversity and the safeguarding of ecological beneficial processes, often through restoration of certain semi-natural ecosystems and by reversing negative external costs.

The relationship between valued environmental and landscape services and the agricultural NCOs is also evident in this case. Nevertheless, some authors (Wronka, 2001; Schmitz et al., 2003) dig a little deeper by attempting an integrated valuation of landscape functions, but only for particular areas. Schmitz et al. (2003) used CE to measure welfare changes in the regional population, in response to changes in the quality of such landscape functions as drinking water, biodiversity, food production, and landscape aesthetics. To deal with landscape multifunctionality the authors resort to simulation results from the SWAT (hydrological), ANIMO (ecological), and ProLand (economic) models to assist the design of valuation scenarios (Zander et al., 2004).

The valuation study of Schmitz et al. (2003) shows the potential of an integrated economic and ecological assessment of the supply-side of the agriculture-related NCOs to support respective service specification on the demand-side. Schmitz et al. (2003) followed on from the work of Wronka

Table 5
WTP estimates for preservation of nature and landscape and beneficial processes valued by residents in the MULTAGRI project survey (case-studies from Germany)

Author(s)	Valuation method	Attribute valued	Payment vehicle	Mean WTP estimates[a] (€, 2000 prices)	Area valued	Spatial scale
Fischer et al. (2003)	CVM—multi-attribute	Hedges attributes	Donation to fund	36–58 €/scenario (single payment)	Regional landscape	Region
Schmitz et al. (2003)	CE	Landscape and water quality (amount of species, average field size in ha, land-use share (%), mg nitrates/l water)	Claim for compensation	97–59 €/year/scenario (single payment)	Regional landscape	Region
Meyerhoff and Dehnhardt (2002)	CVM	Habitat preservation	Donation to biosphere reserve	7–15 €/year	Flood-plains river Elbe	Region
Wronka (2001)	CVM, CA	Biodiversity and water quality (eutrophication in streams, nitrate concentration in groundwater, β-biodiversity, organic waste in *t*)	Claim for compensation	68–76 €/year	Mountain landscape	Region
Rommel (1998)	CVM	Habitat preservation	Local tax	26 €/year	Biosphere reserve	Region

[a] Values per household.

(2001), who had tried to integrate ecological and economic valuation of land-use in less favoured areas into an interdisciplinary model.

Table 6 shows estimates of the visitors' WTP for landscape and nature conservation provision services.

Some of the studies in Table 6 also offer estimates for resident populations (see Tables 4 and 5), hence giving more complete estimates for economic benefits (Noublanche, 1998; Rommel, 1998; Madureira, 2001; Dachary-Bernard, 2004). Even so, only the case-study from Siriex (2004) covers all the relevant populations when non-use values are involved: residents, visitors and the general public. The latter category is rarely surveyed, which might be due to budgetary limitations or to the researcher's choice of selection criteria. The general public might prove incapable of valuing services provided by assets that are unfamiliar to them. That is one of the principal limitations generally attributed to SP valuation methods when measuring non-use value (Nunes and Bergh, 2001).

The review of estimates provided in Tables 4–6 emphasizes some common features of the underlying valuation of agriculture-related NCOs in the three countries surveyed. They are: (a) prevalence of the SP approach; (b) resort to landscape as a valuation scale; (c) presence of a link between valued services and agricultural NCOs supply, namely in the framework of preservation/restoration policies, programmes or projects. This review also points out that often estimates allow us to answer questions such as "which attribute is more valuable in a particular area" (Santos, 1997; Le Goffe, 2000; Madureira, 2001; Wronka, 2001; Schmitz et al., 2003; Dachary-Bernard, 2004; Mollard et al., 2006), "which areas are more valuable in supplying a particular attribute" (Degenhardt and Gronemann, 1998; Mollard et al., 2006) and provides information regarding the relative value of goods or attributes for different segments of the public (Noublanche, 1998; Rommel, 1998; Madureira, 2001; Siriex, 2004; Dachary-Bernard, 2004).

Nevertheless, only the German studies, Wronka (2001) and Schmitz et al. (2003), come close to answering the question: which NCOs should be bundled together in a particular area? This is a relevant question from the political and technical decision-making standpoint in the MFA context at broad level. Thus, case-studies from Wronka (2001) and Schmitz et al. (2003), reinforce the idea that there are certain methodological directions worth exploring in the agriculture-related NCOs valuation: (1) the design of multi-attribute valuation experiments; (2) resort to bio-physical data to delineate attributes; (3) the integration of ecological and political information into the design of valuation scenarios.

