Science with a view. Ubii research camp is one of two field stations in Papua New Guinea run by Binatang Research Center.

Uncertain Future For Tropical Ecology

Three premier research outfits are scaling back ambitions—and struggling to maintain local staffs as funds grow scarce

MADANG PROVINCE, PAPUA NEW GUINEA— Joseph Kua peers at the computer screen of a survey tripod perched precariously on a jungle hill. The 30-year-old oversees part of a team that will spend much of this year logging species in a 50-hectare plot of pristine rainforest. That may sound like the makings of a doctoral dissertation, but Kua has only a high school diploma. A native of a remote mountain village, Kua spent 2 years helping a Czech graduate student study bark beetles and then several months learning how to conduct biodiversity surveys. He's one of 18 paraecologists—locals trained to do the nuts and bolts of ecology research—employed by the New Guinea Binatang Research Center (BRC), a tropical ecology institute here on Papua New Guinea's north coast.

Western researchers point to the work of Kua and other paraecologists as an example of excellent science on a shoestring. By hiring and training locally, scientists can boost productivity and cut costs, all while supporting conservation. On the backs of paraecologists, BRC and two similar outfits in Costa Rica—the National Biodiversity Institute (INBio) and a group at Area de Conservacion Guanacaste (ACG) led by University of Pennsylvania ecologist Daniel Janzen—over the past 2 decades have discovered thousands of species and churned out hundreds of peer-reviewed articles. Although most paraecologists start with little science knowledge, some have gone on to earn advanced degrees and take key positions in national forest management and conservation.

It's "a brilliant approach that builds relevant local capacity at modest cost," says Thomas Lovejoy, a biologist at George Mason University in Fairfax, Virginia, and a former chief biodiversity adviser to the World Bank. Thanks to paraecologists, BRC, INBio, and ACG "have had a profound impact on tropical ecology over the last 2 decades, most fundamentally through the sheer number of species identified and documented," says Elizabeth Losos, president of the Organization for Tropical Studies, a consortium of 63 universities and institutes headquartered in Durham, North Carolina.

But paraecologists may be a vanishing breed. Money woes now bedevil all three projects and threaten the concept of local, long-term hiring for field research. INBio has shrunk its taxonomic staff from 50 in 2005 to 31 today. At ACG, Janzen and his wife, Penn biologist Winnie Hallwachs, are scrambling to avoid having to lay off 29 parataxonomists they supervise. The U.S. National Science Foundation turned down a grant application Janzen submitted last year—leaving them without NSF money for the first time in 48 years. BRC, meanwhile, is struggling to find stopgap funding after losing the longtime support of the U.K. government's Darwin Initiative. The challenges are "lethal and nerve-wracking," Janzen says.

Funding crises at the three premier centers are the result of a perfect storm of problems. Donors have shifted funding away from taxonomy for more than a decade, leaving a huge backlog of unidentified specimens. A panel that reviewed Janzen's NSF grant application rated it as "outstanding" but expressed this concern: "Although previous work has been very successful in identifying species new to science, it is not clear from the proposal how, when or if these novel species will be described." INBio's 2005 decision to downsize was driven partly by a backlog of unidentified specimens, says INBio Director Rodrigo Gámez. "The world does not have the number of taxonomists required to process [so many new species]," he says.

The global financial crisis intensified the problem. The Darwin Initiative was one of many donors that curtailed grants, accepting no new applications last year and driving up competition for other funds. And as projects have scaled back, some researchers worry that paraecologists are taking jobs from graduate students. One unnamed reviewer noted that Janzen's NSF grant proposal was "unusual in that no students are trained directly by [Janzen] or intellectually engaged in the project." Janzen insists that students would have worked under his supervision at ACG. Moreover, he says, local staffers often become excellent scientists and conservation leaders and deserve opportunities to learn. "Some people in the ivory tower see [paraecologists] as incredibly useful support. Others see them as huge competition," Janzen says.

Today's problems are a far cry from the heady early days. Janzen coined the term "paraecologist" in 1989, when he used a U.S. Agency for International Development grant to train 16 Costa Rican villagers and park service staff in collection and preservation of field specimens. "The concept," he says, "is to take someone out of the farming community and teach them what you expect a good graduate student to be able to do in carrying out an inventory."

