# Operationalising ecosystem services for effective management of protected areas: Experiences and challenges

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## ARTICLE INFO

## ABSTRACT

Protected areas are crucial for biodiversity conservation and the provision of ecosystem services (ES), but management efforts seem not to be sufficient. To increase management effectiveness, the ES framework offers new promising environmental governance instruments, however, the operational use is still poorly integrated in the management of protected areas. This study used a framework designed for Natura 2000 sites for effective management of protected areas by valorising ES. This framework was applied to 21 study sites in Italy, and 55 ES were quantified in biophysical and monetary terms. Forty-one payments for ecosystem services (PES) were implemented in a participatory process involving local communities and stakeholders. Assessment of the management effectiveness before and after the implementation of PES demonstrated that integrating ES into the management of protected areas can improve their management effectiveness and contribute to regional development through PES. Based on the authors' experiences, the study highlights various difficulties and opportunities related to ES assessment, implementation of PES, stakeholder engagement, and monitoring of management effectiveness. It also discusses general challenges related to the operationalisation of ES in protected areas, providing recommendations for science and practice.

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## 1. Introduction

Less exploited landscapes are important biodiversity pools and are crucial for human well-being, as they provide a wide range of goods and services (MA, 2005; Eastwood et al., 2016). However, natural environments are increasingly under pressure due to agricultural intensification, industrialisation, and urbanisation mainly because of the growing human population's increasing demand for food and energy (Cumming et al., 2014). Although great efforts have been made in creating protected areas worldwide and applying sustainable management practices, the rate of biodiversity loss does not seem to decrease (Butchart et al., 2010). The importance of conservation action is evident, but the achievement of long-term effectiveness of conservation practices remains a challenge (Pullin et al., 2013).

In the European Union (EU), the most important network of protected areas, called Natura 2000, was established through the Habitats and Birds Directives, covering 17.9% of EU-27 land territory and comprising 25,717 terrestrial sites (Kati et al., 2015). The member states are responsible to designate Natura 2000 sites for achieving long-term protection of habitats and species on the EU level. However, the conservation status of most sites (83%) is unfavourable or unknown (EEA, 2010). Scarce financial resources are one major reason why conservation objectives are not met, as funding is needed for the establishment, maintenance, and management of the sites (Watson et al., 2014).

To overcome these difficulties, innovative management solutions are needed, and there is increasing interest in integrating ecosystem services (ES) into policies and decision-making (Guerry et al., 2015). For protected areas, ES approaches may create better support for biodiversity conservation, ecosystem management, and decision-making than former conservation approaches, since they facilitate the anticipation of social and ecological impacts and support the identification and management of potential trade-offs (Ingram et al., 2012). In research about Natura 2000, ES have been rarely employed until now, although they could

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facilitate the acceptance of the network by identifying and evaluating potential benefits from the protection of the sites (Blicharska et al., 2016).

Another decisive aspect for the successful management of protected areas is the support and approval of local stakeholders (Wells and McShane, 2004), moving away from conservation approaches that excluded stakeholders from the planning and implementation process of management plans to participative approaches (Lockwood, 2010). Although the relationships between stakeholder involvement and biodiversity conservation are complex and depend on the greater context, stakeholder engagement leads to indirect social benefits, such as deeper comprehension of stakeholder values, increased confidence, and knowledge (Young et al., 2013).

Great advances in science related to the identification, mapping, and/or modelling of ES stocks and flows across various spatial and temporal scales have been made (Schägner et al., 2013; Wolff et al., 2015; Boerema et al., 2017). Assessment and quantification of social, cultural, and economic values may also result in the development of payments for ecosystem services (PES), which are innovative financial instruments aiming at the conservation of specific ES (e.g. Schomers and Matzdorf, 2013; Ingram et al., 2014; Clements and Milner-Gulland, 2015). Although many conceptual frameworks have been developed (e.g. Fisher et al., 2009; de Groot et al., 2010; Maes et al., 2012; Díaz et al., 2015), efforts at making ES operational are still in the early stages (Bennett et al., 2015). Scientists as well as practitioners are faced with a series of practical challenges, for example, to create confidence among decision-makers (Ruckelshaus et al., 2015), to cope with insufficient data, financial constraints, scientific knowledge gaps, different understandings and applications of the framework, adherence to traditional management practices (Bull et al., 2016), and to overcome limitations related to institutional issues (Scarlett and Boyd, 2015). Considering, on the other hand, the strengths and opportunities related to the ES framework, it can be an effective tool for improved decision-making (Bull et al., 2016).

