Commentary

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Conservation in a changing world: biodiversity hotspots and the distracting paradigm

A recent report from the Fifth World Parks Congress in Durban, South Africa, shows that the global network of protected areas covers now 11.5% of the earth�s surface (Rodrigues et al. 2004). This percentage surpasses the 10% target proposed in the last World Parks Congress held in Caracas a decade ago (McNelly 1993). Finally a main conservation goal is reached! But� does it means the global biodiversity crisis reaches an end, returning the hope for the long term maintenance of the world�s biota? The answer is a rotund �not at all�: Rodrigues et al. (2004) show that the global network is still far from representing most species of terrestrial mammals, birds, turtles, and amphibians, some of the best known biological groups. Not even mentioning other known groups like plants and huge still less known groups like insects and fungi... and all the �invisible life� (Nee 2004). Were the precedent estimates ten years ago too low? What is then the �optimal� percentage with which most of the world�s biota will be protected? I won�t risk an answer, I rather believe that this percentage doesn�t exist, it is an illusion, a chimera supported by an out-of date conservation paradigm.

Protected areas and hotspots

I refer to the current conservation paradigm and its central approach, the �hotspots approach�, which has turned out during the last decade as the most popular approach for driving biodiversity conservation decisions (Myers et al. 2000). This approach makes the assumption that protected areas are the best solution for biodiversity conservation everywhere, and therefore studies steadily improve the methods and techniques to identify areas at global scale in which more species can be protected, optimising the money inverted. Protected areas have certainly played the most important role in biodiversity conservation since the first National Park was created in 1872 (Yellowstone NP), but much conservation action and science have been developed since then. Why has this approach become so popular between conservation agencies? Because it is the simplest approach that permits worldwide comparisons and therefore allows decision making at global scale. Its power lies in its simple assessment method: put together species geographic ranges (better endemics) from the worlds� best known biological groups and look where they concentrate. Add information about the remaining natural vegetation in these territories... and voil�!, you will have your hotspot on the map. But this approach suffers methodological as well as theoretical weaknesses, setting aside many other conservation approaches.

Hotspots, black holes of taxonomic information?

Methodologically the application of the hotspots approach is very controversial (Harcourt 2000, Brummit and Lughadha 2003). Why? It is of course possible to overlay the distribution of already known species on the global map and get the red polygons on it... But independent of what biological group we take, red hotspots on the map will continue being �black holes� of taxonomic information: from the 4 million to 100 million calculated species living on earth we only know 1.7 million! Taking just one example from M�xico, a megadiversity country: it will take at least 60 years to complete the floral national checklist (Maga�a and Villase�or 2002). And if we want to be really consequent with the approach, we need to take account of all the groups: insects, fungi, bacteria... yes, even the invisible live should come to play (Nee 2004). The issue is extremely challenging, since the picture we take today can change tomorrow, because we are trying to know the �species�, a momentum in the dynamic line of evolution. But some speciation processes can be occurring in front of our eyes, beyond our comprehension capacity. And we are speaking here only about completing a checklist, not even thinking about getting the minimal information to assess the degree of threat for each species... but how difficult is it to assess the species when we are only beginning to know them! The problem is getting complex, since taxonomists are also an �endangered species�: they suffer a worldwide decline, are seen as �postage-stamp collectors� and publish their monographs in journals with a relatively low Impact Factor. Fortunately, a new taxonomy arises, integrating the traditional morphological approach with the new molecular techniques, showing at least some �light after the dark� (Boero 2001). But taxonomists are already very few to complete the world species checklist, a challenge tackled by the �All Species Foundation� (www.all-species.org). And when we finally get the global species checklist (in only 25 years?), will it be the time of discovering the real hottest hotspots?

The hot against the cold

In spite of the controversial hotspots approach the basic concept still appears compelling: hotspots are a way of directing conservation efforts towards the most effective actions at global scale. But Kareiva and Marvier (2003) vividly express the weakness of setting the conservation goal exclusively to protect the largest possible number of species in the smallest possible area. Broader range of objectives are set to the side, such as

- maintaining functioning ecosystems around the world,
- protect the diversity of lineages for future evolutionary breakthroughs,
- preserving landscapes for recreation and education,
- protecting spaces for the �ecosystem services� nature provides at all scales.

Hotspot-based conservation strategies would not automatically take these objectives into account, on the contrary, many important places on earth will suffer from diminished conservation efforts only because they can be better recognized as �coldspots�. Kareiva and Marvier (2003) give enough examples why a �coldspot� could be as good as a hotspot for directing conservation action. The conservation of a threatened species of a unique genera or family can be crucial for phylogenetic diversity. This can be exemplified well if we have to choose whether to protect in an equivalent area, the **unique** species of the genus *Zephyra* in the margin of the Atacama desert, or 30 species of the almost 3.000 Ecuadorian orchids� Or if we have to decide whether to conserve the only one species of Andean bear (*Tremarctos ornatus*) instead of the high number of American rodents� As Kareiva and Marvier (2003) strongly assert: �This leaves scientifically minded conservationists with the unanswered question: What then should we do?�

Setting the priorities� and the limits?

