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Bridging the Gap: How Can Information Access and Exchange Between Conservation Biologists and Field Practitioners be Improved for Better Conservation Outcomes?

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ABSTRACT

It is widely accepted that there is a considerable gap between the science of conservation biology and the design and execution of biodiversity conservation projects in the field and science is failing to inform the practice of conservation. There are many reasons why this implementation gap exists. A high proportion of papers published in scientific journals by conservation biologists are seldom read outside of the academic world and there are few incentives for academics to convert their science into practice. In turn, field practitioners rarely document their field experiences and experiments in a manner that can meaningfully inform conservation scientists. Issues related to access to scientific literature, scientific relevance in multidisciplinary environments, donor expectations and a lack of critical analysis at all levels of conservation theory and practice are factors that exacerbate the divide. The contexts in which conservation biologists and field practitioners operate are also often highly dissimilar, and each has differing professional responsibilities and expectations that compromise the ability to learn from each other's expertise. Building on recent debate in the literature, and using case studies to illustrate the issues that characterize the divide, this paper draws on the authors' experiences of project management as well as academic research. We identify five key issues related to information exchange: access to scientific literature, levels of scientific literacy, lack of interdisciplinarity, questions of relevance and lack of sharing of conservation-related experiences and suggest new ways of working that could assist in bridging the gap between conservation scientists and field practitioners.

Abstract in French is available at http://www.blackwell-synergy.com/loi/btp.

Key words: conservation biology; conservation practice; research-implementation gap; science.

IN THE PRELIMINARY STAGES OF THE DEVELOPMENT OF CONSERVATION BIOLOGY as a discipline Soulé (1986) suggested that '. . . communications between our colleagues ''on the ground'' and colleagues in the academy are often poor at best'. Over the past 20 yr, however, it is reported that the science of conservation biology has significantly influenced conservation practice (Robinson 2006). Although this might be the case, a considerable body of literature has been generated on the need for greater synergy between academic conservation biology and the practice of conservation in the field (Redford & Taber 2000, Pullin *et al*. 2003, du Toit *et al*. 2004, Sutherland *et al*. 2004, Marris 2007, Knight *et al*. 2008). A recent editorial in *Nature* (Anon. 2007) referred to this problem as the 'great divide', while others term it the 'research–implementation gap' (Knight *et al*. 2008, Shackleton *et al*. 2009).

There are many reasons cited for the persistence of the research–implementation gap. These include the lack of access for field practitioners to published literature (Coloma & Harris 2005), the poor level of scientific literacy of field practitioners, particularly those from developing countries (de la Rosa 2000), conceptual problems and issues of relevance of scientific research outputs (Sutherland *et al*. 2004), a failure to embrace interdisciplinarity by conservation scientists (Campbell 2001), and by implication a lack of engagement in the economic and policy sectors (Czech 2006) and a reluctance of those working on the implementation of conservation science to report their experiences, both positive and negative, to a wider constituency (Redford & Taber 2000, Knight 2006).

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In this paper, we address each of these issues and draw on our experiences from both sides of the divide to provide suggestions and recommendations as to how the research–implementation gap may be bridged for more effective biodiversity conservation.

ACCESS TO SCIENTIFIC LITERATURE

Dissemination of research ensures that research communities are able to build on existing knowledge, highlight new discoveries and do not duplicate efforts in either research or implementation (UNESCO 2008). Scientific journals play a central role and are the principal medium for disseminating research results across the global scientific community. However, access to scientific journals is highly divided between developed and developing countries: the 'information gap' (UNESCO 2008). In the developed world individual scientists rarely subscribe to scientific journals and rely on their institutions to do so. This has protected them from the increase in subscription rates, a reported increase of 227 percent between 1986 and 2002 (Coloma & Harris 2005), particularly those journals published by for-profit publishers (Wilson 2007). In developing countries, however, where most conservation science is implemented, poor governance, weak institutional infrastructures, declining operational budgets and currency weaknesses have resulted in institutions and libraries being unable to maintain their subscriptions to the few journals they can afford. A survey by the World Health Organisation in 2000, undertaken in 75 countries with annual per capita incomes of $<$ US$1000, reported that 56 percent of the institutions surveyed had no current subscriptions to international journals, and had not had for the previous 5 yr. For example, subscriptions to the journal *Conservation Biology* show an

equally uneven pattern of subscriptions, with only 4.6 percent of subscribers from developing countries.