Hence, there is a lack of good practices for implementing ES-based approaches into the management of Natura 2000 sites to support biodiversity conservation. Therefore, this study aimed to make explicit lessons based on our experiences in 21 case study sites in Italy when operationalising ES for effective management of protected areas. We applied a framework based on ES to create additional funding for biodiversity conservation of Natura 2000 sites. We carried out a comprehensive assessment of ES, including qualitative and quantitative valuations, and developed new financial schemes, such as PES, by involving local stakeholders. We analysed the effects of implementing PES on the management effectiveness, i.e. how well values are protected and conservation goals and objectives are achieved (Hockings, 2006), to monitor the impacts on biodiversity conservation. Each step of the theoretical framework includes obstacles and problems when put into practice, and we discuss our experiences emphasising general challenges and opportunities.

## 2. Materials and methods

### 2.1. Operational framework

To improve the management efficiency of protected areas, focusing on sites of the Natura 2000 network, we used a framework (Fig. 1) that relates to the ES cascade model as proposed by Haines-Young and Potschin (2010). It consists of five steps, which are described in the following:

#### 2.1.1. Step 1: identification of ES

The identification and selection of ES for implementing PES should consider both objective valuations and human perceptions.). Simple qualitative ES maps, describing the relationships between the ecosystems and the services (Burkhard et al., 2012, 2014), are suitable to identify the most important ES. On the other hand, perceptions of relevant ES by site managing authorities provide important local knowledge to identify vital services of a site and focus the discussion on the local public for evaluating their suitability and importance PES in a participatory process (see stakeholder involvement 1).

#### 2.1.2. Stakeholder involvement 1

Protected areas are always embedded in a wider social–ecological system (Palomo et al., 2014), and for each area, different categories of stakeholders and beneficiaries can be identified (Schirpke et al., 2014). In discussions and workshops, stakeholder values and perceptions can be understood and relevant ES can be selected to define future PES or other self-financing schemes (Gaglioppa and Marino, 2016).

#### 2.1.3. Step 2: quantification of ES

Quantitative assessment of ES supply and demand in biophysical terms and their economic and non-economic valuation provide important information to decision-makers about the ecosystem processes and values and constitute the basis for identifying PES or other self-financing schemes. The selection of quantification methods depends mainly on the type of ES and should account for the ecological functions and processes for the biophysical evaluation (Eigenbrod et al., 2010), also providing a reliable basis for an economic valuation (Schägner et al., 2013).

#### 2.1.4. Steps 3 and 5: evaluation of management effectiveness

The management effectiveness describes the performance of conservation efforts and can be measured by comparing the results obtained from the management of the sites with the conservation objectives, i.e. by evaluating the outcomes of biodiversity conservation against defined standards (Hockings, 2006). The conservation objectives are defined in general by the Habitats and Birds Directives or specifically by the management plans, but conservation measures are defined in collaboration with the stakeholders when setting up PES agreements. The evaluation of the management effectiveness can be based on indicators, representing different aspects related to environment, economy, society, and governance (Marino et al., 2015). By carrying out this analysis before and after implementation of PES, it is a useful tool for monitoring its effectiveness in terms of environmental benefits and socio-economic impacts (Lockwood, 2010).

#### 2.1.5. Step 4: implementation of PES

Based on the analyses of steps 1 to 3, drivers affecting the habitats and species of a site as well as relationships between ES and beneficiaries can be identified in order to define and implement innovative financial schemes (PES). PES are usually defined as voluntary transactions between private entities including a buyer and a provider if the latter guarantees ES provision (Wunder, 2005). Involvement of government institutions leads to a mixed agreement, a PES-like scheme (Wunder, 2015), including a mediator, a guarantor, a seller, and a buyer. A self-financing mechanism instead refers to an agreement between the ES provider and a public or private institution that contributes to the management of the ecosystem to secure its ES provision. Henceforth, we use only the term PES, which includes all kinds of environmental payment schemes. As social relations, values, and perceptions influence these monetary or non-monetary transfers (Muradian et al., 2010), the type and conditions that allow to set up a contract