

# Ground force

Is parachuting into the Amazonian jungle any way to save an ecosystem? One team of biologists thinks so. **Thomas Hayden** joined them on a trip to Peru to find out what they do.

It's dark on the forest floor, the air humid and still. Various birds startle at an intruder's passing — plump brown tinamous and large bush turkeys or curassows, squawking in protest. Further along the trail, prehistoric-looking hoatzins flap and yodel above an oxbow lake, the blue patches on their cheeks bright in the late-afternoon sun. Suddenly, the air is alive with activity — a small band of Goeldi's marmosets, among the rarest of the New World primates, is alarmed by approaching visitors and unsure which way to flee. The tiny, jet-black monkeys leap from tree to tree, almost buzzing with fluffy, comical charm as they swarm to safety. "Perfect," Peruvian ornithologist Christian Albuja exhales into the silence they leave behind.

The upper Amazonian region of Sierra del Divisor — almost 1.5 million hectares of highland forest along Peru's border with Brazil — is full of similar delights. But decades of aggressive economic development throughout the Amazon basin have made such vast stretches of contiguous forest increasingly rare — and increasingly threatened. Although Divisor also faces pressure from development, it is still substantially pristine, protected thus far by its remoteness and elevation.

Albuja is here to help survey the area's flora and fauna in an expedition organized by the Field Museum of Natural History in Chicago, Illinois. It would take years of meticulous fieldwork to fully document the region's rich biodiversity, but the group of 13 Peruvian, Brazilian and American scientists will spend just three weeks on the ground. This is a rapid biological inventory (RBI), the Field Museum's version of an increasingly popular tool in conservation science — a quick, intensive taxonomic expedition designed to identify areas of particular biological, geological and cultural significance before development and exploitation take hold.

## Fast and furious

The idea is simple. With funds, expertise and time too limited to conduct thorough species surveys of every unknown region, experts instead target the most promising areas and quickly assess whether they are worthy of conservation. Proponents admit that the resulting data are incomplete, but say the compromise is



Christian Albuja gathers data on biodiversity to help build a case for preserving areas of Peru's jungles.

justified because rough estimates of biodiversity can help inform preservation decisions. And even a quick survey by scientists with decades of broad experience in the field and in museum collections can lead to qualitative estimates of an area's relative conservation value. "We would all love to spend more time," says Debra Moskovits, a tropical biologist at the museum and founder of its RBI initiative. "But the time pressure is intense. If we can protect some of these areas, then maybe people will be able to do the more extensive studies the areas deserve."

The protected areas on a list maintained by the United Nations have grown to some 11.5% of the planet's land surface in recent years<sup>1</sup>, but 'gap analysis' studies show that large numbers of species are not represented in the existing network<sup>2</sup>. Conservationists have argued for decades about how best to prioritize areas for future conservation: whether by geographical

location and political expediency, or through some measure of species numbers, degrees of species interconnectedness, or the presence of rare, threatened or keystone organisms.

The Field Museum team has focused its attention on the high-biodiversity upper Amazon and Andean foothills regions of Ecuador, Peru and Bolivia. Working with local, regional and international scientists and conservation groups, members of the core group of five museum biologists have conducted 12 rapid inventories in these regions since 1999, representing 9.2 million hectares of surveyed land — an area about the size of the US state of Maine. Preliminary results are shared immediately with local communities, organizations and political leaders; formal reports are usually published in a matter of months. "People are making land-use decisions all the time, and they can't protect places if they don't know any-

thing about them," says Corine Vriesendorp, a conservation ecologist and the Field Museum's director for rapid inventories. "If you bring in a crack team of biologists, you can very quickly tell decision makers whether a place is special or not." And it can be done relatively inexpensively — a typical, foundation-funded RBI costs about US\$300,000 from initial planning through to the final published report.

Six new protected areas have already been established, comprising about half of the territory the team has surveyed. Most of the remaining land is also on the road to legal protection.

### Preservation order

The survey information can also help local communities and governments prioritize specific zones within a surveyed area, identifying those that most urgently need full protection, and those that might be allocated for uses such as tourism and sustainable harvesting. "People overlook the impact that these kinds of survey can have on building local capacity for conservation," notes tropical land use specialist Arturo Sanchez-Azofeifa of the University of Alberta in Canada, who is not involved in the programme. "You can get local participation and a broader perspective, and that really helps build expertise and interest in the local communities."