Multi-attribute valuation seems to be a general trend, the still open issues being basically the selection and definition of attributes and the criteria used to demonstrate estimates' validity. The use of bio-physical data in the design of valuation scenarios is far from being a common procedure, the main reasons being the scarcity of this type of data (Zander et al., 2005) and probably the researcher's difficulty in handling it. Integration of ecological and political information (e.g. from simulation models) into economic valuation implies evaluating which of the available models are able to provide it. It is worth stressing that the availability of this type of information could also be rather useful in assisting the definition of spatial, and even temporal, scales for valuation.

Table 6
WTP estimates for attribute-related landscape and nature conservation valued by visitors in the MULTAGRI project survey (case-studies for France, Germany and Portugal)

Author(s)	Valuation method	Attribute valued	Payment vehicle	Mean WTP estimates (2000 prices)	Area valued
Mollard et al. (2006)	HPM	Proportion of permanent grassland fodder cereals	Rural cottage rental price	0–0.82 €[a] 0–0.1 €[a] 0 €[a]	Communal surface/ three districts
Dachary-Bernard (2004)	CE	Hedgerows Farm buildings	Tourism tax	1 €/day 4 €/day	Landscape protected area
Siriex (2004)	CVM	Open landscape	Local tax	15 €/year	Regional landscape
Le Goffe (2000)	HPM	Proportion of permanent grassland fodder cereals livestock density	Rural cottage rental price	0.8 €[a] −0.8 €[a] 0 €[a] −20 €[b]	Communal surface, region
Noublanche (1998)	CVM	Chestnut groves	Local tax	20 €/month holidays	Local landscape
Degenhardt and Gronemann (1998)	CVM	Endangered species and Grasslands	Tourism tax	1.2 €/overnight stay	Regional landscape
Degenhardt and Gronemann (1998)	CVM	Endangered species and Grasslands	Tourism tax	0.5 €/overnight stay	Regional landscape
Degenhardt and Gronemann (1998)	CVM	Mountain meadows	Tourism tax	0.8 €/overnight stay	Regional landscape
Degenhardt and Gronemann (1998)	CVM	Mountain meadows	Tourism tax	0.5 €/overnight stay	Regional landscape
Rommel (1998)	CVM	Habitat preservation	Tourism tax	1.6 €/overnight stay	Biosphere reserve
Madureira (2001)	CVM—multi-attribute (continuous)	Almond groves (0–100%) Woodland (0–100%)	Income tax	0–170 €/year[c] 0–60 €/year[c]	Regional landscape attributes
Santos (1997)	CVM—multi-attribute (discrete)	Traditional landscape (T + M + W) Farm terraces (T) Meadows (M) Woodland (W)	Income tax	81 €/year[c] 34 €/year[c] 18 €/year[c] 38 €/year[c]	Protected area landscape attributes

[a] Values expressed for 1% variation of crop areas.
[b] Values expressed in 1 ANU (animal nitrogen unit) per hectare increase.
[c] Values per household.

4. NCO specification: closing the gap between research and end-user needs

This section discusses the main problems, and potential solutions, regarding the specification of agriculture-related NCOs for economic valuation, which could be useful in broader policy and decision-making contexts. It starts by outlining the main drawbacks of the standard NCO specification and the suggestions in the literature that might overcome them. There follows a proposal of an integrative valuation framework addressing a clear definition of ''what are we valuing'': ''we'', being the researchers, the public and the end-users.

4.1. Main drawbacks and answers of valuation research

The answer to the question ''what are we valuing'' (OECD, 2000) must be answered through a correct triangulation of: researcher, public and end-user, and not restricted to the conventional relation of researcher-public. And, as stressed by Berkowitz (OECD, 2000, p. 80), for the end-users, at the policy analysis level and in the field of rural amenities, ''the specification of an NCO is a key technical issue''. Furthermore, Randall (2002) underlines the risks of getting ''green prices'' wrong, because of the problems involved in the valuation of multifunctional outputs from agricultural activity. The same author draws attention to the risk of market distortion if decision-makers base green payments on overestimated economic benefits for NCOs.

