

# Cost–benefit analysis of the Zonal Program of Castro Verde (Portugal): Highlighting the trade-off between biodiversity and soil conservation

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## Abstract

We address the effects of erosion on the environmental services provided by the soil and explore possibilities for integrating soil erosion impacts in cost–benefit analyses of agri-environmental policies. As a case study, we considered the continued soil erosion caused by the traditional cereal farming system which is financially supported by the Zonal Program of Castro Verde. This case study illustrated the conflict between the preservation of biodiversity habitat requirements and the maintenance of soil productivity. We conclude that soil erosion is currently a major threat to the long-term sustainability of the Cereal Steppe of Castro Verde and largely reduced the cost-efficiency of public expenditure in local biodiversity conservation. Although replacement cost has proven to be a suitable method to determine the cost of soil productivity loss from erosion, we argue that there is a need to frame the erosion cost estimate obtained within more integrative approaches of assessing erosion costs.

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## 1. Introduction

The current and potential benefits humans can, directly or indirectly, derive from the soil are diverse yet many soil services are affected by mismanagement leading to loss of soil quality and soil erosion (Singer and Munns, 1996; Merrington et al., 2002). Many of the environmental services provided by soil are not priced in conventional markets and thus many of the

consequences of irresponsible soil management are not captured by any analysis of farms' financial performance or taken into account by farmers in their land allocation decisions. Economic valuation can help to develop more sustainable soil management because monetary estimates of the impacts resulting from soil mismanagement allow their comparison with other conventional goods once they become expressed in the same units. A wide range of monetary valuation methods and techniques for environmental assets are described in the literature (see e.g., Garrod and Willis, 1999, and Turner et al., 2003, for an overview of economic valuation methods). Improvement of monetary valuation methods of environmental assets was crucial in broadening the use of cost–benefit analysis

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(CBA) for appraisal of policies and projects that affect the environment. Within the European Union (EU), there has been a notable absence of institutional guidance for its application to environmental issues and policy appraisal (Bonnieux and Rainelli, 1999; Pearce and Seccombe-Hett, 2000). Moreover, use of CBA in agri-environmental policies evaluation and cost-efficiency appraisal among the EU member states has been restricted to a few studies conducted mainly in the United Kingdom (Kleijn and Sutherland, 2003).

We explored the role of economic valuation of soil mismanagement impacts in the appraisal of agri-environmental policies based on the Zonal Program of Castro Verde (ZPCV). This agri-environmental program was implemented in 1995, within EU's agri-environmental regulation, over an extension of 64,000 ha in Southern Portugal (Fig. 1), mostly within the Municipality of Castro Verde. The area under the ZPCV is dominated by a mosaic landscape often referred to as cereal steppe. The traditional management of this mosaic landscape, consisting mainly of cereal fields, fallow land, pastures and ploughed fields, is based on extensive cultivation of cereals in a rotation scheme. Although an economically marginal farming system, the importance of the Cereal Steppes of Castro Verde as one of the last refuges for many steppe birds with unfavorable conservation status,

such as the great bustard (*Otis tarda* L.), the little bustard (*Tetrax tetrax* L.), and the lesser kestrel (*Falco naumanni* Fleischer) is well known (Delgado and Moreira, 2000).

The ZPCV was designed to avoid the loss of suitable habitat for such bird species by financially compensating those farmers who voluntarily agreed to maintain the farming practice described. In spite of the reported positive effects of the ZPCV on target bird populations (Borralho et al., 1999), the occurrence of soil erosion caused by cereal farming is an important drawback of this program, which has not been taken into account in past program evaluations.

The paper is organized as follows: in Section 2, a systematic description of the functions performed by an undisturbed soil as well as the potential flow of benefits delivered to humans is provided. An overview of the impacts of soil erosion on the flow of benefits, and also on adjacent systems, is described. In Section 3, we present the case study of the ZPCV and an application of the replacement cost method to estimate the costs of soil productivity loss due to erosion. The conflict between biodiversity and soil conservation is highlighted in Section 4 through a simple cost-benefit analysis of the ZPCV. We conclude in Section 5 by drawing policy recommendations and listing further research needs.



Fig. 1. Study area location and geographical limits of the Zonal Program of Castro Verde.

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