



Shipping this kind of velvet worm out of Brazil was labeled biopiracy.

NATURAL RESOURCES

Brazil cuts red tape stifling biodiversity studies

New law eases draconian measures that brought bioprospecting to a standstill

By **Herton Escobar**, in São Paulo, Brazil

When Carlos Jared tried to ship a jar of dead velvet worms collected in Brazil's Atlantic Forest to a colleague in Germany in 2006, he had no plans to derive a drug or other product from the creatures. He just wanted to probe the reproductive system of a rare invertebrate that gives birth to live young. But Brazilian authorities denounced him as a "biopirate."

The evolutionary biologist at the Instituto Butantan in São Paulo had run afoul of a law aiming to clamp down on what Brazil perceived as rampant pillaging of its biological resources. Jared hadn't filled out all the paperwork required under law MP 2186, so the worms were confiscated. Worse was yet to come. "They dragged my name through the mud. It was a psychological massacre," he says. It took him 6 years to get another permit for fieldwork, and he is still fighting in court thousands of dollars in fines.

Jared is not the only scientist to run afoul of the draconian regulations, sometimes because of nothing more than a clerical oversight. "Biodiversity was deemed so valuable that nobody was allowed to research it anymore," says Eduardo Pagani, drug develop-

ment manager at the Brazilian Biosciences National Laboratory in Campinas. "They locked it in a safe and criminalized anyone who tried to work with it."

But after years of wrangling over how to fix the statute, in which officials sought to balance the interests of scientists, the agricultural industry, and biotech firms with those of indigenous populations demanding compensation for traditional knowledge, Brazil President Dilma Rousseff last week signed a law that is raising hopes among

ter Aldo Rebelo while unveiling the law.

The scientific community has greeted the new law with a sigh of relief. "It's an enormous improvement from what we have now," says Helena Nader, president of the Brazilian Society for the Advancement of Science in São Paulo. "We hope this will get scientists and industry excited about working with biodiversity again. There is a lot of untapped potential there," adds Eliana Fontes, a biosafety expert at the Brazilian Agricultural Research Corp. in Brasília and a former president of the Genetic Heritage Management Council (CGEN), the legal body that was created to regulate and enforce MP 2186, now superseded by the biodiversity law.

When MP 2186 came on the books in 2001, its intentions were good. It was passed in response to a contract between the nonprofit company Bio-Amazonia and Novartis that gave the European drug giant exclusive rights to research, patent, and sell products derived from microbes collected in the Brazilian Amazon. (The agreement drew a public outcry and was annulled.) While MP 2186's goal was to combat biopiracy, its wording cast suspicion on even standard research practices involving life forms. "It was so difficult to get permits that I seriously considered not doing research in Brazil anymore," says

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Helena Nader, Brazilian Society for the Advancement of Science

scientists. Like its predecessor, the new "biodiversity law" regulates research on "genetic resources": an all-encompassing term covering everything from genes and proteins to oils and fragrances. It sets rules for sharing benefits with indigenous peoples when R&D leads to a product, such as a drug, shampoo, energy drink, or industrial enzyme, while eliminating bureaucratic hassles and encouraging biodiversity research. Scientists will no longer be "molested" or "bullied" by unreasonable regulation, said science minis-

Emilio Bruna, an ecologist at the University of Florida in Gainesville who studies habitat fragmentation in the Amazon and the Cerro. Two of his students moved their projects to Costa Rica and Ecuador.

Amendments to MP 2186 gradually eased restrictions on basic research. But prospecting for natural compounds remained a daunting challenge. Before starting research, scientists and companies had to get permission from CGEN and sign a benefit-sharing contract with the indigenous group identified with a particular resource. "How can you sign a contract for a product when you don't know if it's going to work, or even if it's going to exist?" asks Paulo Sérgio Beirão, a biochemist at the Federal University of Minas Gerais in Belo Horizonte.

