methods explicitly enough for other researchers to replicate them in their own laboratories. Research writing is also constrained by two other requirements, namely the traditional IMRaD structure (introduction, materials and methods, results and discussion) and the even more rigid formatting requirements spelt out in such style guides as *Scientific Style and Format*[11] and the *ACS Style Guide*[12].

As readers, we seldom realize that the good writing we see in print is the result of re-writing and revising, not merely to eliminate misprints but to make the writing easier and clearer. Students should be encouraged to edit one another's writings to see why revising is necessary and how it contributes to better writing. Having one's writing professionally copy-edited or using style checkers such as the Boeing Simplified English Checker[13], which can check for such common errors as missing articles (based on count and mass distinctions) and unapproved verbal auxiliaries (passive, progressive, perfect, modals) serves to highlight recurring faults. Researchers writing about their work seldom realize the need to organize their writing – not only in terms of the overall structure but also at the level of sentences – for readers who are not as familiar with the subject as the writers: The science of scientific writing[14], with examples taken from molecular biology and geology, shows how sentences can be recast for clarity, demonstrating in the process 'a number of rhetorical principles that can produce clarity in communication without oversimplifying scientific issues' and establishing that 'complexity of thought need not lead to impenetrability of expression'.

The last point is that effective writers are considerate to their readers, a point particularly important in this context because a great deal of scientific writing is motivated by considerations other than communication. As a *Current Science* editorial once put it, 'Writing for a lay audience has very little social prestige among scientists. Students who sometimes indulge in this enterprise are told that they are wasting their time and professors who do so are told that they have run of out ideas for doing science'[15].

As Somerset Maugham concludes his thoughts on writing prose, he observes: 'If you could write lucidly, simply, euphoniously and yet with liveliness you would write perfectly: you would write like Voltaire'[16]. It is not given to everyone to write like Voltaire but, given time and inclination, we all can produce workmanlike prose.

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Biodiversity hotspots: Defining the indefinable?

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Nature distributes its valuable biodiversity unevenly across the earth's surface. This variety of life on earth is in rapid decline. In recent past, the field of conservation biology has been dominated by the goal of protecting the biodiversity for future. Conservationists are meticulously attempting to conserve the biodiversity from anthropogenic erosion and 'pre-natural' extinction. However, conservation of biodiversity for sustainable life in future is a difficult task due to the following major barriers: (i) Inadequate data on diversity and distribution of flora and fauna across the earth, (ii) Inadequate funding for conservation efforts and research, and (iii) Confusion and controversies in selection of areas for conservation. The last barrier is a critical one that is troubling conservationists to a great extent today. Conservation of maximum number of species at a minimum cost is the primary goal of global organizations concerned with conservation of biodiversity. It is clearly an unreachable goal at present due to the above-mentioned major barriers. Another remarkable fact is that the economic strength of the nations, especially developing countries in the tropics with rich biodiversity is also weak. It has been budgeted that the cost of conservation action varies by several orders of magnitude from area to area; an essential factor that also needs greater attention[1]. In brief, lack of precise taxonomic data on global biodiversity and its distribution, lack of proper methodology for selecting areas for conservation and inadequate funding are the major problems today in conservation planning.

The idea of biodiversity hotspots (BHSs) as a solution for preferring areas for conservation of biodiversity was first proposed by Myers *et al.*[2] in 1988. They used species endemism and degree of threat as two basic criteria for defining BHSs. According to them, BHSs are areas featuring exceptional loss of habitat. More precisely, to earn hotspot status, a region must harbour 1500 or more endemic plant species, which are found in that particular area but nowhere else, and it must have lost at least 70% of its original habitat, primary vegetation. By matching these two criteria with global biodiversity distribution databases, they identified 25 hotspots comprising only 1.4% of the land surface of the earth but confining as many as 44% of all species of vascular plants and 35% of all species of the four groups of vertebrates except fishes. By considering additional criteria, viz. endemic species/area ratios for vas-

cular plants and vertebrates and number of endemics, these 25 spots were further grouped into five leading and eight hottest hotspots. More details on their names, locations, species richness and a comparative in-depth analysis are given in an earlier report[2]. Conservation International, Washington DC, one of the leading organization in the field, adapted this idea as its guiding principle in 1989. It has now recognized 34 BHSs, which occupy just 2.3% of the earth's land surface, yet support half of the world's vascular plant species and 42% of the terrestrial vertebrates.

