Ecological Indicators 9 (2009) 1198–1205

Contents lists available at ScienceDirect

Ecological Indicators

journal homepage: www.elsevier.com/locate/ecolind

How ecological indicators construction reveals social changes—The case of lakes and rivers in France

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ARTICLE INFO

Article history:
Received 21 December 2007
Received in revised form 24 November 2008
Accepted 5 March 2009

Keywords:
Science and technology studies
History
Social studies
Ecological indicator
Freshwater
France

ABSTRACT

Social and scientific factors are deeply enmeshed in each other within the development and the use of ecological indicators (EI). Yet low research has assessed which factors contribute to selecting ecological indicators on the long-term. This article proposes to study the historical construction of EI by examining ecological, political, and social background of specific places where EI were developed, in France on lakes and rivers. Our major findings in France were that ecological indicators were never optimised for the present market or political arena. Instead EI development was typically recycling previous tools that were elaborated for other purposes by environmentally committed outsiders, without regular funding. We found that regular funding for monitoring an EI was only provided when it matched an institution's goal. Beyond the geographically limited relevance of the case studies, these results therefore improve the theoretical framework we deploy when constructing or relying on indicators.

1. Introduction

For 40 years, ecological concerns have spread beyond scientific spheres. Public interest and investment for ecosystems have been growing, notably for wetlands, rivers, and lakes. As a consequence, many agencies are developing so-called 'ecological restoration' projects the efficacy of which is not always obvious (Kondolf et al., 2007). Ecological indicators (EI) are meant to support decisions in order to set restoration priorities and/or to assess whether the proposed management will improve ecological conditions or not, or to appraise completed projects. Despite increasing developments in the field of EIs during the last 30 years (Barbour et al., 2000; Kallis and Nijkamp, 2000; Moog and Chovanec, 2000; Wasson et al., 2003), many scientists complain that such indicators are hardly used to support decisions, management plans, and programs evaluations ((Dale and Beyeler, 2001; Lenz and Peters, 2006). They usually attribute the gap separating the creation and the use of EI to social factors (Turnhout et al., 2006). Therefore, research addressing the social perspective of EI has been developed recently. Yet such work focuses on short-term analyses. It has mainly addressed what social drivers are responsible for using or not using EI, once EI have been designed by scientists.

The recent literature on this topic falls in two categories: the market or the political arena as driving forces. In the first category, a market is presumed to exist for EI in which environmental scientists, the providers, must fulfil the expectations of decision makers, the buyers. In this perspective, authors recommend that EI be reliable, cheap, easy to use (Cairns and Pratt, 1993; Lenat and Barbour, 1994). They should provide users with the information they need in a form they can understand (Shields et al., 2002; McNie, 2007) according to their tasks, responsibilities, and values. Different problems in which scientists, politicians, and experts have different roles, may therefore require different indicators (Turnhout et al., 2006). Even so, Ribaudo et al. (2001) noticed there is a need for generalised indicators which meet multiple objectives. In this market-like perspective, social demands challenge EI that were designed under purely scientific considerations. These authors suggest that defining indicators with stakeholders' participation improves their chance of success. In the second category, EI are not presumed to compete in a market but rather in a political arena. Each indicator is believed to promote a particular political point of view. Indeed, the ecological status of an ecosystem depends on the boundaries chosen for the system

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doi:10.1016/j.ecolind.2009.03.010

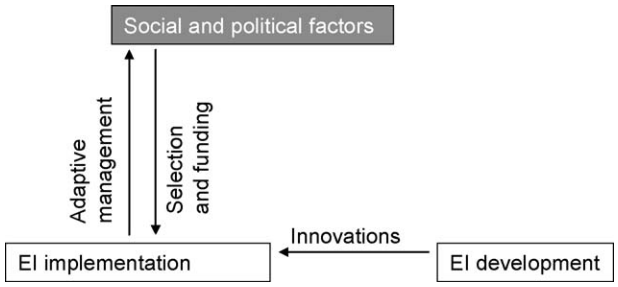

Fig. 1. To date, authors have studied a small loop of feedback between social and political factors and EI implementation. They have not addressed the social and political influences on the EI development.

and on the characteristics chosen to be restored. Scholars adopting this perspective insist on the plurality of ecological objectives (Higgs, 1994; Jackson et al., 1995) and consider that defining restoration goals and objectives is a value-based activity (Lackey, 2001). In this second perspective, economical and technical characteristics of indicators are hardly addressed. Emphasis is put on the expression of choices made within any indicator. Both categories may overlap since the frontier between science, market and policy is a fuzzy area (Davis and Slobodkin, 2004; Hobbs, 2004; Turnhout et al., 2006). In both perspectives, authors have addressed a small feedback loop between science and policy in which social factors act as selection forces for useful or compelling EI, which in turn are meant to supply data for adaptive management and policy changes if required (Fig. 1).

