Twenty-five years of misinterpreting the biodiversity hotspot approach

Robert J. Smith [i] & Hermenegildo Matimele [ii]

i Durrell Institute of Conservation and Ecology, University of Kent, UK

ii Wildlife Conservation Society, Mozambique

A quarter-century after its publication, the biodiversity hotspot concept remains one of the most cited and influential frameworks in conservation science. But its real-world impact is poorly documented in peer-reviewed literature, hindering the development of new approaches for prioritising conservation action.

Despite the urgent need for action to reverse biodiversity loss, the vast majority of associated literature focuses on describing the extent or direct causes of loss, rather than the design and implementation of conservation responses[1]. A notable exception is the biodiversity hotspot approach described in a seminal article by Myers et al[2] in 2000, which identified and mapped a global set of priority conservation areas to guide management investment. This hotspot mapping is one of the most highly cited concepts in conservation science and has inspired dozens of global scale analyses seeking to build on this approach and better prioritise conservation action. The 25th anniversary of this article provides an appropriate point for assessing this impact, so here we discuss the context, design, implementation and influence of the Myers et al article. We argue that the hotspot approach is a brilliant example of translating research into action, but show that its success depended on funding and implementation mechanisms that are largely unknown by academics. This separation from conservation practice has limited the academic community's attempts to build on these foundations. While it is sobering that this well-known and highly cited approach has been repeatedly misinterpreted, we also argue there is much scope for academics and practitioners to work together to better understand and inform pathways to conservation success.

Biodiversity hotspots in academia

The biodiversity hotspot approach is documented in the academic literature through four main articles. The first two were published in 1988 and 1990 by Norman Myers and identified 18 priority regions (Supplementary Information). Ten years later, Myers worked with four colleagues to publish an analysis in *Nature* that identified 25 hotspots covering 1.4% of the global land surface[2]. This was based on a definition that a biodiversity hotspot contains at least 1,500 endemic plants and has lost 70% or more of its original natural vegetation cover. The authors framed the approach as a new conservation paradigm, arguing that "the traditional scattergun approach of much conservation activity, seeking to be many things to many threatened species, needs to be complemented by a 'silver bullet' strategy in the form of hotspots with their emphasis on cost-effective measures". Myers published a fourth article[3] that outlined the impacts of the hotspot work in 2003, including that several organisations had committed hundreds of millions of dollars to fund conservation projects in the priority regions.

This hotspot approach was described by EO Wilson as ''the most important contribution to conservation biology of the last century'[3] and, at the time of writing, the *Nature* article has been cited over 24,000 times and led to over 3,000 projects being funded (Supplementary Information). However, while the academic community were convinced of the importance of using quantitative approaches to identify where best to invest in reducing global biodiversity loss, there were immediate criticisms of the methods used[4] and work over the last 25 years has produced ever more fine-scale and sophisticated analyses based on a wider range of biodiversity, ecosystem services and socio-economic datasets[5].

Despite this increase in sophistication and spatial resolution, none of the subsequent analyses have had anywhere near the impact of the original paper. This lack of influence could perhaps have been predicted, based on the fundamentals of systematic conservation planning, the most widely used approach for identifying priority areas for nature conservation and restoration[6]. Three decades of research has shown that these spatial prioritisation outputs are strongly influenced by opportunity and cost data[7], so producing informative maps depends on incorporating fine-scale, context-specific data – which are not available at the global level. Thus, while more recent global spatial conservation area prioritisations have provided broader context for local decision-making and helped estimate the impacts of international policies and targets[8], there is little evidence of them achieving goals based on guiding where best to work on the ground. This makes it even more important to understand why the biodiversity hotspots map from Myers et al. have succeeded in guiding conservation action and investment where other mapping exercises have failed.

The reality of biodiversity hotspots

The success of the biodiversity hotspot article can be understood by analysing information provided by the organisations that have used the paper to allocate project funding (Supplementary Information). The approach was largely championed at the global level by Conservation International[9]. This non-governmental organisation (NGO) was founded in 1987 with a strong focus on saving threatened species, and it adopted biodiversity hotspots as a guiding principle in 1989 (Figure 1). This is why their scientists worked with Myers to refine the approach and co-author the results[2]. Simultaneously, the NGO recognised that success required more than a map, so they also began developing a funding strategy and an implementation mechanism (Figure 1).

The funding strategy arose in part through recognition of a new type of conservation donor. Previously, most philanthropic funding came from small donations from millions of people, often propelled to protect charismatic species and famous places[10]. But in the 1990s, large foundations and development banks interested in global impact and cost-effectiveness started to become donors. Biodiversity hotspots matched the preferences of these organisations. For example, Dan Martin, formerly of the MacArthur Foundation, said the hotspot approach “allowed us to gain internal agreement about supporting biodiversity conservation, to concentrate our spending coherently, to avoid the largely aesthetic judgments that shaped many international conservation programs, and to explain our actions objectively"[11]. Publishing in a high-impact scientific journal helped with fundraising efforts by further building the legitimacy of the hotspot approach. Thus, Conservation International worked with Myers to turn his idea into a new type of conservation flagship, fundraising for a concept designed to both achieve their conservation mission and appeal to their target audience of large international donors[10]. This approach was highly successful: biodiversity hotspots as a concept are now much more well-known than many of the individual hotspot regions, and Conservation International helped raise hundreds of millions for conserving them as a whole[3]. This funding could then be targeted to where it is most needed, including hotspots with a lower public profile.

