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Forests, reefs, mountaintop illuminate tropical biology

Summer field school brings students to Borneo

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Pien Huang, a 2006 Harvard graduate who joined the class in the Maliau basin, and Harvard Summer School students Mona Octavia of Malaysia, Dewi Suprobowati of Indonesia, Kore Tau of Papua New Guineau, Subekti Sulistyawati of Indonesia, and Megan Bartlett, a Harvard College junior, rest during a hike in Borneo's Maliau basin.

Morning came in the middle of the night in the hikers' hut partway up the side of Borneo's towering Mount Kinabalu.

At 2 a.m., after just a few hours' sleep, the Harvard Summer School students slowly roused themselves, creating a chorus of rustling sleeping bags, zippers, and boots on the wooden floor.

They'd been on the go for weeks, traveling across the island to sample its natural wonders, and they'd be on the go for a few weeks more. But where they'd been and where they'd be didn't matter that morning. It was time to hike. The sun was coming and the peak was still hours away.

It is a rough trail, but a popular one. Mount Kinabalu is Southeast Asia's highest peak: 13,400 feet and frigid even though it stands in the tropics.

Several students on the trip said the Kinabalu trek was the highlight in a summer full of highlights. But there was a cold wait for some after their too-fast hike got them to the peak still in darkness. What followed made them forget the delay, however. Sunrise served them flaming orange on the horizon ahead, blue sky above, and all of Borneo laid out below.

To the students, Kinabalu is a mountain, but to the instructors teaching tropical biology, it is more than that.

Kinabalu's cool, forested slopes and barren, icy top make it a tropical island, albeit one of a different kind.

Its blue, 2-foot-long earthworms; red, worm-eating leeches; unique birds; and unusual plants are as isolated by the miles of humid tropical forest below as the inhabitants of any oceanic island.

The word biologists use for species found no place else is "endemic," and Kinabalu has a bunch of them.

"You're watching the forest change as you go up and it's really surreal because you start at really lush rainforest at the bottom and by the time you're on the top there's just scrubby bushes and some trees," said Harvard junior Megan Bartlett, an organismic and evolutionary biology concentrator. "It's kind of a weird evolutionary island. You're seeing things that live there and nowhere else. We finally got to the summit in time for sunrise on the third day and it was really beautiful. It was so surreal because we've been in 90-degree temperatures and we're on top of this mountain and there's snow."

But Kinabalu presented neither the first nor the last encounter with unusual tropical species. That was the point, after all, of spending five weeks studying the tangled, riotous life in a part of the world that, though threatened, still holds miles and miles of pristine tropical jungle.

Biodiversity of Borneo

The class, descriptively named "The Biodiversity of Borneo," was offered through Harvard's Summer School and subsidized by Harvard's Arnold Arboretum through its Center for Tropical Forest Science. It was organized by Campbell Webb, a senior research scientist at the Arboretum, at the urging of Arboretum Director and Arnold Professor Robert E. Cook. It was modeled after similar courses offered to Asian scientists by the Center for Tropical Forest Science, a collaboration between the arboretum and the Smithsonian Tropical Research Institute.

The class had multiple goals, including exposing students to the enormous diversity in tropical rainforests and giving them the chance to experience field conditions, learn the techniques for field research, actually conduct their own research, and, eventually, present results to the rest of the group.

"The ultimate goal, really," Webb said, "was to get people enthralled and excited about tropical biology. It was a five-week crash course in tropical

biology."

They achieved that through a series of lectures, activities, and explorations at several sites in the Malaysian states of Sarawak and Sabah. One of the world's largest islands, Borneo is divided by three countries: Malaysia, Indonesia, and Brunei. The course, which occurred entirely inside Malaysian Borneo, took students from the mountaintop to the forest to the sea, where they compared terrestrial diversity with that in the nearby coral reefs.

Students also got to see enormous oil palm plantations and forestry operations to gain an understanding of the pressures the forests are under and an appreciation of the economic pressures driving the activities of local inhabitants.