To date, very little attention has been paid to the manner values or expectations of stakeholders influence the development of EI prior to selection. Determining the role the social context plays in EI development requires a historical perspective to study a larger feedback loop (Fig. 2). This paper develops a method to study long-term interactions between EI development and social factors. Social factors are understood here to designate all dynamics within human society including structural constraints and human agency. We elaborate an analytical framework to account for these interactions. Then we apply this approach to five case studies in France on lakes and rivers (saprobic index, test on minnows, biotic index, fish index and rapid diagnosis). Last we conclude on the interest of this new approach which provides new elements for explaining the gap between production and use of EI.

2. An analytical framework to study the long-term co-evolution of EI and society

Managing the environment and the human population is a recent concern of states. Foucault argues that western governments and scientists became interested in indicators only in the last 150 years, as governmental legitimacy shifted from expansionism to optimizing the well-being of domestic population. As political definitions of well-being evolved, they reshaped the scientific agenda (Foucault, 1978–1979). Scientific facts are not simply given, but selected by actors to make sense at one point (Fleck, 1979; Latour, 1987). Access to nature influences data collecting (Forsyth, 2003). Power structures influence the way experts define crises (Trottier, 2008). In turn, experts' discourses spur new social demand. This long-term dynamic changes relationships between technology and society (Callon, 1986; Latour, 1987; Star and Griesemer, 1989; Sabatier and Jenkins-Smith, 1993). This applies for EI as well. Exploring their history sheds light on the manner EI evolve, are selected and kept and how in turn, they influence knowledge and social representations (Fig. 2). This research identifies such long-term influences. For this purpose, we propose an analytical framework to sketch a new approach for social studies of EI, which is (1) interdisciplinary, (2) inductive, and (3) historical.

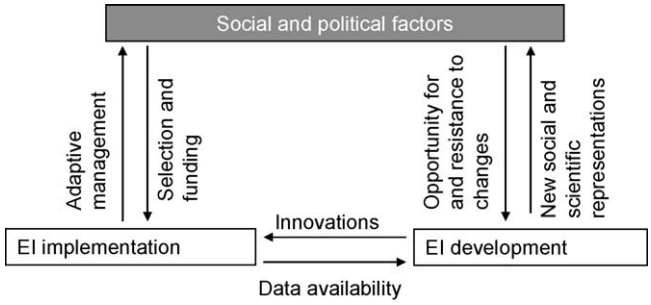

Fig. 2. We propose to address a larger loop of social interactions in which EI development is also included. This approach enables to take into account influences of data availability, changes in social and scientific representations, opportunity and resistance to changes.

(1) A social study of EI requires a multidisciplinary dialogue between social and natural sciences. Social representations of nature are simultaneously influenced by the scientific state of the art, with which biologists are more familiar, and by the cultural and political context of the period, which social scientists know better. Both competencies are needed. They should not be separate; they should provide different assumptions for the same research questions. Once this is achieved this multidisciplinary approach has yielded an interdisciplinary framework (Trottier and Slack, 2004).
(2) An inductive and qualitative approach allows emerging concepts to be incorporated during the research (Bryman and Burgess, 1994; Altheide, 1996). In doing so, we identify causal relationships that may be significant even though not being always necessary nor sufficient. We advocate focusing on a small set of largely used indicators rather than studying many different ones. We look for factors that were significant at least in one case study.
(3) Without questioning the validity of scientific methods used, we explain how social factors historically influenced the choice of species and the finality of research. For this purpose, we define constitutive elements of the historical trajectory of an EI: the historical background of places where it was developed, the way data were collected and treated, what ecological knowledge was available, what belief concerning nature and society was spread, and what were the ecological management goals. We elaborate on the variation-selection-retention model of socio-environmental co-evolution developed by Kallis (2007): why different social groups promoted different representations of nature (variation), how a mainstream representation emerged (selection) and how it was maintained despite possible criticisms (retention). The variation step received very little attention in previous academic work. A second layer of evolution was also missing in previous short-term analyses. Scholars often considered society as a homogeneous entity one could represent in one box (Figs. 1 and 2). To account for the social evolution, we propose to split the social component into two elements (Fig. 3), one representing what is established (institutions, law) and one representing more evolving social features (coalitions, representations).

This analytic framework enables to address cumulative effects, historical opportunities, technological gridlocks and path-dependence of EI that are otherwise ignored.