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How to overcome the implementation gap in ecosystem services? A user-friendly and inclusive tool for improved urban management

Harold Levrel[a,b,*], Pedro Cabral[c,d], Clément Feger[e], Mélodie Chambolle[f], Damien Basque[f]

[a] CIRED, AgroParisTech, CIRAD, CNRS, EHESS, Ecole des Ponts ParisTech, Université de Paris-Saclay, Campus du Jardin Tropical, 45 bis, avenue de la Belle Gabrielle, 94736 Nogent-sur-Marne, France
[b] IFREMER, UMR AMURE, ZI pointe du Diable, 29280 Plouzané, France
[c] Université de Brest, UMR AMURE – Centre de droit et d'économie de la mer, IUEM, 12 rue du Kergoat, CS 93837, 29238 Brest Cedex 3, France
[d] NOVA IMS, Universidade Nova de Lisboa, 1070-312 Lisbon, Portugal
[e] Muséum National d'Histoire Naturelle, UMR 7204 – CESCO, Paris, France
[f] LyRE, Centre de Recherche de Lyonnaise des Eaux Bordeaux, France

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ABSTRACT

One of the main issues with the concept of ecosystem services is its absence on the ground in concrete operational decision-making contexts; that is, an implementation gap. In this study, we investigated if this gap could be overcome through the use of open-source data and free tools, and the adoption of a short-term participatory process. We tested these methods in the context of a project in the urban metropolitan area of Bordeaux (Communauté urbaine de Bordeaux: CUB) in France. The ecosystem services were defined using a participatory approach involving local stakeholders, and then selected scenarios were simulated to test the impact of various development or conservation plans. The study addressed three main questions: (1) Is it possible to adopt a simple methodological approach that overcomes the implementation gap through the development of a user-friendly and inclusive method? (2) What is the added value of a participatory approach? (3) With regards to four scenarios in this territory, what are the ES trends in the selected biophysical and monetary indicators, and will knowledge of these trends help planners to shape a sustainable trajectory for the territory?

1. Introduction

One of the main issues with the concept of ecosystem services (hereafter, ES) is its absence on the ground in concrete operational decision-making contexts; that is, an implementation gap (Cowling et al., 2008; Laurans et al., 2013). The first aim of this study was to investigate the possibility of adopting a simple methodological approach to overcome this gap through the development of a user-friendly and inclusive method that allows ES to be included in decision-making. To do this, we used the context of an urban case study.

Urban planning must take into account interactions between multiple ecological boundaries, various human uses and diverse value systems (Gunderson and Holling, 2002). All these elements are a source of complexity for urban planners, particularly if they have to take into account the dynamics of both development and biodiversity conservation issues (Berkes and Folke, 1998). This often leads to contentious relationships between stakeholders, notably if there is a lack of common language and difficulty in agreeing on a compatible vision of the future of the territory (Dietz et al., 2003). Even if the views, values and interests regarding a particular territory are not necessarily 'reconcilable', they require collective discussions to allow the formulation of new rules of management (Ostrom, 1990).

A first step to initiating collective discussions is to have a specific organizational framework (structuring the 'arena of discussion') and common 'rules of the games' (supplying the common language) (Lal et al., 2001; Olsson et al., 2004; Levrel and Bouamrane, 2008). In Western countries, the main organizational frameworks and 'rules of the game' come from environmental policy and legislation. For example, in European Union (EU) countries, all development projects must now carry out impact studies,[1] which create, *de facto*, an arena of discussion for plans and programmes that have an impact on the environment. In addition, several planning instruments have been developed at a local scale within OECD countries to help decision-makers deal with interactions between development and conservation goals. In France, for example, there is the Local Urbanism Plan (*Plan local d'urbanisme*: PLU) for urban planning, the Territorial Coherence Plan

* Corresponding author at: CIRED, AgroParisTech, Campus du Jardin Tropical, 45 bis, avenue de la Belle Gabrielle, 94736, Nogent-sur-Marne, France.
E-mail address: Harold.Levrel@agroparistech.fr (H. Levrel).

[1] Directive of the European Parliament and of the Council of 27 June 2001 on the assessment of the effects of certain plans and programmes on the environment.

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(*Schéma de Cohérence Territoriale*: SCoT), which maps the main stakes for a territory, and the Water Development and Management Plan (*Schéma Directeur d'Amanagement et de Gestion de l'Eau*: SDAGE).

However, these legal and organizational frameworks often lack assessment tools that allow the parallel evaluation of conservation and development objectives. The concept of ES appears to have the potential to help overcome the traditional opposition between development and conservation, by emphasizing the positive interactions between ecological dynamics and economic development goals (MEA, 2005; Daily et al., 2009; Naeem et al., 2009; Cabral et al., 2015). An integrated valuation approach can help stakeholders take into account the complexity of interactions behind these ES (Díaz et al., 2015; Jacobs et al., 2016). Studies have shown that to inform collective and individual decision-making at the local scale it is important to carry out an ecosystem diagnosis and simulations of different potential scenarios (Bousquet et al., 2002; Costanza and Ruth, 1998; Levrel and Bouamrane, 2008; Olsson et al., 2004). Evaluations of scenario simulations for ES have recently been used in projects such as the Natural Capital Project (Kareiva et al., 2011; Maes et al., 2012). However, an implementation gap remains that appears to be very difficult to overcome. This study was guided by the idea that one of the main goals of the ES approach should be to provide a simple interdisciplinary instrument that facilitates discussion between scientists and policymakers regarding the interaction between development and conservation goals.

