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Actionable knowledge for land use planning: Making ecosystem services operational

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ABSTRACT

The term 'actionable knowledge' indicates the rising expectation that science should produce useful results for policy and planning. In line with this, the success of the notion of ecosystem services (ES) in ecological sciences has been associated with promises of enhanced environmental protection and a narrowed gap between ecological knowledge and action. Promising to deliver operational knowledge for land-use planning, the notion allows ecologists to address social and economic issues related to conservation. We show that actionability of ES in land-use planning is not given, but requires active engagement by ecologists, land-use planners and nature managers. Making ES knowledge useful can be achieved through a range of techniques facilitating collaborative action between the producers and users of ES knowledge. We draw on exploratory case analyses in France and Finland to show how ES maps and scenarios are mobilised to operationalise ES. More specifically, we identify four techniques associated with mapping and scenario-making that seek to render ES knowledge actionable: (1) measures of ES in specific units, (2) visualisation of the results, (3) storytelling to discuss future options and (4) gamification to enact a culture of cooperation. We underline that these techniques can be used in several different ways in the planning process, providing specific advantages and limits depending on the goals, and that they have a diverging place in professional cultures.

1. Introduction

While scientific activity always has been embedded in society and linked to economic and political interests (Pestre, 2003), recent changes in the contract between science and society have made these links explicitly desired and, hence, more conspicuous (Hessels et al., 2009). Scientists are increasingly expected to produce knowledge that can be used for management and policy-making. This has blurred the boundary between basic and applied science (Gibbons et al., 1994), especially in environmental sciences (Barot et al., 2015).

Among the various ways of defining the relation between scientific knowledge and society (e.g., Hessels et al., 2009; Cash et al., 2003), the emphasis on actionable knowledge has gained much ground, and the term has even become a buzzword (Kerr, 2011; see also Kirchhoff et al., 2013). It indicates the rising expectation that science should produce useful and relevant results for society. Actionable knowledge has been said to have '*the potential to inform decisions (in government, business and the household), to improve the design or implementation of public policies, or to influence public or private-sector strategies, planning and behaviours that affect the environment*' (Palmer, 2012: 6). The demand for societally relevant knowledge pushes environmental scientists to move out of their comfort zones; collaborate with unfamiliar disciplines, such as psychology and sociology; and co-define research questions with policymakers (Palmer, 2012).

Land-use planning forms a crucial arena in which scientists are particularly encouraged to better account for and respond to the needs of land-use planners (Frantzeskaki and Kabisch, 2016). In this context, the notion of ecosystem services (ES) has been promoted, emphasising the intertwining of natural and social systems and the key services that ecosystems provide to human societies. The Millennium Ecosystem Assessment (2005) was an important step in encouraging ecologists to directly address social issues, followed by the inception of the Intergovernmental Platform for Biodiversity and Ecosystem Services (IPBES) (Granjou et al., 2013).

Even though the operationality of the ES notion has been advertised by many (Daily et al., 2009; Cowling et al., 2008), evidence about the

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use of ES knowledge or how it impacts decisions and policies is still lacking (Laurans et al., 2013; Posner et al., 2016). As suggested in the ES literature, operationalising the notion requires adjustment and the ability to deal with the complexity of socio-ecological systems (Norgaard, 2010) and their multiple scales (Hein et al., 2006), as well as involve various actors in knowledge production (e.g., Sitas et al., 2014). This suggests that actionability of ES knowledge needs to be demonstrated and achieved in practice.

Land-use planning has been considered an appropriate field for operationalising ES science because it can support the coproduction of relevant knowledge and the collaboration of different actors (e.g., Frantzeskaki and Kabisch, 2016), and because it allows different framings of nature (Opdam et al., 2015). In this paper, we show that two frequently used tools, maps and scenarios, play a crucial role in making the ES notion actionable in land-use planning. Maps are often developed to visualise ES (Hauck et al., 2013), and scenarios enable comparisons of their possible futures (Patel et al., 2007; Rounsevell et al., 2012; Oteros-Rozas et al., 2015). Rather than mere representations of ES in particular areas, we view ES maps and scenarios as practices that create various effects as they are prepared, used and modified (see Mol, 2002: 4). This helps us look beyond mere ideals and intentions (Turnhout et al., 2013) related to their use, as well as analyse how actionable knowledge is enacted and developed in practice. We document how the notion of ES is mobilised by maps and scenarios to bring together different fields of science, management and policy to provide solutions supposedly capable of solving real-world problems. Through this, we show that making ES knowledge actionable in land-use planning requires engaging various actors to exchange ideas, involving them in genuine learning processes and supporting a collaborative culture.