For the Field Museum team, that means working with local scientists and graduate students to compile the inventories, and forming links with indigenous groups, regional and national governments, and local conservation organizations. The biological work is paralleled by 'social inventories' — surveys of the organizational structure and natural resource use of local villages. That social aspect, says Vriesendorp, sets RBIs apart from other rapid conservation



assessments and is crucial to their success. "The dream is to protect these areas indefinitely," she says, "and that can only happen if the local people and their leaders are fully engaged."

The core of the RBI approach is the rapid inventory itself. The surveys have their roots in a 1987 birding trip, when physicist and avid birder Murray Gell-Mann and ornithologist Ted Parker first started talking about using quick-time biological surveys to spur conservation. By 1990, environmental group Conservation International, based in Washington DC, had put their ideas into practice; Moskovits and other Field Museum team members, including botanist Robin Foster and ornithologists Doug Stotz and Tom Schulenberg, were all early participants. The idea caught on with other groups, and by 1995 the Field Museum had initiated its own rapid inventory programme, spearheaded by Moskovits.

Each inventory starts with satellite images, geological maps and, if possible, video footage taken from the air. Experience has taught that the taxonomists' time is better spent walking trails than wielding machetes to create them. The RBI scientists identify areas they think will give them a broad cross-section of the available habitats, and advance teams of local workers prepare bush camps and cut trails to their specifications.

In Sierra del Divisor, that means three separate campsites: two at higher elevations, one along a lowland riverbank, and each with a network of trails stretching for dozens of kilometres along streams, through swamps and up mountains. The museum biologists are joined by nine scientists and students from Peru and Brazil. "We try to balance the teams to get broad experience across the region, as well as local expertise," Vriesendorp says. The inventory focuses on limited taxa — trees, shrubs, mammals, birds, fish, reptiles and amphibians — to keep the workload manageable, and seeks to determine "what's common, what's rare, what's dominant and what's really weird", says Vriesendorp. The scientists tabulate individual species of plant and animal, and draw on experience to gauge the relative health, uniqueness and diversity of each ecosystem. The social inventory team, meanwhile, conducts its own surveys to map out the location and structure of local human populations, including the potential for and threats to long-term conservation.

### Jungle manoeuvres

The survey site is spectacular. Sierra del Divisor contains the only mountain range in the Peruvian Amazon, a series of low sandstone ridges and weathered volcanic cones with peaks of up to 800 metres high. The resulting series of 'elevation islands' supports a stunted forest ecosystem and, combined with a cool wind from the south, provides the unexpected experience of shivering from cold in the middle of the Amazon. Even close to the Equator, seasonal variations in temperature and rainfall affect the forest's plants and animals, presenting challenges to conducting a survey in a single season.

The dry August conditions are ideal for the fish team — lakes and wetlands have shrunk, leaving their quarry restricted to small ponds. But many trees are without the flowers and fruit that botanists often need to make species-level identifications. Seasonal variations make work even harder for the group studying amphibians. "In the wet season, the trees would be screaming with frogs," says Moisés Barbosa da Souza of the Federal University of Acre, in Brazil. It's the middle of the night, and the former jungle warfare specialist is halfway up a tree, working hard to retrieve an Amazon milk frog from a high-up bromeliad. But, he adds, "at this time of year just look what I have to do."

The Sierra del Divisor RBI results<sup>3</sup>, published in December, include up to three dozen new species of plant, fish and amphibian, and many more species that are endemic to the area. The forests are also home to many endangered plants and animals, including valuable lumber trees and 20 threatened species of



"Jungle, lungs of the planet", reads this sign in Pucallpa against a backdrop of wood-smoke smog from slash-and-burn fields.



Out on a limb: numerous species, such as this monkey frog, are threatened by economic development.

mammal, several of which are hunted for bush meat. Schulenberg lured the Acre antshrike — a species of bird previously known from a single ridge on the Brazilian side of the border — out from the stunted ridge-top forests by playing its call on an iPod. And, on one occasion, Moskovits returned to the riverside camp energized, despite hours tramping through an aguajal palm swamp, by the sight of some 30 red uakaris. These monkeys are large, with bald red faces and orange fur, and extremely rare. A total of 12 species of monkey and marmoset was observed at the camp, one of the highest primate diversities documented at a single site in the New World.