In the last decade an enormous variety of methods and computer algorithms for the definition of priority areas at different scales have been developed (Csuti et al. 1997). Priority areas for conservation are also identified in many countries at the national level (Mu�oz-Schick et al. 1996, Rodriguez and Young 2000). All these efforts generate maps that can be useful for decision making and priority setting. On global scale, important conservation investments have been directed to apply this approach (Myers and Mittermeier 2003). But we know that maps are a synoptic view of the reality, an abstraction, data synthesis and generalisation. Maps shows limits, and limits are usually static lines, and we know now that ecosystems are constantly changing at every scale. Therefore we must develop methods to �put the processes on the map� (Balmford et al. 1998) New approaches begin to recognise the inconsistency of limits, focusing on biogeographic ecotones as conservation targets (Ara�jo 2002, Spector 2002). Many species live now on the edge of their historical range (Channel and Lomolino 2000) and others are expected to change their geographic range dramatically due to climate change, getting rapidly under threat (Thomas 2004). Other species like leatherback turtles (Ferraroli et. al 2004, Hays et al. 2004) have such a big geographic range due to their migration necessities, that they move freely from one hotspot to the next, crossing enormous unsure fishery arenas�

Conservation action v/s conservation science

The impact of computational site-selection tools in applied conservation planning have been minimal, revealing big gaps between theory and practice in reserve design (Prendergast et al. 1999, Cabeza and Moilanen 2001). Conservation practice usually surpasses conservation science, applying a diversity of methods and techniques to stop ecosystems diminish and damage. Salafsky et al. (2002)� proposed at least 20 approaches complementary to the protected areas approach, in a context of a long term biodiversity conservation-practice program.

Community-based conservation has been very controversial but nevertheless shows good examples of success (Peres and Zimmermann 2001), related to three conceptual shifts in applied ecology: a shift from reductionism to a systemic view of the world; a shift to include humans in the ecosystems research; and a shift from an expert-based approach to participatory conservation and management (Berkes 2004).These shifts show a changing conservation paradigm, to the development of new applied approaches, like �adaptive co-management�, defined as a process by which institutional arrangements and ecological knowledge are tested and revised in an ongoing process of �trial-and-error�. The central idea of this process is that decisions cannot be imposed from top down, and local communities are not seen as just one stakeholder more, but as the most powerful force driving local and regional improves in conservation. This is shown by the high presence of communities and indigenous people in the Fifth World Parks Congress (Brosius 2004). The approach is hardly bounded to grass-roots efforts, and in many cases shows many more effective results than the top-down programme. As Chapela (2000) puts it, �The fine-scale management cannot be done by remote control from the boardrooms of the World Bank�.

A paradigm shifts, a new one arises ?

The biodiversity crisis is not a problem for conservation agencies, it is a concern for the global society, for the poorest and the richest, the hottest and the coldest. Sustainable use of resources, less consumerism, energy saving, alternative economies, political agreements, frontiers peace, social equality and solidarity are all challenges that can not be�evaluated apart from the global conservation urgencies any longer. The most effective argument that human activities should safeguard biodiversity is the need to secure the basic ecosystem services dependent on that diversity: production of plant biomass, retention of nutrients, resistance to drought and availability of fresh water, pollination of crops, and, just as important, opportunities for humans to recreate, to learn from and to enjoy natural landscapes. This is not an easy argument to tell to heavily consuming populations in industrialized countries or to impoverished, marginalized populations in developing countries (Novacek and Cleland 2001). But the argument�must be spread nonetheless through demonstration of the services the natural world provide. Indicators of sustainability have been applied at different spatial scales, recognizing the different levels of biodiversity organization (Sober�n et al. 2000). We must recognise that most ecosystems in the world already have the �human footprint� (Sanderson 2002). But human-dominated landscapes are the best conservation targets in an approach of systematic conservation planning (Margules and Pressey 2000).

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We can describe the current conservation paradigm as a �distracting paradigm�, because the general opinion and we as the �map makers� easily reach a point on which we naively believe that with making the best maps for selecting the really hottest hotspots we can be satisfied. But this is not the case, as with the global spread of the �hotspots� approach the scientific community reached the peak of an out-to date conservation paradigm. It�s now time to change paradigm, like some other authors have already strongly advised (Jope 1994, Stott 1998). We don�t know the new arising paradigm yet, but I�m convinced that it will be the result, in the near future, of the more fruitful synergy effects between conservation science and conservation action everywhere on earth, from the cold to the warm and the warm to the hot.

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