The process of creating the implementation mechanism to disburse these funds began in 1996 when Conservation International's CEO, Peter Seligmann, discussed the concept with James Wolfensohn, the newly appointed president of the World Bank (Supplementary Information). From this meeting came the idea of creating the Critical Ecosystem Partnership Fund (CEPF), an organisation founded in 2000 to support local conservation groups in biodiversity hotspots. In its role as the main international implementation agency, CEPF funds a small number of hotspots at any one time, each for a five-year period. Once CEPF has selected a hotspot for a new funding round, it oversees production of an ecosystem profile report for the hotspot and appoints an in-country organisation to form the Regional Implementation Team (Figure 1). This ecosystem profile is a year-long, participatory assessment that identifies sites and landscapes within the hotspot that should be the focus of investment, based on their biodiversity value, conservation opportunities and threats. CEPF then launches funding schemes and encourages local groups working within the priority sites and landscapes to apply. Through this mechanism, CEPF has provided grants totalling more than US$300 million and technical assistance to over 2,700 organisations and individuals (Supplementary Information).

Implications of the mismatch

The biodiversity hotspot approach is a brilliant example of using science to underpin practice: pioneering a data-driven system for minimising biodiversity loss through a three-step process that created (i) a new type of conservation flagship based on a spatial prioritisation exercise, (ii) a global-level implementation mechanism, and (iii) a process for prioritising funding and targeting action at the site-level. However, only the first of these steps is documented in the literature. This pattern is not exclusive to the hotspot approach. Due to the costs involved, practitioners tend to focus on publishing work that best supports their conservation goals, prioritising articles that bolster and promote the credibility of key elements of their work with target audiences. The target audience changed once the funds started being disbursed within each hotspot, which is why Conservation International and CEPF now share relevant information via unpublished reports and webpages.

This pattern would not be problematic if academics had filled this gap in the literature, which might be expected given the prominence of the biodiversity hotspot approach. Yet this has not happened: although the term “biodiversity hotspot” is mentioned in the title, abstract or keywords of more than 8,500 articles, only 13 articles do the same for “Critical Ecosystem Partnership Fund”, and none of them describe how CEPF translates their global map into action on the ground[12]. The result is that, we believe, many academics view the Myers et al Nature article in isolation, unaware of why it was developed or how it has been used. This has led groups of researchers to publish increasingly detailed maps of global conservation area priorities, but none of these articles have directly influenced the implementation of the biodiversity hotspot approach by CEPF. Thus, while Conservation International and CEPF have updated the global map four times, now recognising 36 hotspots (Figure 1), they still do not use global scale analyses to identify where to work on the ground. Instead, they continue to develop ecosystem profiles for each hotspot, producing fine-scale priority area maps that account for the local conservation context (Figure 1).

A way forward

There is a pressing need for more research to improve the effectiveness of conservation interventions[1] and academia could play a major role in filling this gap[5,8,9]. That depends on academics having a firm understanding of how conservation actions are implemented, but the biodiversity hotspot example shows that even the most famous initiatives can be poorly understood. In this case, hundreds of articles have been published[5,9] based on the assumption that the coarse-scale nature of the hotspot analysis was a problem that needed solving, rather than an approach specifically designed to identify and support the best regions for establishing field programmes. This is why co-production between academics and practitioners is so important, as exemplified by the collaboration between Norman Myers and his colleagues from Conservation International and illustrated by dozens of other examples from spatial conservation planning[13], because it helps ensure that work is embedded in the relevant implementation context. Future co-produced research should focus on the different components of implementation[14], including fundraising, local project design and engagement, and monitoring outcomes and impacts.

However, to maximise the benefits of this future research, we also need comprehensive datasets on implementation context. Otherwise, we will continue with a system where academics lack the information they need to build on exemplar approaches and identify the broader factors that predict conservation success. This could be relatively straightforward, as practitioners already provide relevant details in their progress reports for managers and donors, and many of them would be willing to share this information to help support learning processes. Thus, funders who want to boost academia’s potential to inform conservation practice should invest in approaches to share information on how conservation is implemented, ideally building on existing systems that collate and synthesise evidence on the effectiveness of specific conservation actions[15]. This will need interdisciplinary collaborations and approaches that capture the ecological and institutional dimensions of conservation, helping ensure that future research is both scientifically robust and relevant for real-world impact.

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Competing Interests

The authors declare no competing interests.

