Evaluating the impact of ecosystem service assessments on decision-makers

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A B S T R A C T

Ecosystem services support human livelihoods and economies but are declining in many places. Ecosystem service assessments estimate the benefits that nature provides to people and can be used to evaluate trade-offs in impacts and changes resulting from land use decisions. Such assessments can affect the capacity of decision-makers to make sustainable land use decisions, but the actual impact of such projects on decision-maker attitudes is almost entirely unstudied. We addressed this knowledge gap by evaluating the impact of an ecosystem service assessment on decision-makers in California. We asked how decision-makers' understanding of and attitudes about ecosystem services changed "pre-" and "post-" assessments and between treatment groups where ecosystem services were assessed and a comparison group where ecosystem services were not assessed. Mixed methods included regression models to estimate the treatment effect of the assessment (using a difference-in-differences approach), as well as interviews and direct observations to further understand how decision-makers responded to the assessment. Regression results showed small increases relative to the comparison group in decision-maker understanding of ecosystem services and perceived relevance of ecosystem services to their work. Interviews confirmed that decision-makers learned specific ways that they could use ecosystem services in conservation and development decisions and believed that doing so would improve outcomes. These results demonstrate how ecosystem services assessments can facilitate a conceptual shift in the minds of decision-makers, which is a necessary ingredient for subsequent policy impact. Impact evaluation studies of this type — that estimate a counterfactual and explore rival explanations for observed outcomes — are needed to truly understand whether ecosystem service projects impact decision-makers and, ultimately, produce outcomes for environmental and human well-being.

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1. Introduction

Land use and land management decisions have significant impacts on ecosystems and ecosystem services (ES), the valuable goods and services that ecosystems provide to people (Daily, 1997; Polasky et al., 2011). Increasingly, efforts to conserve, protect, or restore ES aim to influence land use decisions so that they incorporate information about the values of ES (Chan et al., 2006; Daily et al., 2011; Goldman and Tallis, 2009). Efforts to incorporate ES knowledge into policy rest on basic assumptions that this knowledge will improve decisions and result in improved environmental and human well-being outcomes.

But there is a lack of sound evidence about the impact ES knowledge has on the people who make land use and land management decisions, or how decision-makers use ES knowledge (Laurans et al., 2013; Mermet et al., 2014). Many valuation studies mention prospective or intended roles for ES knowledge in terms of informative, technical, or decisive uses, but rarely do these studies describe actual use (Laurans et al., 2013). In a survey of researchers, Fisher et al. (2008) found that ES research was used to inform policy agents, support policy initiatives, and directly influence government policy and investment. A recent review of three international case studies describes similar ways ES knowledge is used: *conceptually* to raise awareness and reframe dialogues, *strategically* to build support for plans or policies, and *instrumentally* to make specific decisions (McKenzie et al., 2014). If conservation science is to inform improved land use decisions, it is

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critical to better understand what difference ES knowledge makes in the minds of land use decision-makers (McKenzie et al., 2011).

According to theories of the science-policy interface, knowledge has an important role in shaping decisions. Theory suggests that decision-makers are more likely to trust and use knowledge that they perceive as salient (i.e., relevant to the needs of decision-makers), credible (i.e., based on expert, reliable science), and legitimate (i.e., unbiased and inclusive of diverse perspectives) (Cash et al., 2003; Cook et al., 2013; Keller, 2010). A simple, linear model of policymaking described by Meier (1991) includes a role for knowledge early in the policy process, when it can affect the understanding and attitudes of policymakers. The more complex stages model (Grindle and Thomas, 1991), the policy streams model (Kingdon, 2011), and the advocacy coalition model of policy processes (Sabatier and Weible, 2014) all portray a similar key role for knowledge. These models share several general components: decision-makers and other stakeholders perceive a problem, gather and evaluate knowledge about the problem and proposed solutions, and acknowledge the need to act on policy options.

Knowledge about the value of ES could thus be valuable as an early lens for shaping how decision-makers identify and understand problems, as well as a tool for evaluating proposed policy options. For ecosystem services specifically, a conceptual framework first presented by Ruckelshaus et al. (2015) and built upon by Posner et al. (2016) describes several pathways through which knowledge impacts policy decisions (Fig. 1). Here we focus mainly on pathway 2, when ES knowledge helps shape the minds of decision makers by raising awareness and providing an ES focus for stakeholders. We also describe the emergence of pathway 3, through which decision makers and stakeholders build support for particular policy options and use language related to ES as a frame within policy dialogues. Lastly, we investigate the potential for pathway 4 and assess how decision makers envision using ES knowledge to evaluate projects, compare options, and design new policies and plans.