Sierra del Divisor has been teetering between protection and development for most of the past decade, but the August 2005 RBI survey and follow-up meetings may have been enough to tip the balance. In April 2006, the Peruvian government declared the entire 1.48-million-hectare area a reserved zone, a preliminary classification that halts all development until the permanent protection status can be determined. However, petroleum exploration leases are still being granted within the protected area, leaving the ultimate fate of the forest and its inhabitants in question. The hope, says Moskovits, is for an area co-managed by conservation groups and indigenous organizations, with strict protection for unique biological and geological resources and for the indigenous groups living in voluntary isolation within its borders. The RBI team remains deeply involved with the planning process, Moskovits says, but it will be up to Peruvians to hammer out the final compromises.

Despite its obvious impact on conservation decisions, there has been debate about the scientific value of rapid assessment data. “We do get criticized — some people say our work isn’t scientific because it’s done so fast,” says Foster, the team’s most experienced member. “People feel that you have to do a quadrant plot and measure each tree to within a millimetre. But for this purpose it’s much better science to sample quick and dirty over several larger areas.”

A one-hectare plot, for example, may contain just a few mature trees, Foster says, “but those canopy trees account for most of the production, most of the insects, most of the fruits that are good for birds, monkeys or peccaries. If you just study your quadrant, you’ll miss the forest for the trees.”

Yet with any short-term study “you’ll get true presences but you can’t know whether the absences are definitive”, says ecologist Michael Willig of the University of Connecticut. “So you’ll almost certainly be underestimating biodiversity.” Given the realities of limited funding and expertise, however, Willig says that rapid assessments are a valuable tool not just for conserving biodiversity, but for understanding it, too. Ultimately, he says, “you just have to respect the limitations of the data.”

It doesn’t take much to see that, even in an area as remote as Sierra del Divisor, the threats are manifold. Although large-scale exploitation has not yet reached Divisor, gas, mining and logging leases overlap with much of the

new reserved zone, and unregulated settlers push closer to the area every day. Seen from a helicopter, the intact forest canopy is breathtaking, with brightly coloured parrots and toucans darting between giant trees. But gaps soon appear in the undulating surface where giant mahogany and tornillo trees have been felled for lumber, and wood smoke billows up from the proliferating slash and burn fields below.

In Pucallpa, a sprawling regional capital along the Ucayali River less than 100 kilometres from Sierra del Divisor, thick smoke often closes the municipal airport for days. The town’s only green space — a strip down the centre of a main road — boasts a sign whose translation reads, “jungle, lungs of the planet.”

### Trading standards

Down by the river, settlers pour in from around the region in low-slung wooden boats laden with fish, skins and produce, some of it harvested from near the reserved zone’s boundaries. Downtown, traders display hundreds of peccary and deer hides. One proprietor refuses photographs; another proudly directs a browser to the real prizes — contraband skins of ocelots and other wild cats, barely concealed behind his front door. At the main market, several hundred stalls sell everything from wild palm fruits and desiccated bushmeat to medicinal saps. There are species that have already disappeared from more heavily populated regions of the Amazon, including various fishes as well as tortoises and river turtles. Some of these have already been

butchered; others are propped up and immobile on their backs, and sold alongside plastic buckets of their pickled eggs.

There are wire cages packed tight with bright green parakeets and majestic ruff-necked macaws, but the most wretched pets for sale are the squirrel monkeys and saddle-back tamarins. They can be bought for less than US\$8 — inexpensive,

but evidence of the high cost to local fauna when humans intrude. “The forest still looks so large, people just don’t realize that this is going to be the end of these guys,” says Moskovits. “It’s repeated over and over, every day and in hundreds of places throughout the Amazon. It really has a huge impact, and it makes you worry, are we moving fast enough?”

**Thomas Hayden is a science writer in San Francisco, California.**

**“We’re looking at what’s common, what’s rare, what’s dominant and what’s really weird.” — Corine Vriesendorp**

1. Chape, S. et al. *United Nations List of Protected Areas* (IUCN/UNEP; 2003).
2. Rodrigues, A. S. L. et al. *Nature* 428, 640–643 (2004).
3. The Field Museum. *Peru: Sierra del Divisor: Rapid Biological Inventories*, 17. (Univ. Chicago Press, Chicago, 2006).