

## Earth & Space

# Where do plants and animals live in the tropics?

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*Many plant and animal species inhabit the world's major tropical areas with new species being discovered each year. But the numbers of species differ greatly between these areas. Thanks to new databases, we now show that Latin America has the largest number of species, followed by Africa and Southeast Asia. Defining the makeup of individual ecosystems will help us preserve them.*



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Biologists have understood for a long time that plant and animal species are not evenly distributed among the world's tropical areas, and wondered why. Africa has spectacular numbers of primate and hoofed mammal species. Southeast Asia is much smaller in size than Africa, but has nearly as many plant species, and even more bird species. Latin America has an overwhelming number of plant species, especially in the Andes and the Amazon Basin. To understand these differences and their causes, we need to know the true species numbers in each of these three tropical areas. Here we have compiled, for the first time, comprehensive species numbers from these areas for plants, butterflies, birds, ants, amphibians, lizards, mammals, and snakes.

Until recently, finding exact plant species numbers for Africa and Latin America was difficult and unreliable. The Missouri Botanical Garden and partner institutions have developed new electronic databases detailing the plants in both of these areas. We regularly update the databases with newly discovered species as soon as their scientific names are published.

We extracted species numbers from these databases for the Afrotropical Region (tropical and southern Africa plus Madagascar; 56,000) and Latin America (Mexico southward through South America, including the West Indies; 118,000). For Southeast Asia, we extracted approximate plant species numbers (50,000) from a review of recent scientific

literature because no comprehensive database exists for that region. For species numbers of the selected groups of animals, we reviewed available literature and databases, and consulted leading world experts.

Comparison of the species numbers by tropical area gave results that were generally expected, but the scale of the differences was surprising. In the selected plant and animal groups, Latin America has 145,000 total species, more than twice as many as the Afrotropical Region (71,000), even though Latin America's surface area is somewhat smaller. Furthermore, the number of Latin American species within each group is larger than the number of Afrotropical species. The total number of species in all groups in Southeast Asia (65,000) is almost as large as the total in the much larger Afrotropical Region, and Southeast Asia actually has a larger number of bird and ant species than the Afrotropical Region. Worldwide, Southeast Asia is therefore likely to be the richest major tropical area in species diversity proportional to its size.

To account for these striking differences in species numbers and concentrations, we must examine the very different geological and biological histories of the three tropical areas. At the time of the extinction of the dinosaurs 65.5 million years ago, both Africa and South America were low-lying and level, with species-rich moist forests from coast to coast. As mountains arose in eastern and southern Africa, changes in atmospheric circulation created drier

conditions over large parts of the continent. Grasslands and dry forests with proportionally fewer species replaced many of the previous moist forests, causing a reduction in the total number of plant and animal species.

In South America, the rising of the Andes Mountains had the opposite effect of protecting much of the continent from a drying climate. The Andes provided a complex set of new habitats in which many species survived and rapid evolution greatly increased overall species numbers.

In Southeast Asia, the isolation of species on vast numbers of islands and a continuously moist climate preserved the original species richness, and mountain building provided an increased number of habitats for new species to evolve. Dry geological periods have therefore affected Africa more strongly than the other two major tropical areas, resulting in proportionally lower level of species diversity.

Our knowledge of the species diversity in these areas is far from complete, as biologists describe hundreds of new species each year. At the same time, the habitats needed for these species' survival are quickly shrinking in the face of rapid human population growth. We have only a limited time to discover how many species there really are and how they function in their ecosystems. We need to make the effort, both for the sake of acquiring this scientific knowledge while it is still possible and to provide the best possible basis for conservation.