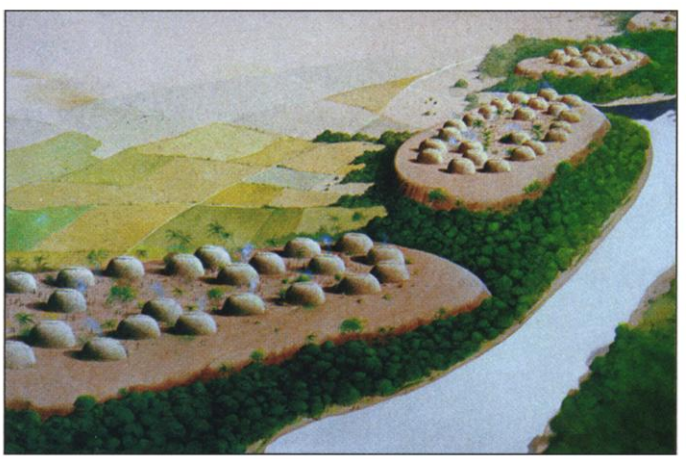
MEETING BRAZILIAN ECOSYSTEMS: HISTORY, MANAGEMENT, AND PRESERVATION

South American Landscapes: Ancient and Modern

CHICAGO—Brazil's tropical rainforests, biological diversity, and freshwater resources are among the world's largest. On 10 and 11 May, more than 100 environmental scientists, anthropologists, archaeologists, geologists, and government officials gathered at Chicago's Field Museum to discuss the status of these exceptional resources and how to preserve them. Many talks focused on what can be learned from historical land use and what the priorities for modern conservation should be.

Ancients Transformed Landscapes

Prehistoric human societies have long been considered too insignificant to have made much of an impact on Earth's landscapes. Now, a small but growing number of researchers is disputing that conventional wisdom. At the meeting, Anna Roosevelt of Chicago's Field Museum and the University of Illinois, Chicago, and anthropologist William Balée of Tulane University in New Orleans, Louisiana, described new findings indicating that people who lived in the Amazon basin, hundreds or even thousands of years ago, left a bigger mark on the ecology of the area than expected. "Paleoecological data don't fit preconceptions," Roosevelt says.



Altered state. As illustrated by this reconstruction of a Marajó Island mound cluster, people living hundreds of years ago significantly changed the landscape—at least for a time.

CREDIT: SAL CATALANO

Her perspective is a minority viewpoint. But, says ethnobotanist David Lentz of the New York Botanical Garden in The Bronx, "the more we look, the more we find evidence that supports her. Roosevelt has done us a service." Whether pre-Columbian societies had an impact on the Amazon basin is no longer a matter of dispute, he adds; rather, the issue is how big that impact was.

Roosevelt bases her conclusions on about 20 years of work in the Brazilian Amazon, where she studies the interaction of humans with their environment by looking at the chemistry and taxonomy of animal and plant remains, including bones, seeds, and shells, that people used daily. This research shows, she says, that late prehistoric humans, who lived from A.D. 400 to 1550, left garbage dumps that changed soil quality over large areas, primarily along the mainstream Amazon.

From the same period, Roosevelt also found evidence of areas with huge earth mounds 1 to 10 meters high, sometimes occurring over many square kilometers, where people lived. This suggests that people created small, open clearings along the Amazon, which have since reverted to forest. "What is viewed today as the great, natural, original Amazon forest is not totally so," Roosevelt says.

Balée offered other evidence, gathered from recent inventories of the very diverse plant life in two Amazon regions, that suggests how prehistoric societies transformed the Amazon landscape and allowed the invasion and establishment of new species. For example, the use of fire, both intentional and accidental, and the expansion of agriculture, involving the cultivation of crops including manioc and trees such as palms and Brazil nut, all changed the land on a broad scale. This, in turn, expanded the number of light gaps in the dense, tropical forest canopy, allowing the growth of novel, sun-loving species, such as corn. Evidence of earthwork complexes in eastern Bolivia, Marajó Island in the mouth of the Amazon, and elsewhere also indicates the intensification of food production and an altered landscape, Balée says. All this happened before the arrival of Europeans in the mid–16th century.