We draw on three case studies on planning processes – two in France and one in Finland – offering different approaches on the use of ES in land-use planning in terms of actors, data and institutional design. In all cases, the actors voluntarily decided to use the ES notion in land-use planning and sought to make the notion operational. However, the actual land-use planning processes differed, allowing us to explore and identify various techniques for making knowledge actionable.

In the French cases, the processes were led or co-led by scientists, whereas in the Finnish case, the lead was taken by city planners and other municipal officials, assisted occasionally by external consultants. Thus, the situations in which ES knowledge was supposed to be helpful were very different. Despite being leaders in ES science, the French scientists were less familiar with land-use planning, and they interacted with land-use planners. The Finnish city planners, in turn, were land-use planning professionals who sought to introduce a scientific concept, ES, into a well-established planning process, and they interacted with other officials, decision-makers and citizens. Analysing such contrasting cases gives us insight into possibilities and choices for operationalising ES in land-use planning.

An inductive approach to the case studies, defined as 'the search for pattern from observation and the development of explanations – theories – for those patterns through series of hypotheses' (Bernard, 2011, p. 7), enabled us to identify four techniques involved in ES mapping and scenario making. These techniques facilitated the production of actionable knowledge for land-use planning in the different case-study settings: 1) measuring; 2) visualisation; 3) storytelling; and 4) gamification (i.e., the practice of introducing game-like features into activities to make them more appealing or enjoyable). We explore what these techniques enabled the actors to achieve in the planning processes, how they related to each other and what tensions they created.

The article develops as follows. First, we introduce our case studies and the methods for investigating them. We then present the four techniques involved in map and scenario making, mobilised to render ES knowledge actionable. Finally, we underline the versatile uses of these techniques in our case studies and their respective advantages and limits in making ES knowledge actionable.

2. Methodology

2.1. Case studies

The two French research projects aimed at operationalising ES and enabling nature managers and local decision-makers to better secure essential ES in land-use planning. They were conducted by ecologists from the Alpine Ecology Laboratory (LECA), located in Grenoble, with a high academic profile, but little initial experience working with planners. LECA has played a major role in the development of ES research in France. One of the projects, ICARE (*Information et Concertation Autour des Ressources Environnementales sur la communauté de communes de Cluses Arve et Montagnes*) (2015–2016), was co-led by a LECA postdoc researcher and a manager from an environmental non-governmental organisation (NGO). The other project, ESNET (*Ecosystem Services NETworks*) (2013–2016), was led by an interdisciplinary team of scientists from several French research institutes.

Both projects relied on consultations with local decision-makers and nature managers who had expertise in land-use planning and natural-resources management. Workshops with partner organisations from voluntary municipalities located in the targeted Alpine landscapes were organised to collect local knowledge on natural resource management, identify threats to ES and propose conservation recommendations. The partners developed a list of key ES to be explored based on technical feasibility from biophysical assessments and relevance to local issues. The main difference between the two projects was that in ESNET, ES scenarios were developed to anticipate future trends, whereas there were no scenarios in ICARE. Another difference was the role of scientists: They drove the ESNET project, whereas ICARE was meant to contribute to a local development project. At the end of the ICARE project, the scientists convened local mayors to discuss the outcomes of the workshops and promoted the use of the ES approach in local planning.

The Finnish case – an urban master-plan process in the City of Lahti, located in Southern Finland, approximately 100 km north of the capital, Helsinki – was chosen because Lahti has been a forerunner in incorporating the ES concept in urban planning in the Finnish context. Like France, addressing ES in urban planning is not mandatory in Finland, but Lahti selected ES as one of the main focal points of its plan in the previous planning round (2009–2013). Hence, it provides us with a window to explore a user-driven attempt to make this scientific concept useful in planning. Importantly, the role of scientists was less prominent in Lahti than in the French cases. However, one of the city officials had a background in ES research, and some of the consultants involved in the impact assessment had expertise in environmental sciences. The author responsible for the case study was not involved in the planning process.

From a planning perspective, the master-plan process in Lahti is constantly ongoing and synchronised with the four-year city council terms. As soon as the plan is ratified by the city council, planners start to revise it according to the goals set by the new city council. Each newly elected council determines the goals for the plan and approves the final plan during the last year of its term. This is meant to increase the flexibility of the master plan as a land-use planning tool, as well as its relevance and ability to address pertinent issues. The city planning department is responsible for the planning process and for making the plan, but the process also involved city officials from other fields of city administration. In addition, citizens had a chance to voice their views on the plan at various stages throughout the process. Compared with the French cases, the ES knowledge needed to be actionable for a broader audience in Finland.

More details about the case studies are presented in Table 1.

2.2. Data collection and analysis

The research material for the French cases stems from 10 semi-