

COMPONENTS OF BIOLOGICAL DIVERSITY IMPORTANT FOR CONSERVATION - FOCUS ON ENDEMIC FAUNA

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Proceedings of the South and Central Asian MAB Meeting of Experts on Environmental Conservation, Management and Research, Hikkaduwa, Sri Lanka 15-18 October 2002

Under the broad theme of Legal and Regulatory Mechanisms, this session will focus on the Role of Biosphere Reserves in relation to International Conventions. Biosphere Reserves and other similarly protected areas are expected to fulfil three functions, i.e. conservation (mainly with reference to biological diversity), development (ecologically and socially sustainable development at the local level) and logistic support. In my presentation I will focus attention on the first of these functions, namely, conservation.

The international efforts needed to address the issues of conservation of biological diversity are embodied in the Convention on Biological Diversity. I would like to refer in particular to Articles 7-9 of the Convention, which, among other things, refer to the need to identify components of biological diversity of special importance in the context of adopting and implementing conservation measures. One of these components is "ecosystems and habitats containing high diversity and large numbers of endemics or threatened species". The rainforests of Sri Lanka fall squarely into this category. The level of endemism in Sri Lanka is high, and a very large proportion of the endemics (90 per cent for the flora) are confined to the rainforests.^{1,5} These forests are confined to the wet southwest quarter of the country, and within this area they cover only a very small percentage of the land area. What is more, the large majority of these forests occur as isolated blocks, seldom exceeding a few hundred hectares in extent, and areas that are highly developed and populated separate them.

Studies elsewhere in the world have revealed that endemics make a disproportionately larger contribution to extinction and near extinction (endangered) than non-endemics.^{12,2} The elevated levels of threat to the endemics as compared with widespread species might be due to one or more of several reasons: small geographic distribution,^{15,16} small population size,³ greater habitat specialization^{6,10} and lesser competitive ability.^{14,7}

I directed my attention to the question: why are endemics considered to be specially important in the context of conservation of faunal biological diversity in Sri Lanka? In particular, I was interested to see if there are any ecological reasons that might contribute to their greater vulnerability. Although the flora of our

rainforests have been fairly well studied, the same could not be said of the fauna. My study related to the ecology and distribution of small mammals in and around the Sinharaja rainforest.

Considerable differences were observed in the distribution patterns between the endemics and non-endemics across different habitat types within the forest and in the non-forest areas adjacent to the forest (details reported elsewhere).

In ecological terms, what could be the reasons for the observed differences in distribution patterns between the endemics and the non-endemics? I focused my attention on two of the most fundamental processes governing the distribution of species - habitat specialization and competition. First, could the differences in distribution between endemics and non-endemics be the result of differential abilities to tolerate varied habitat conditions, particularly those created by human disturbance? Second, do the differences in distribution patterns reflect competitive interactions between the endemic and non-endemic species? My studies on home ranges and dietary habits of different species confirmed greater habitat specialization among the endemics compared with the non-endemics. The non-endemics were competitively superior and more widespread than the endemics. It is likely that these factors act together to increase the susceptibility of the endemics to extinction.

The findings of this study have many important implications for conservation. First, since this study has shown that many endemics were core-forest species, continued forest destruction and fragmentation will lead to the loss of more habitat for these species than for the majority of the non-endemics that were spread across both forest and non-forest habitats or were confined to the non-forest habitat. The low tolerance of the endemic species to habitat changes compared with the non-endemics might also mean that they would be the first to disappear from the community when habitat destruction occurs.

Habitat destruction also causes fragmentation of natural habitats, which leads to the creation of small and isolated populations. Because range-restricted species generally have lower population densities than widespread species, their surviving populations will be smaller and they thus face higher risks of extinction than non-endemic species.^{8,3,2}

If habitat disturbance continues, it is evident that a highly adaptable invasive species (like *Rattus rattus* which has colonized all continents and all types of ecosystems) is capable of displacing a forest-adapted native species, particularly endemic species that are unable to adapt to non-forest habitats. Such displacement and extinction of endemics have occurred in the Galapagos and Madagascar. This effect will be pronounced if the invaders are of similar morphology and body size as is the case with some rat species.

Conservation biologists tend to focus their attention on particular species, and there has sometimes been less than adequate attention being paid to differences between distinct populations of the same species. For example, two subspecies of *Rattus rattus* show contrasting distribution and behavioural patterns. *R.r. kelaarti* is a forest dweller, which has low densities and shows little competitive ability. *R.r. kandianus*, on the other hand, is a very versatile taxon that attains high abundance in a wide range of habitats and also exhibits competitive superiority over the endemic *Srilankamys ohiensis* and the forest dwelling *R.r. kelaarti*. Differences between such subspecies should also be recognized when adopting conservation measures.