It is therefore unsurprising that new knowledge is largely generated in the developed world where finance available for research and academic support is highest. In a study of the world's major producers of general scientific literature, King (2004) found that only eight countries (in rank order: the United States, the United Kingdom, Germany, Japan, France, Canada, Italy and Switzerland) produce 85 percent of the world's most cited publications. With the inclusion of an additional 23 developed countries in the analysis, the total ratio of publications comes to 98 percent. The world's remaining 162 countries, the majority of them developing nations, contributed < 2 percent of scientific papers to the global body of literature (King 2004). If such asymmetry in research output and access to up-to-date information remains a characteristic of the scientific world, then research scientists and practitioners in the developing world will remain isolated and their work will continue to have little impact (Chan *et al.* 2005). Given these figures it could be argued that developed country scientists are currently failing their colleagues in developing countries, ignoring their academic isolation, because we are encouraged and expected to publish our research in 'high-profile' journals, which increases our competitiveness. This, in turn, facilitates access to further research funding, further accentuating the information gap between developed and developing countries.

In the last few years a number of initiatives aimed at increasing access to scientific journals have been launched (Chan *et al.* 2005, Coloma & Harris 2005). Although it is estimated that up to 90 percent of the world's scientific journals are now available online (UNESCO 2008), prohibitive subscription rates remain a hindrance to access (see, however, http://www.tradeoffs.org/static/index.php where many papers and articles related to conservation, even from subscription journals, are now freely available). The digital availability of scientific journals has increased significantly in recent years, particularly with the rising popularity of open-access publications. Based on the principle that public-funded research should be made publicly available, a principle supported by many donor governments (Chan *et al.* 2005), open-access journals provide a medium that has a greater reach and a larger global influence at little or no cost to the user. While there is a recognized 'digital divide' (Coloma & Harris 2005) between developed and developing countries and within regions, where many national research and education networks are based on low-speed, and often irregular, internet services, electronically accessible journals potentially provide a means of bridging the information gap for developing country scientists (Chan *et al.* 2005).

However, committing to dissemination through open-access journals remains problematic for many developed country research scientists, including conservation biologists. Even with rigorous peer-review, new electronic journals do not attain the same impact status as traditionally printed journals (Coloma & Harris 2005). The measure of the impact of a journal remains the yardstick by which research scientists judge their career development and scientific credibility although the methods by which 'impact' is assessed has recently been questioned (see Wilson 2007, Campbell 2008). Hence, convincing most academically oriented scientists to also publish in open-access journals will require a significant shift in the mindset of researchers and agencies funding their work. It is hoped that this Special Issue, which highlights some of these important problems, will go some way to effect this change.

ISSUES OF SCIENTIFIC LITERACY

Unfortunately, limited access to scientific journals also affects the capacity of developing country researchers to contribute their work and experiences in a published form. Few researchers and field practitioners receive training on how to convert their work into manuscripts that are publishable (Coloma & Harris 2005). In addition, the complexity of the publishing process with respect to language use, standardized formatting and the need for up-to-date bibliographic information makes the process somewhat of an ordeal for all but the most dedicated worker (de la Rosa 2000). The domination of the English language as the scientific medium for dissemination constrains many researchers and field practitioners and also hinders the impact of any published paper in the authors' country of origin.

A further problem characteristic of conservation science is that building the capacity of researchers and field practitioners in developing countries can be good for the individual and not necessarily beneficial to the capacity of the country as a whole to implement conservation science. This is due to the significant migration of high-quality individuals from developing countries to those in developed countries (Ali *et al.* 2007). This results in a lack of critical mass of qualified and motivated researchers and practitioners in many developed countries. An example of this is the Limbe Botanic Garden (LBG) in Cameroon where two authors of this paper were based for many years. With funding from the UK Department for International Development and the British Council, over the period of 14 yr, more than 25 graduate-level national staff of LBG were provided with postgraduate scholarships. These included three PhD, 11 MSc or equivalent and nine postgraduate diplomas. At its peak the research and implementation capacity of the institution was unrivalled in the region, with a functioning herbarium and an excellent remote-sensing unit. Five years after international donor funding to the institution ceased, only two of those recipients of training remains in Limbe; the herbarium is unstaffed, with inadequate curation of the specimens, and the remote-sensing unit is now closed. Only six of those who received scholarships remain in Cameroon while the majority are now based in developed country institutions. There is a clear challenge to foster the conditions that will encourage those who have been educated overseas to a high level to return and dedicate their professional career to their country of origin (Ali *et al.* 2007). This should come in the form of fostering long-term support for developing country institutions and encouraging host nations to provide basic core support for research organizations. While it could be argued that those individuals who are employed outside their country of origin may continue to contribute to conservation science, they may not ultimately be contributing to conservation in their own country—the area where they are most needed; hence, the provision of academic opportunities and