Under the new law, Brazilian scientists need not ask CGEN for permission to do research. All they must do is register their project in a database and document permission from the appropriate indigenous group. Contracts and other legal matters will come into play only if research leads to a product. "A clear distinction is made now between scientific research and technological development for commercial purposes," says Francine Leal, an environmental lawyer in Curitiba who has consulted on the law. Foreign scientists are prohibited from prospecting for genetic resources in Brazil, unless they are part of a company or institution that strikes a partnership with a Brazilian counterpart.

The law is getting a cool reception from indigenous and other local groups, who believe the rules of access to traditional knowledge and benefit sharing are skewed in favor of companies. "The law moves in the right direction for science and technology," says Carlos Joly, a plant ecologist at the University of Campinas and a key figure in the regulation of biodiversity research in Brazil, "but there are still major problems with it." For instance, he says, the law is blurry about the rights of indigenous and local communities to withhold access to traditional knowledge, if they felt an agreement would not benefit them.

Jared, at least, would have fared better under the new law, which abolishes the case-by-case permits for shipments abroad: It only requires noting them in a registry. "The spirit of the law," Fontes says, "is to trust researchers." But for Jared, the moment may have passed. He can retrieve his velvet worms from the University of São Paulo's zoology museum, where they were deposited for safekeeping, but the German colleague he hoped to collaborate with has long since retired. ■

Herton Escobar writes for O Estado de São Paulo.

AGRICULTURAL RESEARCH

Reading the tea leaves for effects of climate change

Cloudy forecast for crops cherished for their complex flavors

By **Christina Larson**,
in *Xishuangbanna, China*

"Taste it," Selena Ahmed says, offering a delicate green bud plucked from a tea plant on a terraced hillside here. It's like a tiny cup of espresso: bitter at first, then a caffeine buzz. When

Ahmed returns to Montana State University, Bozeman, the ethnobotanist will analyze chemical constituents of the leaves along with other data, looking for clues to how climate change will affect the taste of the tea for which southwestern China's Yunnan province is famed.

"We drink tea for the quality, not because it's providing energy [from] calories," says Sean Cash, an applied economist at Tufts University in Massachusetts, who works

What they find could have implications for scores of other crops, from coffee to chocolate to cherries, whose taste and value also depend on local climates (see p. 954). "Our agricultural system has adapted to a set of conditions that are now in flux," says Samuel Myers, an epidemiologist at Harvard Medical School in Boston who studies how rising carbon dioxide concentrations in the atmosphere alter crop nutrients. "Understanding the implications on both quantity and quality is very important."

"Rainfall is central for tea," says Colin Orians, a chemical ecologist at Tufts, who is collaborating with Ahmed and Cash. In Xishuangbanna, "the monsoon rains come, and within 5 days, the quality of tea really drops. You can see big shifts in the chemistry." During the summer monsoon, which brings 80% of the annual rainfall, tea leaves grow



A Hua farmer in Yunnan province picks tea leaves that will later be fermented into the prized pu'er variety.

with Ahmed. The complex mix of phytochemicals responsible for its taste may be far more sensitive to climate than are the yields of commodity crops. And an ideal place to study the relationship is tropical Yunnan, known for an oxidized and fermented black tea called pu'er, one of China's most prized and already being touched by climate change. Earlier this year Cash, Ahmed, and others embarked on a 4-year project backed by the U.S. National Science Foundation that examines the linkages among climate, tea quality, and farmer livelihoods.

roughly twice as quickly as in the dry season. That's not as happy a prospect for farmers as it sounds, says Wenyan Han of the Tea Research Institute in Hangzhou. "Quality and yield often exist in inverse balance," he says. "If one goes up, the other goes down." Here in the Bulang Mountains, pu'er harvested in the spring, before the monsoon, tastes richer and fetches a premium: \$680 per kilogram, compared with \$405 for summer pu'er, harvested during the rainy season.

Orians and colleagues have traced the chemical shifts responsible. During the