The health, policy, and international development fields have long included systematic impact evaluation research, and researchers and practitioners in conservation increasingly recognize the need for improved evidence of impact (Ferraro and Pattanayak, 2006; Fisher et al., 2013). The complexity and scale of real world social-environmental interactions has made rigorous and quantitative evaluation of impact in conservation difficult, but recent research is moving beyond anecdotal evidence and testing specific causal mechanisms through which impact may occur (Andam et al., 2010; Arriagada et al., 2012; Ferraro and Hanauer, 2014b; Miteva et al., 2012; Naidoo and Johnson, 2013; Pfaff et al., 2008). In order to understand how conservation programs and projects lead to improved outcomes for biodiversity and well-being, these studies use control groups and statistical matching to estimate impact (Ferraro, 2009; Margoluis et al., 2009).

Our study complements this growing body of work, which tends to focus on the impact of conservation policy on environmental outcomes (pathway 5 in Fig. 1). Instead, we focus on impact at an earlier stage of the policymaking process – when ES knowledge has an impact on the minds of those proposing and making policy decisions (pathway 2 in Fig. 1). We aim to detect whether knowledge about the value of ES changes the capacity of natural resource managers and conservation decision-makers to make conservation-oriented decisions. In the process, we evaluate the importance and impact of ES knowledge as a resource for decision-makers.

Specifically, we ask: do ES valuation projects impact local decision-makers' 1) understanding of ES and natural capital concepts, and 2) attitudes about conservation and planning approaches based on these concepts? We follow ES assessments in two counties in California, employing quantitative methods to compare changes in decision-maker understanding and attitudes with those in neighboring counties without assessments. We also use qualitative methods to explore why understanding and attitudes did or did not change. Tracking change in decision-makers and their capacity to consider ES is vital in order to link scientific knowledge with action and to understand the difference that ES knowledge may make.
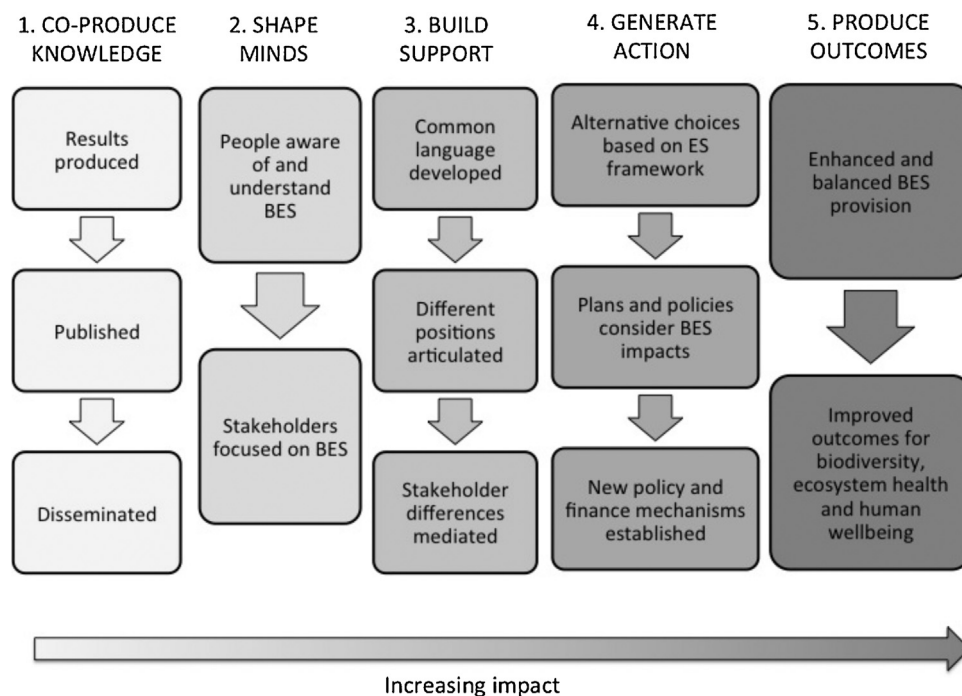
Fig. 1. Framework for how ecosystem services knowledge leads to impact. Five different pathways to impact are represented as columns with increasing impact the further one moves to the right. Our study focuses mainly on pathways 2 and 3. Based on Ruckelshaus et al. (2015) and modified by Posner et al. (2016).