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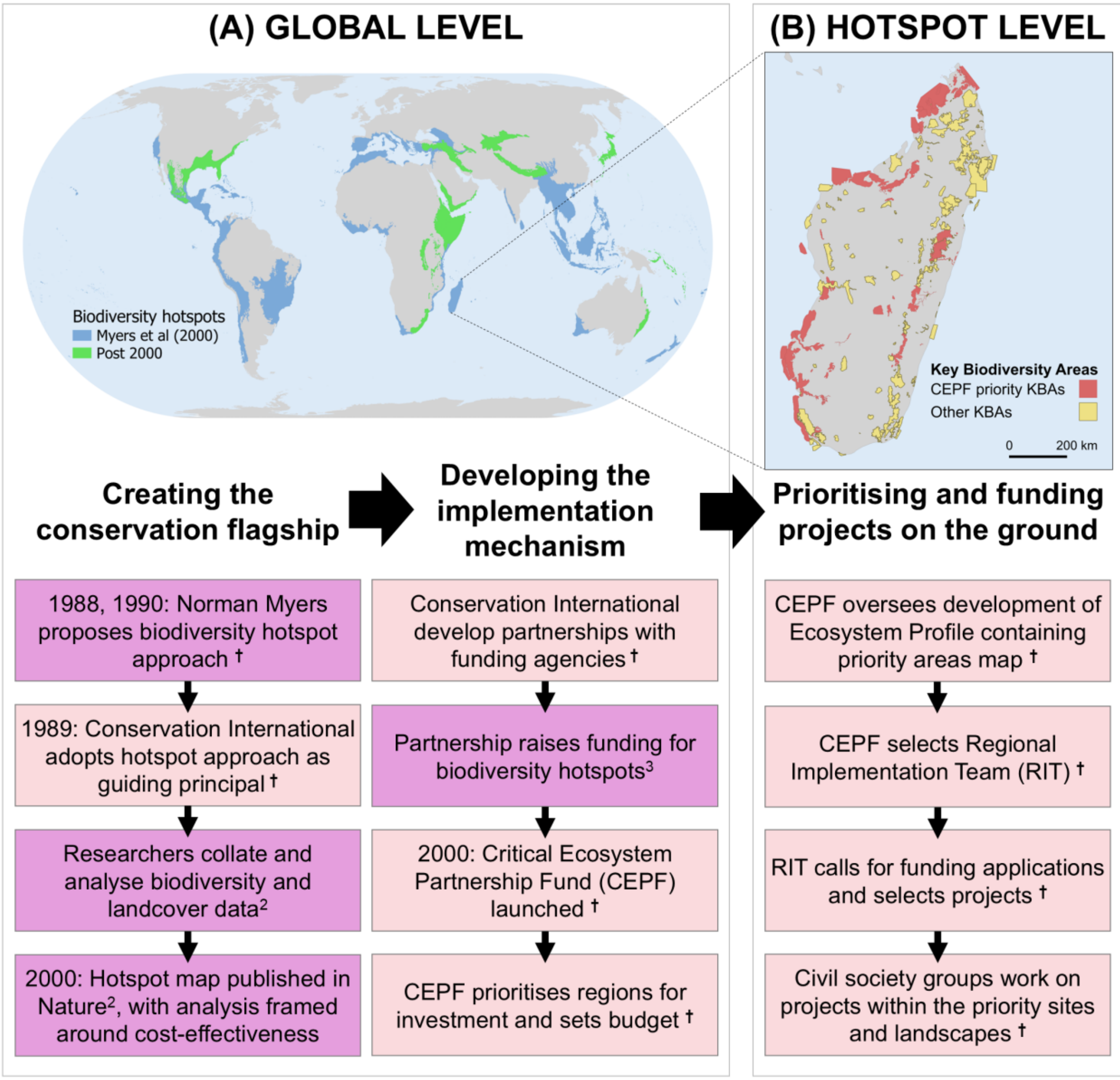

Figure 1: The biodiversity hotspot approach. The schematic illustrates the link between the global stages of the biodiversity hotspot approach (a) and action within an example hotspot, Madagascar (b). Purple text boxes show stages that are described in the peer-reviewed literature and pink text boxes show stages that are described on websites and in the grey literature († see Supplementary Information for references). (a) The hotspot map is from data collated by and cited in Hoffman et al (version 2016.1, https://zenodo.org/records/3261807), which shows the 25 hotspots identified by Myers et al[2] in 2000 and the nine hotspots added in 2004, the one added in 2011, and the one added in 2015; note that the boundaries of some of the hotspots identified by Myers et al[2] were revised as part of the 2004 analysis. (B) The Madagascar map is based on KBA data (BirdLife International, 2025, World Database of Key Biodiversity Areas. Developed by the KBA Partnership. March 2025 version), highlighting sites identified as priorities in the 2022 CEPF Madagascar and the Indian Ocean Islands Ecosystem Profile and the 2022 Ecosystem Profile Summary (see Supplementary Information for references).