In this study we carried out a participatory project based on an ES approach that tested alternative planning options by simulating different scenarios for a territory. This project involved various local stakeholders and was conducted between 2011 and 2013 by the authors (an economist, geographer, business manager and environmental scientist) with funding from a local water services company (Lyonnaise des Eaux – Suez Environnement) (Cabral et al., 2016). Testing this approach in an urban context was particularly important as cities must accommodate growing populations and yet depend on ES beyond their boundaries to sustain long-term conditions for life, health, security, social relations and other aspects of human well-being (Gómez-Baggethun and Barton, 2013).

The experiment was based on observed changes over both space (the distribution of ES within the metropolitan area of Bordeaux) and time (from 1990 to 2012). We also simulated future land cover changes using a land change model for the period 2012–2030 to make projections about future trends of ES changes in this territory. We used open-source data (i.e. data that is freely available on the Internet) and an open-access simulation tool (InVEST – Integrated Valuation of Ecosystem Services and Tradeoffs) in order to allow this experiment to be replicated and to develop a range of indicators corresponding to the diverse stakes and value systems in the territory (for instance, accessibility, biophysical units, monetary value). We considered that monetary indicators were useful to include when market prices were available.

The study addressed three main questions: (1) Is it possible to adopt a simple methodological approach that overcomes the implementation gap through the development of a user-friendly and inclusive tool? (2) What is the added value of a participatory approach? (3) With regards to four scenarios in this territory, what are the ES trends in the selected biophysical and monetary indicators, and will knowledge of these trends help planners to shape a sustainable trajectory for the territory?

2. Materials and methods

2.1. Study area

The metropolitan area of Bordeaux (*Communauté Urbaine de Bordeaux*: CUB) consists of 28 municipalities (*communes*) and extends over 57,632 ha (Fig. 1; CUB, 2010). It has varied land use and land cover (LULC) that includes densely urbanized areas, agricultural areas and vineyards, the Landes forest in the northwest, and large wetlands along the Garonne River. The region has a low elevation (< 105 m). The study area presents a set of practical issues in land-use planning related to its forecast of reaching one million inhabitants by 2030 (the 2011 population was 727,256 inhabitants) (CUB, 2010). To manage this expected growth, in 2009, the CUB launched a prospective study that resulted in the policy document 'The Metropolitan Project', which articulates a vision for the city to the year 2030. The Metropolitan Project shows willingness to take nature into account, which has helped in shaping local planning tools such as the SCoT (territorial coherence plan) and the PLU (urban planning programme). The SCoT considers a territory on a broader 'ecological scale' (e.g. a water basin), while the PLU focuses on a smaller urban scale. Both help local decision-makers to tackle challenges regarding urban development strategies. A quantitative spatial assessment of ES can help to inform these planning instruments.

2.2. A step-by-step procedure for developing ES maps and simulation scenarios

The definition of the study area, the exploration of local ecological issues, and the selection of the relevant ES were done with the help of the stakeholders through a co-construction process (Fig. 2). A limited number of stakeholders were selected (n = 11) according to their influence and their knowledge in land use planning and management in the area. Stakeholder selection was also driven by the aim of representing a diversity of perspectives regarding the maintenance and/or production of different ES (regulating ES, cultural ES or provisioning ES). This allowed informed interaction and a rich dialogue between stakeholders who rarely have the opportunity to exchange with each other on biodiversity and natural resource management issues. The selected participants were: the water company (Lyonnaise des Eaux) that provides the CUB's water and sanitation services, two environmental NGOs, the Chamber of Agriculture, the CUB Department of Water, 5 people from the CUB Department of the Environment, the CUB Urban Planning Department. These were all institutional representatives of people using ES rather than direct users. These stakeholders had a broad vision of what happens in their territory in their specific domain. The disadvantage is that they lack details regarding the resource use and specific constraints of individuals in the community they represent. However, for our aims, it seemed more valuable to include institutional representatives of categories of people that depend on or influence ES dynamics.

The first step was to select a list of ES that were believed to be relevant for the CUB area. Then interviews were carried out with these stakeholders to present the study's objectives and engage them in participating in two workshops. The aim of the workshops was to better understand the connection between the respective activities of the stakeholder's organization/institution and the various ES and solicit their point of view on the importance of preserving each ES for the CUB area. The range of ES discussed with these stakeholders reflected the diversity of interests around the table and, more broadly, in this territory (for more details, see Cabral et al., 2016 and Feger et al., 2015).

Next, local spatial data were collected and an extensive literature review was carried out for the values of parameters required to run the ES models. Local scientific experts were consulted when it was impossible to find adequate values in the literature. The models were developed to provide a first representation of the local ES trends both at the PLU (urban metropolitan) scale and the SCoT (territory) scale (Cabral et al., 2016). The models used (mainly from the InVEST toolbox) were not necessarily the most sophisticated available in the scientific literature and, like any models, have several limitations (Tallis et al., 2014). However, their advantage is that they are open source and are available ready to use for anyone who wants to do integrated ES assessments in GIS environments. In addition, it required no additional data other than that already available at the national scale, nor any fieldwork.