

Bottom-up Conservation

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ABSTRACT

Conservation initiatives that have worked well in temperate and developed regions have often been applied in the tropics but with only limited success. Part of this failure is due to top–down conservation planning that has been conducted without taking local socio-economic considerations into adequate account. Here, we argue that conservation approaches would benefit from a deeper understanding of human–nature interactions.

Key words: indigenous people; local stakeholders; natural resource management; traditional knowledge; tropics.

RAPID AND ONGOING HABITAT DEGRADATION, SPECIES, AND POPULATION LOSSES, global climate change, biotic invasions, and overkill have created a planetary state of environmental crisis (Raven 2002, Millennium Ecosystem Assessment 2005, Ehrlich & Ehrlich 2010). In the face of these problems, caused by the rapid growth of a record human population, our ever-increasing desire for increased levels of consumption, and the continued use of manifestly inappropriate technologies, it is especially difficult to achieve positive conservation outcomes in developing tropical countries. Conservation initiatives that have worked well in temperate and developed regions have often been applied in the tropics but with only limited success. Part of this failure is due to top–down conservation planning that has been conducted without taking local socio-economic considerations into adequate account (*e.g.*, Olson & Dinerstein 1998, Myers *et al.* 2000, Langhammer *et al.* 2007). Similarly, large-scale forest conservation efforts organized through the United Nation's Reducing Emissions from Deforestation and Forest Degradation have been conceived in such a way as to limit community involvement, a fatal flaw over the short to medium run (Phelps *et al.* 2010). From a developed world perspective, even the sustenance activities of local people have sometimes been viewed as threats to conservation (Ancrenaz *et al.* 2007).

Indigenous societies have been practicing natural resource management through food taboos (*e.g.*, limits on hunting of certain species during the breeding season), environmentally sensitive harvesting techniques (Davis 1991), and the protection of sacred sites that incidentally provide refuges and resources for plants and animals (Read *et al.* 2010). Ironically, local traditional cultures are now frequently threatened by the same processes (*e.g.*, commercial exploitation; Sutherland 2003) that threaten biodiversity. Here, we

argue that top–down conservation approaches would inevitably benefit from a deeper understanding of human–nature interactions. Similar calls have been made previously (*e.g.*, Silvius *et al.* 2004, Ostrom & Nagendra 2006, Sodhi *et al.* 2006), but the current level of disarray (*e.g.*, ongoing habitat loss and unrestricted commercial exploitation) warrants a reiteration. Further, we emphasize that environmental technology developed by the resource-strapped developing world should be urgently tapped for alleviating environmental damage.

Protected areas (PAs) often present quintessential examples of top–down conservation initiatives. For those who live in industrialized countries, the preservation of large, pristine, wilderness areas is often seen as an essential component of all approaches to conservation (Claus *et al.* 2010). PAs on this scale are still being presented as the best or even the only strategy to mitigate climate disruption and preserve biodiversity (Ricketts *et al.* 2010). Driven by this philosophy, the forcible expulsion of indigenous or rural people from some conservation areas in the Americas, Australia, Africa, and Asia (Dowie 2009, Claus *et al.* 2010) has led to serious conflicts between conservationists/governments and local people (Curran *et al.* 2004, Sodhi *et al.* 2008), and has sometimes even increased the intensity of natural resource harvesting (Lee *et al.* 2009, Mascia & Pailler 2011). These examples illustrate the necessity of building a greater understanding of the existing interactions of local people with nature as an important component in achieving effective levels of conservation. Indigenous people have incorporated conservation measures within their management systems for centuries (Berkes 2008), but some of these measures have been curtailed by new opportunities provided by increased commercialization and access to the global market, as well as the activities of missionaries and conservationists, resulting in the destruction of indigenous conservation cultures (Ancrenaz *et al.* 2007). In other instances, the heavy interference of foreign organizations (*e.g.*, Humane Society of the U.S.A.) have sometimes muddled locally centered endeavors such as culling of rogue elephants that damaged crops and killed people

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in Zimbabwe (Ehrlich 2010). All conservation initiatives should be sensitive to existing interactions that are of key importance for the lives of local people, who are and will remain the primary stakeholders in the conservation of their landscapes and biodiversity.

