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Arboretum Scientists Document Indonesia’s Biodiversity

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The vast archipelago of Indonesia and Papua New Guinea, lying between mainland Indochina and Australia, has one of the most dynamic geological histories in the world. Over the past 100 million years, plants and animals have somehow spread among Indonesia’s many islands, which have changed dramatically in size and shape over time. Although the migration of many animal species stopped short of Wallace’s Line—the demarcation between Borneo and Sulawesi—plants have crossed this boundary more easily and spread much farther. How these species have moved through the region is a fascinating and important question, one which we are now close to answering using the tool of DNA sequencing. With physiological data from today’s species, we can also explore how ecological factors such as drought tolerance have changed as species moved between the wet and dry areas of the archipelago.

Such questions about the botanical history of the region are a main focus of our current research in Indonesia. Sargent Fellow Sarah Mathews and I recently were awarded funding by the U.S. National Science Foundation (NSF) for a three-year project to explore the biogeography and community ecology of trees on five Indonesian islands: Borneo, Sulawesi, West Papua, Seram, and Sumbawa. With our senior Indonesian collaborator, Dr. Teguh Triono, and students from local universities, we will set up four-acre research plots on each island to collect plants and amass data on tree physiology, morphology, and habitat. We expect to encounter over 200 species in the Borneo and Papua New Guinea plots, and just keeping track of the different types of plants in the field will be a major challenge. We will be taking extensive photographs of all plant material, which will act as photo vouchers in matching species between plots and in determining their Latin names.

Some of the plant collections from these plots will be utilized for molecular study. DNA extracted for sequencing will enable us to build the phylogenetic ‘family trees’ needed to resolve relationships among species and chart their historical evolution and movement. These sequences will also serve as standardized DNA barcodes, or species identifiers, that will form the basis of a genetic library for the trees of the region. Once they are sufficiently comprehensive, these libraries will enable us to perform “biodiversity forensics” when identifying unknown plants.

The Arnold Arboretum has always had a special interest in the plants of Southeast Asia, and holds the largest dried specimen collection from the region of any herbarium in North America. A second research and training layer of this project is aimed at building local capacity in biodiversity informatics so that more of the country’s biodiversity data can be managed and served from within Indonesia. In addition to managing and sharing large amounts of collected location, DNA, and image information, we are also looking toward integrating our data into a growing network of global biodiversity resources.

Sadly, Indonesia’s forests are rapidly disappearing. Perhaps the most lasting impact we can have is to share knowledge and foster appreciation of these magnificent forests in young local scientists. All over the country, thousands of Indonesian students conduct their own biodiversity surveys, usually funding the trips themselves. As I see it, there is simply no other group that can do the work of collecting biodiversity data in the short time remaining, so working with these students to maximize their own quality of data collection is a high priority. We also hope that some of these young scientists will participate in local and national decision-making themselves, as advocates for biodiversity preservation.