Webb was joined by several Harvard faculty members, including Hessel Professor of Biology Naomi Pierce, Associate Professor of Biology Paul Moorcroft, and Assistant Professor of Organismic and Evolutionary Biology Charles Davis. Stuart Davies, director of the Center for Tropical Forest Science and of the Arnold Arboretum's Asia Programs, also joined the course faculty, as did several lecturers from local conservation organizations and other organizations involved in tropical forest management.

The days were structured to keep students in the forest as much as possible, with a lecture early in the day followed by fieldwork. There was, typically, another talk just before or just after dinner.

The bounty of the rainforest

The course ended with a firsthand experience of the rainforests' potential bounty. The students' stay in the soaring, pristine forest of the Maliau Basin coincided with a rare masting event. Various forest trees — which reach 180 feet — and other plants produce fruits in bursts, called "mast fruiting." The all-at-once fruiting is a strategy to overwhelm fruit eaters with bounty, ensuring some seeds survive to grow into the next generation of trees.

Once every several years, the masting events of several species coincide, creating a forestwide explosion of fruit and flowers. Davis, who joined the

trip in the Maliau Basin, said he'd never seen a masting event like Maliau's during those days.

"It was a really special time; the forest was alive and there was a mast fruiting event. It's just an amazing experience," Davis said, describing footlong fruits spiraling to the ground on wings and oak relatives that dropped acorns as big as baseballs. Fruits and flowers fell "like snowflakes," he said.

Davis and Webb led the group on a three-day hike through the forest, covering 20 kilometers. The fruits and flowers drifting to the ground provided ample opportunities to stop and talk about specific aspects of the forest's life.

"When the wind blew, we saw hundreds of seeds flying down — so pretty," said Dewi Suprobowati, a student from Indonesia, who added that in addition to the seeds' natural beauty, their function interested students. "They fascinated us by the way they fell."

Students slept in hammocks during the hike, a marked contrast to the comfortable accommodations — hotels in the city, bare but comfortable scientific field stations in the country — that they had elsewhere.

"This was down and dirty. No baths, drinking silty, tannin-filled water," Davis said.

Value of a field course

The value of such a field course for students can be immeasurable, Davis said. His first field experience put his feet on the path that led him to a career of teaching and research. Stepping into a tropical forest is such a different experience from hiking in a temperate forest, he said, that it has a powerful impact.

"You really realize this isn't Kansas anymore when you step into a tropical rainforest. The level of diversity is an order of magnitude [higher] than a temperate forest. In a temperate forest, you can actually know every woody plant in that community," Davis said. "For me, it shifted my world on its axis. I can't speak enough about the value of this kind of experience."

The class seemed to share Davis' enthusiasm. The student body was made

up of nine U.S. students and nine students from Asian countries.

Bartlett said the trip left her hungry for more. She said Kinabalu was an eye-opener, starting in the hot, lush rainforest at its base and climbing through successive bands of vegetation to the scrubby bushes near the peak. Bartlett also recalled seeing, during the last hike, the bulby, smelly flowers of rafflesia, whose rotten odor attracts flies to pollinate the plant.

Charles Ryland, another junior biology concentrator, left the course wondering how to conserve the rainforest best. Ryland was most impressed — or distressed — by the forces threatening the forests. He got to see some of the political and societal forces behind the destruction and realized that much of it is driven by demand in the West, Ryland said.

Ruchira Somaweera was working as temporary staff at the University of Peradeniya in Sri Lanka when his adviser recommended he take the class.

A biologist interested in herpetology, Somaweera said the trip was one of the best experiences he's had. Since returning, he's begun working as a full-time lecturer at Peradeniya and has already incorporated what he learned over the summer into his teaching.

Somaweera said climbing Mount Kinabalu was the most unforgettable experience for him. He also recalled catching a horseshoe crab, not found in Sri Lanka's waters, and seeing a coral snake, which, as a herpetologist, he was tempted to catch.

"I was warned not to catch any snakes during the trip," Somaweera said. "I have caught much more venomous species."