Unfortunately, human interactions with nature, including cultural and spiritual aspects of resource harvesting, have been generally undervalued or misunderstood (Ghazoul 2010, Read *et al.* 2010). Encouraging natural resource management research by local scientists will help to overcome such biases (Bawa *et al.* 2004). We are not arguing for the abandonment of PAs, which can be critical for the survival of biodiversity in some areas, but rather that local conservation efforts and needs should be properly accounted for.

In some regions, an understanding of local socio-economic factors has resulted in tangible conservation gains. For example, in Thailand, Poonswad *et al.* (2005) integrated 28 hornbill poachers into hornbill monitoring programs, using mostly locally generated funds (68%; hornbill family adoption for US\$120 each), resulting in a 39 percent increase in the number of nests with fledglings. This ongoing effort shows that local biologists can leverage local funding that provides employment to local people while reducing impacts on biodiversity (in this case the poaching of hornbills). Around Gunung Palung National Park, Borneo, locals gain affordable healthcare through forest protection (<http://www.healthinharmony.org/mission.html>): patients pay for their health needs through conservation-oriented programs (*e.g.*, reforestation). Additional incentives are given to the communities that protect the park from illegal logging activities.

Conservation endeavors must incorporate human sustenance into their plans (Bawa 2006). Local people need natural capital; some 70 percent of one billion undernourished humans are dependent on natural resources for survival (Millennium Ecosystem Assessment 2005, Sodhi *et al.* 2010). For instance, local people should be assisted in identifying suitable productive areas for agriculture, so that biodiversity can be sustained in the noncultivated areas (Koh & Ghazoul 2010). They can also be provided with environmentally benign tools and knowledge of how to deal with the new agricultural lands sustainably (Lohman *et al.* 2007), important elements in a successful regional conservation program.

Suggesting alternatives can also translate into conservation benefits. The charismatic maleo bird (*Macrocephalon maleo*), a megapode endemic to the islands of Sulawesi and Buton (Indonesia), faces the imminent risk of extinction because its eggs are harvested unsustainably (Sodhi & Brook 2006). A community in Pakuli (central Sulawesi) that is the custodian of the local maleo nesting grounds is being assisted in the exploitation of alternative prey, the invasive fish *Osteochilus*, so as to reduce their harvest of maleo eggs (Sodhi & Brook 2006). We believe that the adoption of similar approaches across Sulawesi would greatly help to ensure the survival of maleos and other exploited species.

As with conservation, technology transfer to the developing world has also been mainly top-down, with both positive and negative outcomes (Hill 2010). Cash-strapped developing country inhabitants have achieved a number of ingenious environmental solutions that should be adopted widely. Large corporations are already engaging in 'reverse innovation' (Immelt *et al.* 2009) whereby state-of-the-art but low cost technologies are applied to solve environ-

mental or waste management problems. For example, a cheap water filtration system that uses rice husks, an abundant waste product, is being developed by Tata Consultancy Services in India (<http://worldisgreen.com/category/greening-the-world/greening-india/>). This system has the potential to provide families with purified water given an initial investment of only US\$24, and a subsequent cost of US\$4 every few months. There are many widely publicized pharmaceutical examples of reverse technology transfer, perhaps the best known of which is the bark of cinchona trees that has long been used by indigenous people in Amazonia to cure fever (Newman *et al.* 2008). This bark, which contains the antimalarial quinine, was brought to Europe in late 16th century and was found effective for the treatment of malaria. Similarly, the use of daisy flowers (*Chrysanthemum cinerariifolium*) to control insect pests by African tribal people inspired the discovery of the insecticide pyrethrum, now the basis of a multimillion dollar industry (Plotkin 1986).

There have been encouraging signs in the energy sector, where cheap innovative and low greenhouse gases emitting 'developing world' technologies are being envisioned. For example, power is being extracted from rice husks in India to provide electricity to rural inhabitants (Anonymous 2010). Biogas (*e.g.*, cooking gas obtained from cow dung; Cuellar & Webber 2008) is another source of energy that has been used in the developing world for centuries, and could curtail energy use if it is to be made widely available through commercial development. We urge a heightened effort to understand existing environmental technology used in the developing world, and if practiced widely, these may curb environmental damage and thus benefit biodiversity and human well-being (see also Schumacher 2000).

Although conservation efforts at grassroots have been recommended previously, and have been increasingly practiced with beneficial results for biodiversity conservation (*e.g.*, Raven 2002, Ostrom & Nagendra 2006, Agarwal *et al.* 2008), we argue that the time for increasingly bottom-up approaches has come, with conservationists being more attentive to local needs and environmental innovations.

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