capacity building would not have been required in the first instance (Meyer & Brown 1999).

FAILURE TO EMBRACE INTERDISCIPLINARITY

A significant contributing factor to the research–implementation gap is that the academic side of conservation is primarily focused on biological issues (Campbell 2001). Those involved at the implementation side are often faced with managing complex human-dominated landscapes with the concomitant socioeconomic, legislative and governance issues, aside from those related to conservation. These issues are only sporadically taken into account in conservation biology (Campbell 2001, Czech 2006). Greater engagement with the social sciences and applied anthropology would arguably significantly increase the capacity of conservation science to be more effective (Schmidt 2005, Brosius 2006). By better integrating human, social and economic issues into the concept and delivery of conservation biology, we may see a shift away from it being regarded as a 'crisis discipline' focused primarily on biodiversity conservation (Redford & Sanjayan 2003).

WHOSE INNOVATIONS? WHAT CONCEPTS?

In a survey of field practitioners in the United Kingdom, Sutherland *et al.* (2004) report that only 2.4 percent of respondents obtain technical information to support their work from the primary scientific literature. As this example includes people with the ability to purchase journal subscriptions and have good internet access, this is a surprisingly low number. If, in this instance, accessibility is not an issue, why is there so little reference to the scientific literature and why does science not inform conservation practice more?

Despite conservation biology being ultimately an 'applied science' (Martinich *et al.* 2006), the field is often dominated by conceptual approaches to understand conservation and development and their linkages (Salafsky & Wollenberg 2000, Brown 2002). Despite the value of such work, particularly among the academic community, it is often regarded as being too broad, conceptual or too abstract for relevance to the field practitioner. In addition, a 'one-size fits all' approach, often advocated by conservation biologists, has also arguably hindered the implementation of conservation at the field level as local realities are not taken into account (Sayer & Campbell 2004).

SHARING EXPERIENCES TO INFORM CONSERVATION SCIENCE

It is widely recognized that those involved with the implementation of conservation projects generally do not share their experiences in a published form and many field practitioners do not generally publish their experiences (Redford & Taber 2000, Pullin *et al.* 2003, Sutherland *et al.* 2004). The very nature of the management of field projects requires devoting extensive time and resources to nonscientific activities and this compromises the ability of most field practitioners to devote time to publish papers related to their work (Pullin & Knight 2005). Indeed, few individuals feel a responsibility to do so. Unfortunately, most conservation projects rarely document their work internally and most project libraries are poorly stocked, referenced and maintained and often deteriorate rapidly once external funding has ceased (Sayer & Campbell 2004). For example, in a regional survey of conservation projects supported by various donors in Western Cameroon commissioned by the Wildlife Conservation Society in 2003, of eight that had received considerable external funding, which had subsequently closed, only one had a library containing both project literature as well as standard reference material; for the rest even basic project documentation was unavailable or missing (T. Sunderland, unpubl. data).

Although conservation in complex socioeconomic and political contexts may require experimentation, this may result in failure or 'unexpected consequences' (Redford & Taber 2000). These are rarely reported despite their potential value in terms of 'lessons learned' for others working in similar situations (Knight 2006) and to ensure conservation science also learns from field experience (Knight *et al.* 2008). There are understandable concerns in sharing negative or unplanned experiences for most field practitioners. Reporting such experiences could jeopardize future funding in a discipline where there is a need to fulfill donor requirements and maintain individual and institutional reputations (Knight 2006). Although Redford and Taber (2000) and Sutherland *et al.* (2004) implored the conservation community to share negative experiences of implementation, this call has gone largely unheeded, and examples of *mea culpa* are rare (although see Knight 2006). The paper by Sutherland *et al.* (2004) resulted in the launch of an online open-access journal (http://www.conservationevidence.com) for conservationists to share their experiences in conservation implementation, similar to the *Journal of Negative Results in Biomedicine* for the medical profession (http://www.jnrbm.com). While an excellent resource, the *Conservation Evidence* journal is dominated by UK-related conservation issues and generally does not attract contributions from the frontiers of conservation efforts, and problems, in the tropics.