Balée also suggests that although many ecologists claim that natural environments are the richest in diversity, his research indicates otherwise. He claims that biologic diversity in forests occupied by prehistoric societies, particularly where pre-Hispanic agriculture existed, is "probably higher today because of [earlier] human occupation, use, and management of the land" than it would be if such settlements had not occurred. The enhanced biodiversity comes from the import of plants and seeds from other areas and small-scale transformations of the landscape from a moist, shady forest to a sunny, dry savanna that allowed the invasion of new species.

Roosevelt stresses that understanding the historical use of land is key to planning modern conservation programs. For example, the sustainability of agriculture in Amazonia is often questioned, but prehistoric evidence shows that some areas that are well forested today were used for thousands of years for a type of agriculture in which farmers shifted their plantings from area to area, allowing previously planted areas to lie fallow to recover. Lowland forests in Amazonia, she says, appear resilient, able to withstand modest deforestation by small-scale human societies. Over time, despite various trials and tribulations brought on by nature and indigenous humans, they "just go chugging along," she says.

Conservation Efforts Need Broadening

For a decade or more, the Amazon rainforest has been a poster child for the environmental movement. Over about 20 years, this large, exotic, and diverse region of South America has lost perhaps as much as 18% of its area, almost 400,000 square kilometers, to human activities, such as farming, logging, and gold mining. But as several presentations at the meeting made clear, the Amazon rainforest, some 40% of which is now protected, is not the only threatened ecosystem in South America. Three others are in even worse shape, a situation that is drawing calls for new conservation efforts in those areas.

The regions causing most concern are the Atlantic forest, a sliver of dense green stretching 23 degrees of latitude south of the equator along the Brazilian coast; the Caatinga, a semiarid region in east-central Brazil; and the Cerrado, a large, open savan-

In trouble. Deforestation of Brazil's Atlantic forest has greatly reduced the distribution of endemic birds, such as the pin-tailed manakin.

na that occupies much of central South America in northeast Paraguay, eastern Bolivia, and western and central Brazil. "These areas have been ravaged, but they are just as important as the Amazon," says ornithologist Joel Cracraft of the American Museum of Natural History in New York City.

When the first European settlers began to colonize the land that would later become Brazil, the Atlantic Forest, known locally as the Mâta Atlantica, stretched over 1306 million square kilometers. But as landscape ecologist João Paulo Capobianco of the Instituto Socioambiental in São Paulo reported, it has since been nearly wiped out by human activity, including the sprawl of São Paulo, one of the world's largest cities. One recent study that charted land use change between 1990 and 1995 found that more than 500,000 hectares of forest were destroyed in states that encompass about 90% of what is left of the Brazilian Mâta Atlantica. "This is a destruction proportionally three times greater than that recorded for Amazonia within the same period," says Capobianco. Today, only 6% of the original forest is left, and it's still under threat.

Even so, the remaining Mâta Atlantica is well worth saving. It has, Capobianco says, one of the richest collections of ecosystems on the planet. They contain numerous endemic species found nowhere else, including 73 species of mammals, of which 21 species and subspecies are primates, 160 species of birds, and 165 species of amphibians.

Equally endangered is the Cerrado, the world's largest tropical savanna. It covers about 1.86 million square kilometers, mostly in Brazil, although parts extend into Paraguay and Bolivia. As recently as 50 years ago, the Cerrado was almost pristine. But José Maria Cardoso da Silva of Conservation International do Brasil in Belém told the meeting participants that intense colonization over the 40 years since construction of Brasília, Brazil's new national capital, changed at least 70% of the region. Most of the changes were due to soybean and rice farming that "has not followed the most basic principles of conservation," says Cardoso da Silva. He notes, for example, that habitats are often fragmented, resulting in loss of biologic diversity, and farmers often do not protect topsoil from erosion. Still, the Cerrado's biodiversity remains impressive with 10,000 plant species, 120 reptile species, 161 mammal species, 837 bird species, and 150 amphibian species.

The dryland Caatinga has also been so strongly disturbed, Cardoso da Silva says, mainly by fire, timber exploration, and cattle ranching, that it is almost impossible to describe what original vegetation thrived there 500 years ago. Current estimates suggest that at least 60% of Caatinga has already been converted to agriculture and other types of land use.