Having established the particular vulnerability of endemic species, what legal, regulatory and other measures should be taken to give protection to these species and their habitats? Let us first look at the adverse factors that can affect these species in their natural habitats i.e. in the rainforest areas of southwest Sri Lanka.

Size and Edge effects: The rainforests are scattered over the southwest, with over 100 separate blocks, mostly of around a few 100 hectares each. Sinharaja and KDN are the largest stretches representing the lowland and mid-elevation rainforests. A small forest suffers from a double disadvantage in the context of conservation - the smallness of its extent and the greater edge effects compared to a larger forest; the latter would have a more profound impact on the endemics, as these are primarily core-forest species.¹¹ In contrast to their effect on endemics, edges often favour habitat generalists, particularly invasive species like *Rattus rattus kandianus*.^{9,13}

The wet zone forests have highly convoluted edges, mainly due to encroachers eating into the forests at the edges, and the *de facto* boundaries are not clearly demarcated. Species in a forest having a convoluted edge will be more severely affected than species within a forest of the same size having a smooth edge, and entry of invasive species would be enhanced.

Human Population: Human activities are responsible for habitat degradation and habitat loss. A paper by Cincotta et al. in *Nature*⁴ has reported on the human population in the 25 areas identified as biodiversity hotspots around the world. Of these, the hotspot referred to as Western Ghats/Sri Lanka has by far the greatest population density (of around 340 persons per square kilometre). The southwest of Sri Lanka is the most populated part of the country. If the wet zone districts (wherein are found the rainforests) are considered, it will be seen that their average population density exceeds 500 persons per square kilometre.

Over the past decade, many once remote outposts close to the borders of the forests have turned into busy, bustling market towns. The villages are dotted around the forest boundaries, and where one village ends the other begins. There is

continuing encroachment into the forests by the villagers to expand their agricultural (mainly tea) holdings.

Forest products: Though non-timber forest products continue to be collected by families for their own use from the forests, this activity generally does not make any significant contribution to the family income in most of the peripheral villages. However, some people are involved in the collection of forest products for trade, both locally and for export, with consequential stock depletion. What are most at threat are the endemics, both flora and fauna. Illicit timber felling continues to take place.

Conservation Measures: The Forest Ordinance and the Fauna and Flora Ordinance are the main legal instruments through which measures could be taken to safeguard the habitats and populations of vulnerable species. The National Conservation Review that was carried out in the 1990s provides a good database of species in the natural forests. Acting on the information provided by the Review, the Forest Department has identified over 30 forests, rich in endemic species, to be declared as Conservation Forests. The implementation of conservation measures on the lines of what is applied to biosphere reserves has still to be put in place in many of them. Boundary marking (excluding the encroachments on the edges) should be expedited. The core areas should be given special protection, with a total banning of all extractive uses. The peripheral zone is referred to as the "Traditional Use Zone". Considering that the thirty odd forests have been selected from a much larger number because of their special conservation value, and that even these forests have been highly exploited in the past, collection of forest products should be strictly regulated and confined to non-timber products. It should be for local use only, and controlled through an effective and fully operational permit system. Collection of faunal species should not be allowed.

With regard to individual species, endemic and other threatened species should be given special protection, particularly against trade and export, by a rigorous implementation of the relevant sections of the Forest Ordinance and the Fauna and Flora Protection Ordinance. The question of identification of species often arises when attempts are made to export certain protected species. A programme should be launched to enhance the capability of law enforcement officers to identify species protected under law, and more intensive implementation of the relevant provisions is necessary.

The problem of encroachment into the forest has to be addressed through an intensive programme in the buffer zone villages aimed at enabling the people to secure gainful employment without encroaching on the forest. For this, opportunities must be provided for the people to acquire technical and entrepreneurial skills in different fields of activity.

Degraded peripheral areas around some of the wet zone forests have been replanted with the exotic species *Pinus caribaea*. This has proven to be an effective protection measure as it provides a "buffer zone" and marks a clear boundary, within which illicit encroachments by villagers could easily be detected. The buffer zones will also help alleviate effects of edges. Buffer zone planting around the conservation forests should be extended.

Corridors may also provide additional habitats for the maintenance of species within an altered environment. Additionally, they can be used to connect forest patches of remnant habitats facilitating the movement and exchange of individuals between the isolated forests.

My study provided evidence of the ecological basis of the vulnerability of faunal species to habitat disturbance. The rainforest ecosystem of Sri Lanka, while being the last refugium of a number of species of fauna and flora found nowhere else in the world, is patchy and undergoing steady depletion under present conditions. It is, therefore, essential that legal and regulatory measures be strengthened to provide protection to the residual rainforests and the species they are home to.

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