The main drawback regarding NCO specification to the usefulness of valuation of agriculture-related NCOs in the political context lies in the difficulties in dealing with broader scales (e.g. the EU) required by politicians and decision-makers. So far, as empirical evidence in the European context shows, the regional scale prevails (Navrud

and Vagues, 2000; Eftec, 2002), confirming trends reported for case-studies reviewed in the MULTAGRI project. Most case-studies address particular landscapes or agro-ecosystems crudely defined at local or regional scales. Attempts to generate value estimates at a national level are scarce (Drake, 1992; Pruckner, 1995), and even then, studies rarely regard all potential beneficiaries, thus limiting the usefulness of aggregate benefits estimates to political decision-making. The exception to this situation seems to be the systematic and relatively complete valuation (in terms of the segments of the public considered) of ESAs (environmentally sensitive areas) in the United Kingdom (Hanley et al., 1999).

Valuation of economic benefits from UK ESAs has been financed, at least partially, by the UK Ministry of Agriculture, Fisheries and Food. This support has certainly played a decisive role in their systematic realisation. The absence of institutional interest and support for the routine pursuit of similar valuation studies probably explains why, in the majority of EU countries, they arise mainly in the academic or research project context. This also explains their focus on testing methodological aspects and a lesser concern with usefulness to the potential end-users of the resulting estimates. Nevertheless, most of the studies, as the survey for the MULTAGRI project demonstrated, establish a link with concrete policies, programmes or projects in order to answer current problems and achieve relevance and plausibility in valuation scenarios, which makes the estimates, if of acceptable quality, useful at the respective local or regional levels.

Notwithstanding, there is another relevant feature of the ESAs that helps to explain the pattern of systematic valuation observed. The overlapping of institutional and agro-ecological scales in the ESA delimitation process facilitates this kind of evaluation. It makes valuation useful at the policy level, because it enables estimates to be compared and assures benefits aggregation at the national level, since the substitution effects are accounted for. It also allows top-bottom valuation, as shown in Garrod and Willis (1995), in line with Randall's (2002) proposition for an upscale valuation regarding MFA.

The prevalence of ''landscape'', as a valuation scale for the goods and services involving land use, is overwhelming, in the literature, as the survey for MULTAGRI project shows (e.g. Table 6). The option for ''landscape'' is grounded in the fact of its being, as Berkowitz (OECD, 2000, p. 80) states, ''an organising factor in the relationship of a cluster of environmental (and cultural) characteristics''. Thus, it offers a perfect spatial scale for valuation of land-base services, because it can be broadly defined and is comprehensible to individuals. Yet, it often does not provide a comparable valuation framework, as the discussion in Section 3 showed for the case-studies assessed. Several factors account for this limitation; fuzzy boundaries, diversity and heterogeneity of attributes, and often a divergence between agro-ecological and institutional scales.

The multiple interactions between NCOs are another difficulty in standardising a ''landscape'' scale able to link the supply to the demand-side. In addition to these interactions one must count on: (a) the interrelation between NCOs and COs (commodity outputs) when the first are jointly produced; and (b) the complex interactions between elements in semi-natural ecosystems and cultural landscapes. These complex interactions inhibit the establishment of proper spatial and temporal scales for agriculture-related NCOs valuation and make difficult the specification of attributes. This is not just a problem with valuing these kinds of NCOs: valuing biodiversity poses similar, or even greater problems (Nunes and Bergh, 2001; Hein et al., 2006).

Therefore, more research is needed in to the specification of valuation scales and the attributes to value. The empirical evidence of the agriculture-related NCOs valuation gives some hints on how to pursue these tasks. It shows that the resort to multidisciplinary data and models to specify NCOs closes the gap between valuation specifications (demand-side) and the NCO delimitation on the supply-side. This methodological option could be a valuable procedure to be routinely implemented in the valuation of agricultural NCOs. Moreover, recent literature on economic valuation of complex environmental assets, such as biodiversity, recommends the reinforcement of complementary survey techniques, both ex ante and ex post economic valuation (Hein et al., 2006; Powe et al., 2005). This recommendation addresses mainly the quality of estimates, yet it simultaneously enhances the participation of end-users and the public in the valuation design.

4.2. Integrative valuation framework for agriculture-related NCOs

The integrative valuation framework for agriculture-related NCOs proposed here is outlined for SP methods, which are based upon the construction of hypothetical markets allowing for ex ante changes in the provision level of agriculture-related NCOs. Policy and decision-making context are usually heavily dependent on ex ante information when land use changes and alternative options for landscape management are at stake. The flexibility of SP methods for ex ante valuation makes them attractive even when only use values are involved (like NCO ''healthy and safe food'' for instance).