Some pioneering paraecologists took jobs at INBio, which Janzen cofounded and where he continues to serve as an unofficial adviser. INBio started with the lofty vision

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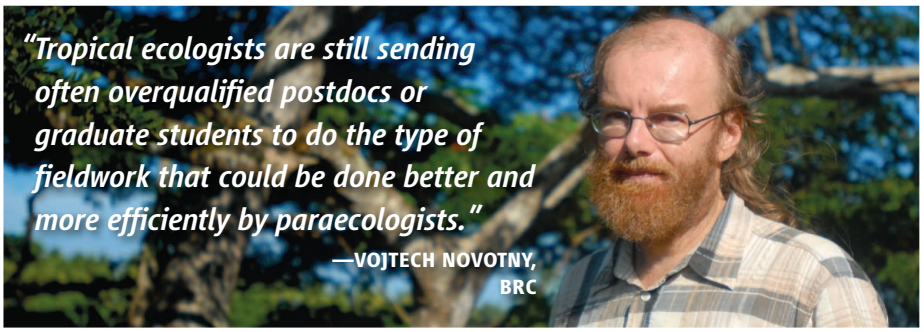

Leading the way. Paraecologist Joseph Kua (*right*, *top*) is helping to oversee a survey of tree species. Local staffers are Binatang's lifeblood, says Director Vojtech Novotny.

Vanishing breed. INBio parataxonomist Marcos Moraga (*top*) prowls for insects. At another field site in Costa Rica, Daniel Janzen (*above*) is scrambling to avoid having to lay off parataxonomists.

of inventorying every species in Costa Rica and finding sustainable ways to use the country's immense biodiversity. While its leaders have since scaled back their ambitions—for example, deciding not to sample mollusks and nematodes—they have discovered two species on average each week since 1989. "Within a few years of the initiation of INBio in Costa Rica," Losos says, "the number of insect species known to exist in the country increased more than fivefold."

Paraecologists have enabled large-scale and long-term research at ACG and BRC as well. Janzen's project has cataloged more than 9000 butterfly and moth species in the 120,000-hectare ACG, a feat that could have been accomplished only with paraecologists, he says: Hiring graduate students would have required "a budget 10 times bigger."

In Papua New Guinea, BRC is running two major initiatives. The project Kua helps lead will count every tree with a diameter of 1 centimeter or more in a 50-hectare plot; it will contribute to efforts by the Center for Tropical Forest Science, a project run by the Smithsonian Institution and Harvard University, to understand how forests change over many years. A second project is inventorying herbivorous insects on every plant in a 1-hectare plot of highland rainforest. So far, researchers have documented only a thimbleful of roughly 50,000 plant-insect interactions presumed to exist, such as a caterpillar that feeds on specific fig tree species, says BRC Director Vojtech Novotny, an ecologist who splits his time between BRC and the University of South Bohemia in the Czech Republic. "We definitely need such large studies simply because of the complexity of tropical rainforest," he says.

Costs are also significantly lower than for studies that involve flying in researchers and equipment. At BRC, paraecologists earn roughly $300 a month plus training fees and receive room, board, and health care. Village assistants earn $4 a day and benefits—a welcome wage in a region with few job opportunities. "In most businesses and even intellectual activities, Western countries are outsourcing while tropical ecologists are still sending often overqualified postdocs or graduate students to do the type of fieldwork that could be done better and more efficiently by paraecologists," Novotny says.

As a bonus, he says, paraecologists help doctoral students carry out dissertation research more quickly, and they promote conservation. "The forest research sites in Papua New Guinea show locals that conserving forests can bring a sustainable income," says Chris Dahl, a 35-year-old BRC deputy director who started as a paraecologist in 1994. Local knowledge can also pay off. Five years ago, for example, villagers angered over a land dispute threatened to raze a BRC field station. Paraecologists defused the tension by presenting the villagers with a pig—a traditional peace offering.

These days BRC itself could use an offering. Staff now "absolutely have to raise new grants" this year, Novotny says. "If we don't, we'll become dormant here." Janzen faces similar problems. When NSF turned down his grant application last summer, he scrambled to raise $500,000 from private sources, enough to pay staff salaries through this coming July, and began building what he hopes will become a $10 million endowment. He also reapplied to NSF with a slimmed-down proposal. Even if he gets the grant, he says, he must raise at least $400,000 a year from other sources to maintain his budget.

At INBio, until 2005 a pair of 7-year grants had covered most of the inventory program's $900,000 annual budget. Today, almost its entire $471,000 budget is self-funded, largely by ventures that include a biodiversity theme park, a publishing house, a bioprospecting unit, and an environmental consultancy. INBio built those businesses as Costa Rica grew richer in the 1990s and foreign governments cut aid to projects, including INBio.

Here in Papua New Guinea, BRC is hunkering down for a hard year. Whereas visiting scientists can pack up and go home when grant money dries up, Novotny must meet payroll for the station's staff—including its indispensable paraecologists. "We really can't afford to have a gap in funding, even for a single year," he says. New growth is out of the question, he adds. "Now our best-case scenario is to stabilize the place." **–CRAIG SIMONS**

Craig Simons is a writer in Beijing.

CREDITS (LEFT TO RIGHT): CRAIG SIMONS (3); INBIO; BRAD ZLOTNICK

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