For the past 10 to 15 years, Bolivia and Paraguay have made notable efforts to conserve their bits of the Cerrado with the establishment of preserves, but Brazil's efforts to conserve the Cerrado, Caatinga, and Mâta Atlantica date only to the last 5 years or so. Cardoso da Silva and ornithologist John Bates of the Field Museum support the establishment of more Brazilian reserves and of conservation corridors to connect them. They also suggest increasing productivity on lands already under agricultural cultivation to reduce pressure on areas in these three biomes still covered by natural vegetation—a doable project, given Brazil's current commitment to conservation.

–ANNE SIMON MOFFAT

Anne Simon Moffat is a freelance writer in Chicago.

ASTRONOMY

Hubble Gets New IR Eyes

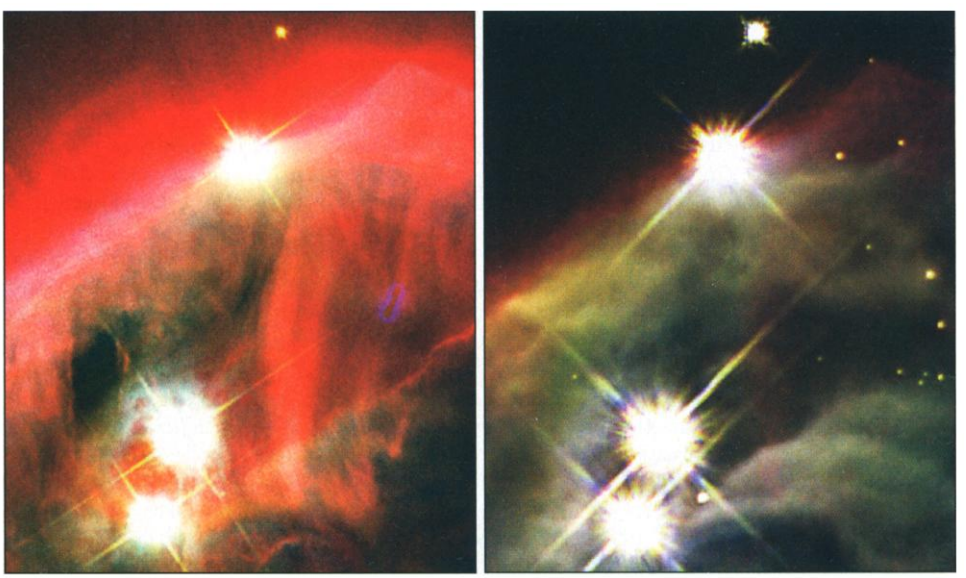
ALBUQUERQUE, NEW MEXICO—The Hubble Space Telescope's infrared vision has been restored, and it's better than ever. At an American Astronomical Society meeting here,* excited astronomers presented the first images taken by Hubble's Near-Infrared Camera and Multi-Object Spectrometer (NICMOS) after it was outfitted with a new cooling system in March. "It's absolutely fantastic that we now have infrared eyes back on Hubble," says NICMOS principal investigator Rodger Thompson of the University of Arizona, Tucson.

Observing in the infrared enables Hubble to peer into dusty star-forming regions and to study the extremely distant universe. NICMOS was installed in February 1997, but the solid nitrogen used to cool the sensitive infrared detectors to 62 kelvin was depleted just 2 years later, much faster than anticipated. Now, with a new refrigerator-like cooling system, the camera should be back in business indefinitely. NICMOS is between 30% and 40% more sensitive than it used to be, says astronomer Daniela Calzetti of the Space Telescope Science Institute in Baltimore, Maryland, because its detectors work more efficiently at the new system's 77-kelvin operating temperature. "This will enable us to look deeper, or to do the same science in less time," Calzetti says.

–GOVERT SCHILLING

Govert Schilling is an astronomy writer in Utrecht, the Netherlands.

* 200th meeting, 2–6 June.



Dust buster. In side-by-side pictures of the Cone Nebula, stars and other details that Hubble's Advanced Camera for Surveys misses (*left*) pop into view in the dust-penetrating infrared NICMOS image (*right*).

CREDITS: (TOP) JOHN S. DUNNING/PHOTO RESEARCHERS; (BOTTOM) NICMOS GROUP (STCI, ESA)/NICMOS SCIENCE TEAM (UNIVERSITY OF ARIZONA)/NASA