Fig. 1 outlines a proposed valuation framework.

This framework makes explicit the four steps that need to be followed in economic valuation and the two pillars which must support it: (1) the incorporation of data and results from simulation and predictive models developed by bio-physical and agro-economics research areas; (2) the participation of end-users in designing steps of economic valuation. It also defines a clear option for the multi-attribute valuation approach. The advantages of this approach have been pointed out in Section 3, and are mainly related to the accuracy in the specification of the valuation object and with

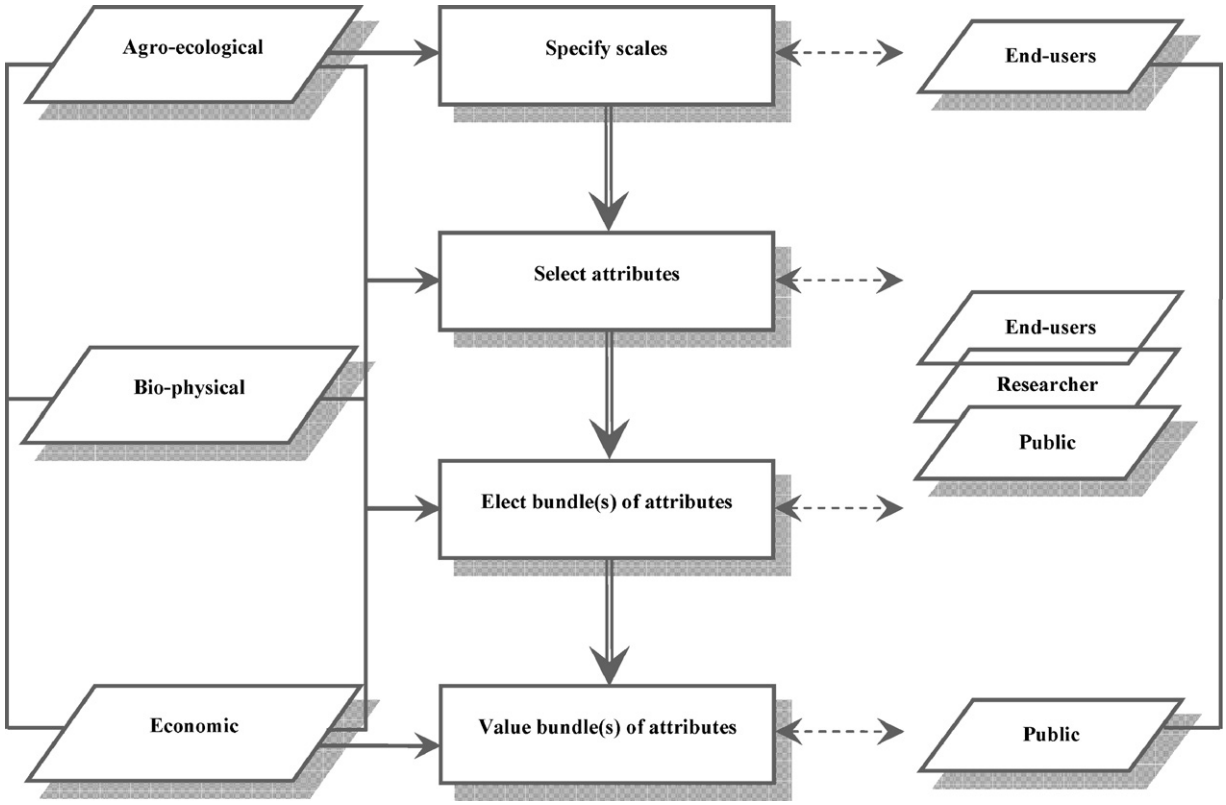

Fig. 1. Outline for an integrative framework for the valuation of agriculture-related NCOs.

the possibility of modelling interaction between different attributes (and NCOs).

Implementing the proposed framework implies gathering and modelling data and information from different data-sources and available models at three levels: agro-ecological, bio-physical and economic. Modelling should be conducted so as to shed light on interactions between agro-ecological factors and NCO provision as well as interactions between NCO and CO on a well established spatial scale.