Robinson (2006) also articulates a more controversial issue regarding the selective use of data by some scientists and field practitioners to further an argument. This issue is discussed in relation to the purported displacement of people in protected areas in Central Africa (Sunderland *et al.* 2008). In attempts to report the overwhelming success of conservation initiatives, there is concern that the field realities are misrepresented.

The impacts of not sharing, particularly negative, experiences can be significant. Duplication of effort is a notable problem with conservation assessments and implementation (Mace *et al.* 2000). Without urgent critical self-analysis and informing our peers how conservation can be better implemented, it is clear that efforts will continue to be duplicated. Funding agencies should also be open to reading reports of unsuccessful implementation and not be content with reading continued, and often inaccurate, reports of success. Michael Wright, previously of the MacArthur Foundation, responsible for funding conservation and sustainable development projects, spoke of his frustration at reading glowing grantee reports when he would have preferred to see more self-assessment and honest reporting (Marris 2005).

SELECTIVE REPORTING: A CASE STUDY OF COMPROMISING REALITY

The Kilim-Ijim project in Cameroon has been the subject of a number of papers and book inserts highlighting it as a rare case of a conservation success story. The area has been the focus of conservation activity since the late 1980s and has had a number of donors and implementing agencies working there, although Birdlife have been the institution most consistently present supporting national institutions. Rands and Thomas (cited in Gradwohl & Greenberg 1988) discuss the significance of the Kilim-Ijim forests to local people in terms of forest products and highlight the contribution of the forest to local livelihoods in terms of the harvest and sale of key NTFPs. They indicate that project interventions were focused on sustainable exploitation of key species. The same case study is also cited by Sutherland (2000) as an example of combining conservation and development through the Birdlife project facilitating 'Cameroon's first community-managed forest' (Sutherland 2000) through working with local institutions and resolving local conflicts. Sutherland (2000) goes on to describe the project as a 'success'. This view is further supported by Abbot *et al.* (2001), who explicitly state that the development activities of the project had a positive impact on the perceptions of local people to support conservation, which led to changing 'local attitudes and behaviour' (Abbot *et al.* 2001). Reading these accounts of the Kilim-Ijim Forest Project, one could conclude that this was indeed a rare success among many examples of conservation failure in the tropics (Hayes 2006), particularly in Cameroon (Schmidt-Soltau 2004). However, how the success of the project is actually evaluated is unclear. None of these accounts indicate how 'success' is measured or provide quantitative data that support the assertion that project interventions had an impact on the conservation of the biodiversity of the area. It is quite perplexing then to read that in the period between 1987 and 1995, forest cover loss was > 25 percent, and that only a tiny fragment of the original forest, *ca* 70 km^2, remains (Cheek *et al.* 2000). Maisels *et al.* (2001) record the extirpation of almost all large mammals from the same forest over the past 20 yr. This much more sanguine view of the situation in Kilim-Ijim is further compounded by Stewart (2003), who reports that traditional controls on the harvesting of certain NTFP species had broken down leading to unsustainable harvesting and local extirpation of the main tree resource, *Prunus africana*. It is then difficult to reconcile the glowing success story reported by those working on the ground with such large-scale biodiversity loss coupled with the context of diminishing local institutions.

BRIDGING THE GAP: THE WAY FORWARD

Conservation projects are currently having little success in arresting biodiversity loss (Hayes 2006) and conservation biology remains a crisis discipline (Redford & Taber 2000). One of the main reasons for this is that science is not informing conservation practice. In recognition of the obstacle to conservation effectiveness, high-impact journals such as *Nature* and *Conservation Biology* have recently highlighted the clear research–implementation gap by publishing a range of papers and articles on the issue (Marris 2005, 2007; Pullin & Knight 2005; Knight 2006). Now that the problem has been articulately aired, and further discussed in this Special Issue, the challenge is now for both sides to fundamentally change their way of working, and thinking, to engage for more meaningful delivery of conservation. In concluding, we offer some practical suggestions as to how this might be achieved.

