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Review

Tracking the origins and development of biodiversity offsetting in academic research and its implications for conservation: A review

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ABSTRACT

Spurred by recent initiatives aimed at achieving "No Net Loss" of biodiversity, the concept of biodiversity offsetting (henceforth BO) is growing in popularity in the political, business, conservation and academic arenas. Promising to make economic development compatible with biodiversity conservation, BO mechanisms appear as the new tool for biodiversity conservation, and they are increasingly integrated into agendas and strategies to biodiversity. The concept has also become popular with scholars but it is still highly debated in particular its ecological consequences. Moreover, this recent enthusiasm for BO has led to confusion especially on its emergence and development in the academic sphere, and its implications for conservation. This article addresses these issues. It examines the origins, characteristics and dynamics of BO in academic output and highlights the main drivers of its development, to finally conclude on its implications for conservation practice. We carried out a systematic literature review based on thorough scientometric analyses of the scientific literature on BO recorded in the Web of Science database over the past three decades (1984–2014). Through the analysis of 477 articles we identified three stages in the development of the topic in academia, and highlighted the influence of specific countries, authors, research areas and articles. We found that non-academic institutions were particularly influential, notably environmental non-governmental organizations. Furthermore, we identified a major change in the past decade in the topics and lexicon related to BO, which has moved from ecologically-driven approaches to an economic and market lexicon. Overall, this review highlights the use of an economic rhetoric to frame the BO discourse resulting from political influence rather than an actual scientific progress in ecological or economic sciences. This trend seems aligned with a new movement in conservation aimed at using economic approaches to justify and achieve conservation goals. Caught in a strong normative current and supported by a specific view of nature, we argue that BO is not a neutral concept for conservation practice. We therefore advocate the wise and careful use of this mechanism in practice, and further research be carried out to examine the theoretical and practical dimensions of BO, and the ethical implications underlying its development.

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1. Introduction

Biodiversity offsetting (henceforth BO) is increasingly used as a way to achieve "No Net Loss" (henceforth NNL) of biodiversity when economic development leads to environmental degradation. The basic principle of BO is that ecological losses resulting from development can be counterbalanced by gains elsewhere. The gains can be obtained by, for example, giving protected status to an existing habitat, or by restoring the habitat of species. In many environmental legislations, offsets are incorporated into a mitigation hierarchy aimed at avoiding, minimizing and restoring ecological damages resulting from development, and offsetting in a last resort (Kiesecker et al., 2010).

In practice, BO operates through three main mechanisms: (1) direct offsets, a case by case approach in which developers manage compensatory measures linked to the project's impact; (2) banking mechanisms, in which a bank manages offsetting measures on behalf of developers through the creation of a biodiversity bank that generates credits; and (3) the offsetting funds system that is organized by country-specific entities (public agencies, environmental non-governmental organizations (henceforth NGOs), municipalities, etc.). These entities receive money from developers that is then used to fund conservation projects (Calvet et al., 2015a).

Since the 1970s, a growing number of governments have introduced BO into environmental legislation, and the three mechanisms have been more (or less) rapidly and intensively implemented depending on country-specific regulations and the institutional context (Madsen et al., 2011; McKenney and Kiesecker, 2010). However, although BO commitments have been a feature of environmental legislation for the past four decades, they have not been widely applied in practice (Quétier et al., 2014). But recently, and surprisingly, the principle of BO has gained in credence and popularity in four main spheres: political, business, conservation and academia.