The first step for valuation consists of specifying manageable scales at national and EU level that are simultaneously useful for end-users of data provided by economic valuation. One possibility is to resort to the definition of agro-ecological units at EU level. Yet, this task is still far from being achieved, at least at the EU level, as the European Commission recognizes (Caradec et al., 2005). Technical definitions relating to Nature 2000 sites make them a potential platform for the provision of a spatial scale that would be comparable at the EU level, even if this implied only a partial coverage of agriculture-related NCOs. That experience could be then expanded to broader agro-ecological units, if its delimitation is available.

The second step comprises identifying and selecting relevant attributes, as well as the respective levels. Bio-physical and agro-ecological data, and particularly results of its modelling, are fundamental inputs to identify attributes and respective levels that can be operationally defined. For instance, attributes ‘‘number of species per area’’ (Schmitz et al., 2003) or ‘‘nitrate concentration in groundwater’’ (Wronka, 2001) fulfil this requisite. In addition to that, a direct association between valuation attributes and NCO provision on the supply-side have to be assured. This seems to be the case for the attributes just mentioned. Yet this requisite is not clearly accomplished in some of the case-studies surveyed in the MULTAGRI project: see for example ‘‘habitat preservation’’ (Rommel, 1998) or ‘‘open landscape’’ (Siriex, 2004). The use of complementary survey techniques, such as expert valuation (Hein et al., 2006), might be helpful at this level, both to assist identification of measurable attributes and to achieve correspondence with agro-ecological scale.

In order to integrate the relevant actors in the second valuation step the use of group-based participatory approaches is recommended (Chilton and Hutchinson, 1999; Kontogianni et al., 2001). End-users should be allowed to play an active role at this level, selecting the attributes and respective changes which are relevant for policy and decisions regarding the provision of NCOs, namely in the MFA context. Final selection of attributes and respective changes should be determined by end-users choices, researcher evaluation of the use of such choices and the comprehensibility and plausibility of researcher definitions to the public. To allow up-scaling of value estimates the ‘‘public’’ has to include all the affected beneficiaries. These are, following categorisation of goods and services supplied by agriculture-related NCOs established in Table 2: (a) the

''consumers'' who value ''healthy and safe food''; (b) the ''visitors'' who value ''leisure and recreation'' services; (c) the ''general public'' (including both users and non-users populations) who value ''beneficial processes'' and ''nature and cultural heritage preservation''.

The multidisciplinary and triple-stakeholder approach used to assist step 2 should support also step 3, which selects the bundle(s) of attributes to be valued. The main goal of step 3 is to elect bundle(s) of attributes (different combinations of NCOs at different levels) that can be correctly specified in economic terms and that can be effectively provided at the spatial and temporal scales. Establishing these bundles as particular landscape functions, as done by Schmitz et al. (2003), is a possibility. At this level it is important to identify and to model the interrelations between attributes bundled. Bio-physical data and economic modelling appear to be useful tools to assist this task.

Finally, the fourth valuation step comprises specification of other valuation details, related to the hypothetical transactions, such as the elicitation scheme and payment vehicle and options related to the implementation of hypothetical markets.

SP valuation methods, such as choice experiments, contingent ranking and contingent rating, have been used since the late 1990s to value bundles of attributes (e.g. Boxall et al., 1996; Stevens et al., 1997; Adamowicz et al., 1998; Hanley et al., 1998b). Moreover, contingent valuation method (CVM), applying a dichotomous choice elicitation scheme (Mitchell and Carson, 1989), has been also used for multi-attribute valuation (Santos, 1997; Hanley et al., 1998b; Madureira, 2001). Within this later elicitation format for CVM, prices for alternative bundles are established by the researcher and offered to the individuals as an additional attribute, following the design of SP methods derived from conjoint analysis (choice experiments, contingent ranking and contingent rating). The relative disadvantage of CVM is in allowing the comparison of only two choice alternatives (to provide the bundle selected at price X versus not providing it), whereas the other SP methods provide larger choice sets. Nevertheless, the CVM has an advantage compared with other SP methods which is the possibility of modelling relatively complex multi-attribute valuation functions, able to account for the interactions between attributes, as shown by the evidence surveyed (Santos, 1997; Madureira, 2001; Wronka, 2001; Fischer et al., 2003; Dachary-Bernard, 2004). To account for these interactions, namely the substitution effects between attributes at valuation level (due to income effect), is a relevant issue to avoid overestimates for the agriculture-related NCOs.

