

Biological Diversity and Tropical Forests

The conservation of biological diversity has recently become a subject of significant international action. Task-forces in its support have been established by institutions such as the World Bank, and campaigns to improve its prospects are being orchestrated by international nongovernmental conservation organizations. This world-wide concern is largely based on the widespread belief that more species of organisms are becoming extinct in the latter part of the 20th century than at any time in the history of the Earth. A major manifestation of this concern is the significant international effort which is now under way to save the forests of the tropical 'developing world'. These forests are the most biologically diverse biomes on Earth, and many of the present species extinctions are thought to result from their rapid disappearance.

The current preoccupation with the conservation of biological diversity leads to a tendency to concentrate conservation efforts in areas where this diversity is greatest. The term 'megadiversity' has been applied in respect of such areas as the Atlantic forests of Brazil, the east-coast forests of Madagascar, Peninsular Malaysia, and parts of the huge island of Borneo. These sites are indeed of very high value for conservation, and consequently merit special international attention. However, a logical extension to this preoccupation with species diversity as a criterion for the application of conservation resources, could lead to unfortunate distortions of conservation programmes, much as can overemphasis on conservation of a single species.

IUCN's Ongoing Programme

The 'World Conservation Union', IUCN (the International Union for Conservation of Nature and Natural Resources), has ongoing programmes which monitor the status of species and protected areas throughout the world. Recent analyses of data from various components of this programme have shown that existing systems of protected areas, at least in the old-world tropics, contain a remarkably high proportion of the biological diversity of those groups of plants and animals for which information is available. For instance, in 12 African countries that were studied, between 47% and 91% of their native bird species are present in protected areas, and in most cases population sizes are thought to be viable for long-term conservation (Table I and *see* Sayer, McNeely & Stuart, 1988). Moreover, several of the species which are not present in protected areas are coastal or marine species, or are associated with human settlements and agricultural land. These species are probably not particularly endangered. A relatively small number of additional sites are known in Africa whose protection would lead to a situation where virtually all African bird species would receive a reasonable level of protection in national parks and reserves.

Recent studies by P. Round (cited in IUCN, 1986) in Thailand have shown that 508 of the 578 species of resident birds occur in the existing system of National Parks and Wildlife Sanctuaries. Of the remaining 70 species, 27 are open-country species which are unlikely to be severely threatened by forest loss, while 10 of the other species are considered likely to occur in protected areas but have not yet been confirmed as doing so. A very high proportion of the mammals of India are thought to be adequately conserved in the 30 areas that were established some years ago under 'Project Tiger' as Tiger (*Felis tigris*) reserves. The situation with plants is much less clear, and information currently available is quite inadequate to permit any generalizations.

Diverse Floras Under Threat?

There is certainly evidence that, in some parts of the Andes and the Andean foothills of the Amazon basin, areas of very diverse flora are under great threat from transformation to agriculture, while the species which they contain are very inadequately represented in protected areas. However, for some sites in the forests of the old-world tropics for which information is available, the situation may not be as bad as one might fear. Over 50% of the endemic vascular plants and 64% of the trees of Sri Lanka are known to occur in the 11,000-ha Sinharaja Biosphere Reserve in the moist lowlands of the south-west of the island (Gunatilleke & Gunatilleke, 1985). Anderson *et al.* (1982) have listed 450 pteridophytes and 1,500 angiosperms from the Mulu National Park in Sarawak, representing about 20% of the vascular plants that are currently known from the entire island of Borneo. The 4,500 species of vascular plants that are estimated to occur in the Mt Kinabalu National Park in Sabah represent 45% of the known vascular flora of Borneo (Cockburn, 1978; Corner, 1978).

The conclusion which we draw from these figures is that, if the preservation of species is our primary conservation objective, then we might best achieve this through investing in completing, and assuring adequate management of, the network of national parks and reserves in the tropical forest biome. At present some 9.7% of the remaining moist forests of Africa are protected in national parks and equivalent reserves. It is probable that as many as 90% of all tropical forest vertebrates species of that continent would be maintained if these and a few additional critical sites could be adequately protected.

TABLE I
Numbers of Species of Birds Occurring in Protected Areas in Selected African Countries.

Country	Number of bird species in protected areas	Number of bird species in the country	Percentage in protected areas	Literature source*
Cameroon	649	848	76.5	Louette (1981)
Ghana	558	721	77.4	Grimes (1987)
Ivory Coast	568	683	83.2	Thiollay (1985)
Kenya	908	1 064	85.3	Britton (1980)
Malawi	485	624	77.7	Benson & Benson (1977)
Nigeria	719	831	86.5	Elgood (1982)
Somalia	302	639	47.3	Ash & Miskell (1983)
Tanzania	833	1 016	82.0	Britton (1980)
Uganda	880	989	89.0	Britton (1980)
Zaire	967	1 086	89.0	Lippens & Wille (1976)
Zambia	637	728	87.5	Benson <i>et al.</i> (1970)
Zimbabwe	581	635	91.5	Irwin (1981)

* Not cited in References but available from the Authors. — Ed.

Increase Reserves to Protect Species

It might be possible to ensure the continued existence of a high proportion of the plant and animal species of the planet through a relatively modest increase in resources applied to existing protected area programmes especially in the moist tropics. However, in adopting such a strategy, we would need to be aware of the fact that conservation resources might thus be diverted away from measures to conserve functioning ecosystems throughout the ecobiome. To take an extreme example, the emphasis on biological diversity conservation would suggest that very few conservation resources should be applied to the species or ecosystems of the Sahelian zone. But one could argue that the continued functioning of these fragile ecosystems might in reality be a much higher conservation priority than the preservation of the very highly diverse fauna of folivorous Coleoptera in the tropical forest canopy. Similar arguments could be applied to polar, mountain, wetland, or marine, ecosystems where small numbers of species have critical ecological roles in maintaining ecosystem functions.

At a period when the prospects of global climatic change make all predictions of the future evolution of The Biosphere somewhat problematical, it would seem unwise to base one's conservation strategy on an excessive concentration of resources in a small number of megadiversity sites. Instead, we would contend that the balanced approach to conservation prescribed by the World Conservation Strategy remains the most appropriate standard by which to dispense those resources which are available for conservation. Biological diversity is just one, admittedly important, criterion alongside the need to conserve ecosystem functions and to promote sustainability in the exploitation of all biological resources.

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