In the political arena, it is seen as a promising tool for biodiversity conservation and is expected to be more effective than traditional "command-and-control" approaches (Boisvert et al., 2013). Through economic incentives structures, BO is expected to be able to: i) correct market failures by putting a value (through a price) on biodiversity losses; ii) encourage developers to implement sustainable environmental practices; and iii) foster new sources of funding for biodiversity conservation, particularly through the creation of business opportunities (Boisvert et al., 2013; Broughton and Pirard, 2011). Given these economic applications, BO is frequently regarded as a market-based instrument (henceforth MBI) and an innovative financial mechanism. Given these BO features, international and political structures such as the Organisation for Economic Co-operation and Development (OECD), the European Commission, or the Convention on Biological Diversity, strongly support the use of BO in environmental policies (Hrabanski, 2015). Thus, with the potential of making economic development compatible with biodiversity conservation, many governments have incorporated BO mechanisms into their political strategies and conservation agendas.

In the business sector (including corporations, investors and financial institutions), interest in BO is motivated by two main economic considerations. First, developers can anticipate their BO obligations and thereby reduce costs, limit risk exposure or demonstrate leadership. Although businesses still struggle to fully incorporate biodiversity concerns into their day-to-day practice (Van den Burg and Bogaardt, 2014), six of the world's 500 largest companies (in terms of revenue) have nonetheless integrated BO into corporate strategy (Rainey et al., 2014). Furthermore, the International Finance Corporation has developed a performance standard that requires developers to consider environmental impacts and biodiversity offsets. Second, investors are interested in taking advantage of a mechanism that may offer significant financial benefits. For example, in 2011, the overall BO market was estimated to be around USD 2.4 to 4.0 billion in the United States alone (Masden et al., 2011). A major lobby has emerged around BO, explicitly focused on financial goals. Meanwhile, voluntary BO initiatives have increased in recent years, particularly in developing countries where regulatory offsetting requirements are not yet incorporated into environmental legislation (Bidaud et al., 2015).

Conservationists have paid special attention to BO in recent years, although they do not all share the same vision of the mechanism when applied to biodiversity conservation. For some practitioners, BO can be an effective way to encourage developers to assess the ecological impacts of their project, or even pull out when compensatory measures are impossible to implement or are too expensive. Others argue that it represents a tool for the commodification of nature (Dauguet, this issue). International environmental NGOs such as the International Union for Conservation of Nature (IUCN), the World Wide Fund for Nature (WWF) and The Nature Conservancy advocate the use of the BO principle, although this may be motivated by a strategy to gain political influence and develop their own standards linked to BO processes (Hrabanski, 2015).

Finally, concepts, methods and metrics related to BO are being increasingly discussed in academia (Gonçalves et al., 2015). Despite the recent surge in interest, the real contribution of BO to biodiversity conservation is still unclear and scholars continue to debate the issue. The principle is repeatedly challenged on its economic and ecological foundations (Bull et al., 2013a; Gardner et al., 2013). The literature shows that offset mechanisms are often not designed and implemented effectively in order to achieve the expected ecological outcomes (Maron et al., this issue). Arguments justifying the use of BO are weak from both a theoretical and empirical perspective. Economists challenge whether BO mechanisms are real market-based instruments (MBIs). Studies revealed that BO has been shown to be significantly different to classical MBIs and incentive structures, and its promise of cost-efficient conservation is not really demonstrated in practice (Boisvert, 2015; Calvet et al., 2015b; Pirard, 2012; Vaissière and Levrel, 2015; Spash, this issue). Other authors have concluded that the value of BO does not lie in its theoretical and empirical relevance, but rather as a rhetorical tool that can increase the use of MBIs in conservation, as an alternative to traditional measures (Boisvert et al., 2013; Lapeyre et al., 2015).

Overall, since the ecological effectiveness of offsets is strongly debated, the reasons underlying its popularity in academia, and particularly in conservation, remain to be explored. Other reviews of the BO literature have examined the origin and success of the concept in politics and global governance (Hrabanski, 2015), or conceptual and theoretical challenges (Bull et al., 2013a; Gonçalves et al., 2015). However, to date, there has been no scrutiny of the emergence and dynamics of BO in academia. Similarly, there is no detailed characterization of academic output that accounts for the attention that has been given to the tool's development and its recent and rapid adoption in conservation. For