The choice of payment vehicle is another important issue involved in the fourth valuation step. To assure usefulness of economic value estimates in broader contexts, namely in the assessment of MFA at EU level, the question ''how do we pay'' is parallel to the one ''what are we valuing''. Case-studies surveyed in the MULTAGRI project show a quite diversified bunch of options (see Tables 4–6). Hence, a common payment vehicle should be established according to the public involved by valuation. The association between NCOs categories valued and respective beneficiaries, suggested in valuation step 2, could also be useful at this point. Hence, the same payment vehicle could be established in a broad level (e.g. EU level) for each one of the three publics: ''consumers''; ''visitors''; ''general public''.

Therefore, the framework outlined appears useful to orientate new studies in the area of valuation of agriculture-related NCOs to value more comparable bundles through indexation to similar spatial scales. This seems to be fundamental to a more systematic use of this economic information in the decision-making contexts at broader levels. Furthermore, the information regarding the public preferences for different NCOs bundles, appears to be essential for the assessment of MFA, if policies to implement MFA were to be defined at those broader levels, such as the EU level.

A final remark regarding the valuation framework proposed in this section, relates to the potential to improve content validity of valuation scenarios used in the hypothetical markets. It helps to increase accuracy of attributes definition, but especially it supplies a guideline to a better specification of formal aspects, such as spatial (and also temporal) scale and certainty in the provision of valued NCO. The participation of end-users in the selection of NCOs to be provided might be helpful to assign more realistic degrees of certainty to the valuation scenarios presented to the public. It could also prove useful to assist the selection of up-scaled payment vehicles able to get the individuals close to a realistic expectation of payment.

In addition, this valuation framework can be envisaged as a valuation protocol useful both to test convergent validity between alternative SP methods and to enhance benefit transfer. Benefit transfer is the process of using estimates from one particular valuation to value similar things in different contexts. It means, for instance, taking estimates for the value of preserving a particular landscape located in a certain geographical area, and using them as the value of another similar landscape in a different location. This can be done through different processes, allowing for a larger or smaller degree of adjustment of the original values to the differences relative to the context where they are transferred (Bateman et al., 2000). This process has been the object of increased interest by researchers in the economic valuation field, because it allows, potentially, a systematic use of value estimates in both the policy and the decisional context regarding environmental policy.

5. Conclusions

In spite of the diversity of MFA concepts and their functions, there are basically three main reference points: (1) activities for food production; (2) spaces in which nature, landscape and environment preservation and protection take place; (3) the socio-economic structure that links the above-

mentioned activities and spaces. Hence, any assessment of MFA requires a multidisciplinary framework able to integrate these multifunctional activities, spaces and agents. Such a framework is far from being built. Economic valuation is just one piece in this complex puzzle. It is basically a tool to produce information on the relative value of environmental and recreational spatial-based services that may be delivered by multifunctional agriculture.

Empirical evidence for agriculture-related NCOs valuation highlights the prevalence of regional valuation scales and the use of the SP approach. Both options seem to be intimately linked to the spatial dimension and spatial differentiation that define environmental and recreational services related to NCOs provision by agricultural activities. Thus, the usefulness of available value estimates in the policy and decision-making context is usually confined to the respective regional valuation scales. Even so, this information is not widely used, probably because it is scattered in diverse scientific publications and grey literature and not easily available to potential end-users (e.g. technical staff, politicians and decision-makers). Organising a data-base at EU level focusing on end-users needs could be a profitable task both to prove the worth of economic valuation exercises and to make it more helpful in assisting contemporary policy formulation and decision-making at the regional level.

The estimates available do not generally allow an up-scale comparability, aggregation or transferability required by politicians and decision-makers. Nevertheless, the more recent applications of economic valuation to agriculture-related NCOs tackle the limitations pointed out above, particularly in the case of the SP approach. The integrative valuation framework that has been proposed in the previous section relies on the hints from this recent research and on the recommendations for valuing complex assets, such as biodiversity. This framework highlights the steps to be followed in the valuation of agriculture-related NCOs and how they should be handled to improve estimates comparability and also their aggregation and transferability.

The integrative framework outlined in Fig. 1 relies heavily on a multidisciplinary and multi-stakeholder approach, thereby opening up valuation to bio-physical data as well as to information from simulation models and alternative survey techniques. Therefore, it provides a promising valuation protocol to assist new valuation studies addressing the issue of usefulness in the MFA assessment. However, to enhance the usefulness of economic valuation in the MFA context other standardisation issues need further development, namely the questions related to the validity standards and the benefits transferability.

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