For science to better inform conservation practice, both the availability and relevance of scientific information and investigation needs to be improved considerably for science to inform field implementation of conservation. The emergence of the open-access journal is one means of extending the reach of scientific literature. Despite concerns about the purportedly low-impact factor of open-access journals, the additional scope and extent of the dissemination process outweighs the traditional academic, and somewhat individualistic, attention to Thomsons Institute for Scientific Information and other impact factor ratings by developed country scientists. However, Coloma and Harris (2005) calculate the greater accessibility of online journals increases the citation rate and, by implication, its impact factor, by 157 percent. To further increase accessibility, and where copyright agreements are not compromised, conservation biologists should also consider posting their papers originally published in subscription-only journals on the 'Advancing conservation in a Social Context' website (http://www.tradeoffs.org/static/index.php) where they are then freely available to download by those to whom they are most relevant but who may not be able to subscribe to such journals due to prohibitive costs.

There is a significant role for the development of mutually beneficial partnerships between conservation biologists and field practitioners to publish research findings together and not in isolation. The authors of this paper have a strong commitment and track record of publishing with field-based colleagues and urge other workers to do so. Such scientific mentoring is particularly crucial if developing country conservationists are to build their own research capacity and dissemination potential. External support for developing country institutions is also critical.

Creating an environment for academic and professional excellence need not be exclusive to developed country institutions and if we are to achieve a level of critical mass of engaged and competent conservation professionals required to address ongoing biodiversity loss, particularly in the tropics, then the optimum conditions for them to remain in their country of origin must be fostered. However, halting the 'brain drain' will require considerable leveling of the playing field in terms of training, remuneration and professional opportunities and considerable long-term support for developing country institutions.

Aside from disseminating research results in high-impact scientific journals, many academics have begun to 'translate' their work into more usable products of more direct relevance to field practitioners. For example, the palm taxonomists at the Royal Botanic Gardens, Kew, recognizing the importance of palms as nontimber forest resources, have begun a series of field guides to enable clear and unambiguous identification of palms in the field for better management interventions (Evans 2001, Baker &

Dransfield 2006). An excellent discussion of the translation of academic research results for field practitioners and local communities is provided by Shanley and López (2009).

Another issue with regard to relevance is the involvement of field practitioners in the academic process. For example, peer-review by field practitioners of new innovations and concepts in conservation biology purported to provide a framework for project-related design and intervention would also ensure that the science remains applied.

Graduates in the biological sciences are seldom taught the requisite skills needed for conservation implementation (Soulé 1986). This may compound the divide between conservation biologists and field practitioners by academic scientists not appreciating, or understanding, the context in which field-based conservation efforts are implemented. We echo the call of Martinich *et al*. (2006) that graduate programs in conservation biology should include extensive field- and management-related experience. Maintaining conservation biology as an applied discipline is crucial to ensuring relevance in practice (Duchelle *et al*. 2009).

New web-based tools such as http://www.journalexperts.com/ will proofread and correct articles for submission to English-language international journals and http://translate.google.com/ provides a translation service in many languages. Both these resources could significantly benefit developing country scientists who are looking to publish their work in international journals.

Finally, the authors acknowledge the efforts of the Centre for Evidence-Based Conservation (http://www.cebc.bangor.ac.uk/index.php.en?menu=0&catid=0), which provides extensive reviews of implementation-related issues (Pullin & Knight 2005). We encourage field practitioners to engage with conservation scientists through the journal *Conservation Evidence* (http://www.conservationevidence.com; Sutherland *et al*. 2004). This dissemination pathway, and others like it, provides an excellent medium for conservation workers on both side of the divide to contribute and interact and build bridges across disciplines, institutions and regions. Of course, *Biotropica* should be applauded for addressing these issues by accepting to publish this Special Issue and the authors hope that some in-roads are made in genuine attempts to bridge the gap by the academic community. Now attempts need to be made to engage with the very field practitioners that we are trying to influence and CIFOR will be making the information presented in this 'academic' paper available in more available forms such as booklets and other forms of dissemination.

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