An island away

Larger forests can help control extinction, not epidemics

KARTIK SHANKER

In the 1960s, two of the world's best-known biologists collaborated to propose a theory that was to revolutionise the world of ecology and, later, conservation. Robert Macarthur, a geographical ecologist, and Edward Wilson, famous for his work on insect societies, wrote a monograph on the theory of island biogeography. This theory generated a whole field of study on animal and plant communities on islands including aspects of diversity, community structure and population dynamics.

The theory proposed that the number of species on islands was essentially determined by the rate of colonisation by new species and the rate of extinction of existing species. The rate of colonisation was dependent upon the distance of the island from the mainland, with closer islands having higher colonisation rates. On the other hand, the rate of extinction was dependent upon the size of the islands, with larger islands having lower extinction rates.

Thus larger islands close to the mainland have relatively larger number of species, while smaller islands have fewer species. The theory was later extended to fragmented and isolated habitats on land and gained importance in the context of fragmentation of forests all around the world.

Initial opposition to this theory came from David Lack, the famous British ornithologist, who believed that the number of species on islands was only a function of the habitats available on the island. However, empirical studies on islands by Simberloff, Wilson and others supported the basic tenets of the theory of island biogeography and contributed to its development.

Island biogeography also spawned a range of related theories such as the stepping stone theory, which tried to explain the pattern of species distribution and richness on archipelagos. The rescue effect examined the recolonisation of islands leading to reestablishment of species that had become extinct. Other studies examined the effect of geometry, topography and other factors that might determine the number of species on islands.

However, island biogeography had its greatest impact on conservation. Within a decade, the theory became the backbone of conservation biology, with a series of papers advocating a set of rules for the design of refuges. These rules suggested a refuge configuration that would maximise species richness or diversity, Actually, the rules stemmed from a series of E O Willis's lectures in 1971. The rules gained more acceptances with papers by Jared Diamond, E O Wilson, and E O Willis, in the seventies, and got a seal of approval from IUCN, WWF and the United Nations in 1980, upon the publication of a report on global extinctions.

The rate of extinction depends on the size of the islands and distance from the mainland

In subsequent years, there has been much debate about whether these rules really conformed to the predictions of the island biogeography theory, and how scientifically grounded the rules actually were.

One of the most widely debated of the rules was the SLOSS ('single large or several small') dilemma. The main question here was, if a given area was to be set aside as a natural reserve or sanctuary, would it be better to have several small patches of forest or a single large patch? Island biogeography suggests that smaller islands would have higher rates of extinction and therefore would not support many of the species that large patches would. This implied that a single large patch would have more species than several small patches combined. This seems to suggest that a single large patch would indeed be better than several small patches.

This work did much to highlight the danger of fragmentation of forests, as a global problem, but it did have some negative consequences as well. For example, it became a popular notion that large reserves were better, and that small, impoverished forest fragments were worthless. Also, the theory did not account for many factors; for example, populations in many small patches may be more resistant to epidemics than single large populations.

In summary, the theory of island biogeography was profoundly successful and energised several fields of research, including community ecology and population biology. It galvanised conservation action and research, and gave birth to many new theories, including the one to supplant it — metapopulation dynamics. ■

Kartik Shanker is faculty at the Centre for Ecological Sciences, Indian Institute of Science, Bangalore