Even though it was described as 'silver-bullet' strategy by authors[2], in fact, it is a seductive idea and recently it has come under fire. The major criticisms against the concept of BHSs can be summarized briefly and simply as follows:

- BHSs vary (both in number and geographic locations) depending on the delineating criteria.
- Lack of reliable biodiversity indices or measures to compare and substantiate the selection of areas as BHSs.
- Lack of congruence between BHSs defined by adapting different criteria[3].
- Overlapping of species richness hotspots with those identified using the other two criteria, viz. number of endemics and number of rare or threatened species; for instance, all ten threatened-bird species hotspots identified by Orme *et al.*[3] are on the Conservation International list of BHSs, which is based on plant endemic richness and habitat loss.
- Hotspot selection analysis ignores the ecological, evolutionary and anthropogenic factors that underlie the origin and maintenance of present-day biodiversity.
- It also excludes the human factor, which significantly determines the distribution of threatened species and their hotspots[4].
- Use of different methodologies in different studies while determining the species richness and subsequently BHSs[5].
- Many BHSs do not contain any rare species and at coarser scales BHSs for different taxa are more likely to appear coincident[6].
- Endemism is one of the primary criteria in selecting BHSs; it is also the weakest factor in many aspects such as lack of up-to-date data, restricted to few individual countries or parts of countries and as best-judgment estimates of experts[2].
- BHSs are overlapping in nature; for instance, out of 25 hotspots identified earlier, 12 extend across two or more countries and six across four or more countries[2].
- Current trends in conservation planning ignore the species-centred approach and prefer a habitat-based approach while setting priority for conservation[7], which provides priority to 'ecosystem-services' of a region rather than species richness or endemism. For instance, the temperate grasslands and Mediterranean biomass of the world need urgent protection against BHSs of tropics[7].

The primary objective of this report is not only to highlight the pitfalls associated with the concept of BHSs but to suggest positively the efforts needed in future in India to re-analyse many aspects of BHSs (Western Ghats and Eastern Himalaya). We need a new scientific outlook on the following aspects:

- Dividing the existing BHSs spatially as endemic, threatened and rarity hotspots by extensive analysis of existing data on species richness and endemism. For example, endemic species of tree frogs, uropeltids and freshwater crabs in Western Ghats were distributed often within a few square kilometers[8], which areas can be focused more for conservation. More research and conservation efforts on endemic hotspots, which are areas of high post, end potentially areas of future speciation[4].
- Exploring the possibility of increasing the number of BHSs by including more precise delineating criteria that are significant determinants of national/regional/local biodiversity. For instance, 43 vegetation types of India that persist as forests (actually before 1986) and represent the network of wildlife sanctuaries and national parks were prescribed as areas with highest priority for conservation[9], even before Myers *et al.*[2].
- Adaptation of habitat-based approach rather than species-centred approach, while setting priority for conservation by considering the significant ecosystem services and renewable resources. Ecosystem services are defined as the processes and conditions of natural ecosystems that support human activity and sustain human life. These services are generated by the biodiversity present in the natural ecosystems[10]. They mainly include food production, climate control, protection against natural catastrophes and as storehouse of drugs, etc. The Millennium Ecosystem Assessment Report drawn up by more than 1300 experts from 95 nations over four years remarked that 24 important human ecosystem services are essential for sustainable human life in future. Of these services, 60% are being degraded fast; for instance, air quality, food production and good climate[11]. Thus, there is a solid base to consider the habitat-based approach.
- Characterization of biodiversity down to more local scales using molecular taxonomic approaches. This suggestion was specifically made for India by Bossuyt *et al*[12]. These workers have shown the distinction between Western Ghats and Sri Lanka in endemic fauna (freshwater crabs, fishes and shrimps, tree frogs, caecilians and shield tail snakes) using molecular yardsticks of biosystematics which are combined into single hotspot earlier[2]. They stressed that future conservation programmes in India should take into account such patterns of local endemism at the finest scale at which they may occur.

It is not at all our claim that the suggestions that we set down above are final; however, we do believe that they provide basic material to focus our attention further deeply. We appeal to all biologists whose work depends on biodiversity and its conservation to throw their weight behind this initiative.

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