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Changing trends and persisting biases in three decades of conservation science

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ABSTRACT

Conservation science is a rapidly developing discipline, and the knowledge base it generates is relevant for practical applications. It is therefore crucial to monitor biases and trends in conservation literature, to track the progress of the discipline and re-align efforts where needed. We evaluated past and present trends in the focus of the conservation literature, and how they relate to conservation needs. We defined the focus of the past literature from 13 published reviews referring to 18,369 article classifications, and the focus of the current literature by analysing 2553 articles published between 2011–2015. We found that some of the historically under-studied biodiversity elements are receiving significantly more attention today, despite being still under-represented. The total proportion of articles on invertebrates, genetic diversity, or aquatic systems is 50%–60% higher today than it was before 2010. However, a disconnect between scientific focus and conservation needs is still present, with greater attention devoted to areas or taxa less rich in biodiversity and threatened biodiversity. In particular, a strong geographical bias persists, with 40% of studies carried out in USA, Australia or the UK, and only 10% and 6% respectively in Africa or South East Asia. Despite some changing trends, global conservation science is still poorly aligned with biodiversity distribution and conservation priorities, especially in relation to threatened species. To overcome the biases identified here, scientists, funding agencies and journals must prioritise research adaptively, based on biodiversity conservation needs. Conservation depends on policy makers and practitioners for success, and scientists should actively provide those who make decisions with the knowledge that best addresses their needs.

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1. Introduction

Conservation science is the mission-driven discipline through which biodiversity knowledge is translated into action (Soulé, 1985; Robinson, 2006). From its inception it has undergone changes in the framing of its goals and approaches (Kareiva and Marvier, 2012; Mace, 2014), but the overall purpose of increasing our understanding of what threatens biodiversity, and what actions and policies are needed to preserve it, has remained unchanged. The continued growth in conservation science literature shows a burgeoning interest that goes well beyond the academic community, spanning practitioners, policy makers and research donors (Arlettaz et al., 2010). However, the scientific focus of the discipline, as it is represented by global peer-reviewed literature, does not always reflect the perceived priorities of biodiversity research and conservation (Stroud et al., 2014). Here we analyse the biases and trends in contemporary conservation literature, and evaluate how these trends have changed over time.

In 2002 two seminal papers analysed the ecological (Bonnet et al., 2002) and conservation (Clark and May, 2002) literature, and showed disproportional attention towards endothermic vertebrates. This was called a 'bias' because endotherms represent only a small fraction of all described vertebrate species (let alone all living species). In this context, bias is considered a concentration on – or interest in – one particular area or subject. Subsequent studies have investigated biases in conservation literature and associated research fields across a number of biodiversity elements, such as the geographical and ecological realms (e.g. Fazey et al., 2005; Velasco et al., 2015). For example, Lawler et al. (2006) found that some ecosystems, especially temperate forests in the northern hemisphere, were dominating the literature with many more articles focusing on them than any other system.

The misalignment between research interests and the needs of the conservation community can generate gaps in the evidence base on which biodiversity conservation is planned and, consequently, implemented (Lawler et al., 2006; Trimble and van Aarde, 2012). This is especially important where insufficient research attention is devoted to those groups or regions characterised by high biodiversity value and high threat levels, such as Southeast Asia (Sodhi et al., 2004). It is thus important to constantly monitor the focus of, and trends in, conservation science relative to changing biodiversity priorities (Fazey et al., 2005), in order to re-align scientific efforts for generating unbiased policy-relevant outcomes (Darwall et al., 2011; Donaldson et al., 2016).

We evaluate the current focus and trends in conservation literature across four main biodiversity elements: taxonomy, geography, ecological systems, and level of biological organisation. We first describe the focus of current literature, by presenting an analysis of all articles published in the period 2011–2015 in three leading conservation journals, one of which is analysed here for the first time. We use the year 2011 as a threshold since this year denotes the start of the 2011–2020 Strategic Plan for Biodiversity (Secretariat of the CBD, 2010). We then evaluate the trends in conservation literature over the past three decades, by comparing our results with those reported in past literature reviews. We present the results of our literature analysis in light of the current knowledge of biodiversity (number of described species), its threat status (proportion of threatened species), and level of conservation intervention (from the extent of protection).

2. Methods

2.1. The current focus of conservation literature

We analysed all articles published between 2011 and 2015 in three leading journals within the Web of Science subject "Biodiversity and Conservation": Biological Conservation, Conservation Biology and Conservation Letters. We selected *Biological Conservation* and *Conservation Biology* because of their primary focus on conservation and their usage in past reviews of conservation research (Clark and May, 2002; Fazey et al., 2005; Griffiths and Dos Santos, 2012; Velasco et al., 2015). We selected *Conservation Letters*, a much younger journal never previously used in similar analyses, as it has a specific focus on articles with a clear significance for conservation policy and practice. We included all articles published in these journals, with the exception of Comments, Editorials and Book Reviews (Table S1).

We classified all articles according to their research focus in terms of taxonomy, geography, ecological systems, and level of biological organisation (Table 1). Previous reviews have adopted these same categories to classify articles (Clark and May, 2002; Fazey et al., 2005; Velasco et al., 2015), but no single work has consistently reported a detailed investigation across all of these categories. We assigned each paper to an individual researcher who read and manually classified its content, as opposed to using an automated search engine. This was necessary to avoid false counts, where a given biodiversity element (e.g. a species) was mentioned in a paper but was not part of the research scope. The classification of articles was done by multiple researchers, and the consistency in classification was verified following the procedure described by the Collaboration for Environmental Evidence (2013) (Appendix S1 and Table S2).

We determined the taxonomic focus by identifying all species groups analysed in the paper. We classified articles dealing with genetic-level biodiversity if they had an explicit focus on genetic diversity and distinctiveness below the species level, and articles dealing with ecosystem-level biodiversity if the focus was on ecological communities above species level. We defined the geographic focus of the articles by referring to the study region in which the study was carried out (i.e. not the location hosting the authors' institutions). We also recorded the ecological system, or systems, in which the study was carried out (terrestrial, freshwater or marine). Importantly, any article could match one or more categories for each given field of classification, e.g. the same article could focus on both 'vertebrates' and 'invertebrates' if both groups were analysed.