



Building an empirically-based framework to value multiple public goods of agriculture at broad supranational scales



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ABSTRACT

Agricultural landscapes deliver multiple, highly valued goods such as cultural amenities, biodiversity conservation and climate stability. These goods are often delivered as side-effects of farmers' production decisions driven by broad-scale, supranational changes in agricultural, trade or other policies. Human well-being is thus affected in ways not taken into account in these macro-policy decisions. To avoid this policy failure, there is a growing demand for the valuation of broad-scale changes in public goods by the general public. For this purpose, context-rich valuation scenarios at this broad scale need to be developed which are empirically-based, policy-relevant and understandable by the general public. In this way, respondents are focused on actual trade-offs rather than invited to give symbolic reactions. This paper presents and discusses a valuation framework developed to fulfil these criteria. The approach is based on a typology of Macro-Regional Agri-Environmental Problems (MRAEP). Each MRAEP is defined by: (1) prevailing farming systems and agricultural landscapes; (2) current levels of public-good delivery; (3) expected direction of land-use change; and (4) expected effects of such change on public-good provision in each macro-region. Multivariate analysis of EU-wide data on agricultural landscapes and farming-systems led to identify thirteen macro-regions in the EU. Current public-good provision was described using public-good indicators. Only those public goods that are expected to change or could be improved by available policy options (core public goods) were used to generate choice alternatives for survey respondents. The paper ends by discussing innovative elements in the proposed approach, achievements, shortcomings and possible policy uses.

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1. Introduction

Cultural and environmental goods and services delivered by agriculture, such as biodiversity conservation or aesthetic amenity, are often provided as side-effects of production decisions made by farmers in response to market prices and diverse public policies. In addition, many of these goods and services exhibit different degrees of non-excludability (and also non-rivalry) in consumption. This side-effect, public-good character of cultural and environmental goods of agriculture makes them prone to

significant market failure, which calls for policy interventions, such as agri-environmental schemes or input taxes, aimed at internalizing the values of those goods and services into farmers' production decisions. Environmental economists have advocated the use of nonmarket valuation techniques to value cultural and environmental benefits of environmentally sensitive farming as part of a full benefit-cost evaluation of agri-environmental policy schemes.

On the other hand, farming systems and the bundles of public goods (PG) they deliver are often driven, at broad supranational scales, by changes in agricultural and trade policies (e.g., Common Agricultural Policy reforms or World-Trade-Organization rounds) which change prices, policy payment schemes and other drivers of farmers' production decisions. PG-related human well-being is thus significantly affected by these macro-policies in ways which are largely not taken into account in policy decisions. The need to assess different policy options and to avoid these policy fail-

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ures, e.g., by considering non-trade concerns within trade policy or available opportunities to use agricultural policy reform to correct market failure in PG provision, led to an increasing demand for the economic valuation of changes in multiple PG of agriculture at broad, supranational scales, which has been acknowledged in the valuation literature (Santos, 2000; Randall, 2002, 2007; EFTEC, 2004; Hein et al., 2006; Madureira et al., 2007).

There are many challenges involved in developing a valuation framework to address this policy demand. Basically, this framework needs to be both empirically-based and policy-relevant, that is: focused on available policy options at broad macro-regional scales. It also needs to be understandable by the general public of the many involved countries whose preferences for the PGs at stake are to be gauged in valuation surveys. In addition, economic values are context-dependent and should be valued as such; providing context-rich scenarios is thus essential for people to engage in the assessment of the actual trade-offs (as required by valid valuation) instead of simply giving us their symbolic reactions to very abstract scenarios. An additional challenge for such a valuation framework is how to take into account substitution effects across goods and services to avoid large aggregation biases when dealing with changes in multiple PGs (Santos, 1998). These challenges might explain why, as far as the authors are aware of, no valuation frameworks have been developed for this purpose within the economic valuation literature in spite of an existing demand for such broad-scale valuation exercises.

This paper discusses the main issues involved in building a valuation framework for changes in multiple PGs of agriculture at broad, supranational scales by developing and discussing one such framework focused on empirically-based and policy-relevant trade-offs. This is supported by a EU-wide analysis of the supply-side of PG provision, using a macro-regional frame of reference to account for socio-ecological gradients across this vast spatial scale, and eventually leading to the identification of the core public goods to be valued in each macro-region. These issues, while crucial to ensure the policy-relevance of valuation exercises, in general, are unfortunately not always addressed with the required detail and rigour in many valuation studies, which prefer to focus instead on experimental design or econometric modelling details. In particular, the valuation of multiple PGs at a broad supra-national scale requires an even more careful consideration of empirical supply-side and policy-relevance issues, which calls for using and analysing complex, heterogeneous (across countries and PGs), incomplete and often limited-quality data.

A related goal of this paper is exploring and discussing the effort involved in the proposed valuation framework to convey context-rich scenarios that may enable respondents to engage in the economic trade-offs that are required to assess different policy options for the provision of multiple PG.

Section 2 discusses basic elements and the foundations of the overall approach used to develop the valuation framework. Section 3 discusses data and methods used in developing the framework. Section 4 presents the main results and assesses the framework's ability to frame the valuation of multiple PGs of EU agriculture at a broad, macro-regional scale. Section 5 concludes by underlining the most innovative elements in the proposed approach, as well as its achievements and shortcomings, and identifies possible applications in informing relevant policy debates.

2. The valuation framework: overall approach and concepts

The valuation framework developed in this article is grounded on three basic conceptual elements: first, the definition of the good(s) to be valued; second, the specification of the agricultural landscape and its role in valuation scenarios; and third, the

way broad-scale socio-ecological heterogeneity across the EU was taken into account in the framework. This last element refers to a central concept within the framework: that of Macro-Regional Agri-Environmental Problems (MRAEPs). This section introduces these three basic elements of the framework.

Agricultural landscapes are specific combinations of farming systems with non-agricultural elements such as woodlands, semi-natural vegetation and other land covers. They have specific structures, functioning and processes which weave all of these components as a whole, or system, which delivers multiple, highly valued goods and services such as food, cultural amenities, biodiversity conservation, water quality, or climate stability.

The first step in any valuation framework is to clearly define the good to be valued. In our case, there were two alternative options: either valuing the broad-scale change in an agricultural landscape as a whole, or valuing changes in the provision levels of the many PGs that change in the context of that broad-scale landscape change.

As people are often more directly affected by changes in PG provision levels than by landscape change as a whole, the valuation framework was focused on directly valuing the former rather than the latter. So, the landscape was taken as the agro-ecological infrastructure delivering things people directly value, such as food, fibre and energy, plus multiple cultural and environmental PGs. As the focus here is on nonmarket outputs, the proposed valuation framework is thus specifically focused on the following PGs of EU agriculture: cultural amenities, farmland biodiversity, water quality and availability, air quality, soil quality, climate stability, resilience to fire and resilience to flooding.

Second, landscape can be specified as either general landscape types or specific landscape areas. Swanwick et al. (2007) identify these two options as: (1) landscape character types, which are generic and occur across different particular areas sharing similar combinations of geomorphology, land cover and historical land use; or (2) landscape character areas, which are unique, discrete geographical areas. The choice between the two was determined by our working scale. In fact, our main concern with policy-driven landscape changes occurring across broad geographical scales led us to adopt the first option. Of course, this ruled out valuing changes in unique landscape areas within the proposed valuation framework. Defining landscapes as landscape character types also underlines their ecological dimension as generic ecosystem mosaics supplying public-good ecosystem services and benefits, which, in the current framework, are the goods to be directly valued by the general public. Examples of this approach within landscape valuation studies are Catalini and Lizardo (2004), Vanslebrouck et al. (2005), Kallas et al. (2006), Scarpa et al. (2007), Chiueh and Chen (2008) and Borresch et al. (2009).

Opting for separating landscape as an agro-ecological infrastructure from both its ecosystem services (e.g., water quality or biodiversity) and its landscape cultural dimension (e.g., landscape cultural services) led us to exclude the landscape itself from the set of ecological and cultural goods and services to be valued; instead, it is considered as the overall ecological structure delivering all of these goods and providing the context for the valuation exercise.

Third, broad-scale changes in agricultural landscapes and the PGs they deliver, including the direction of change itself, are spatially differentiated across socio-ecological gradients within the EU. These gradients determine different regional responses to the same broad-scale (e.g., EU policy) drivers of change. Differentiated responses require the valuation framework to integrate a macro-regional frame of reference (or 'map of macro-regions') that controls for broad-scale socio-ecological heterogeneity. This is why changes in PG provision levels were framed within specific Macro-Regional Agri-Environmental Problems (MRAEPs).

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