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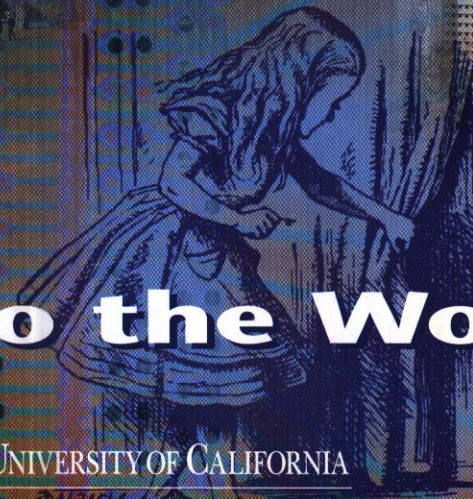
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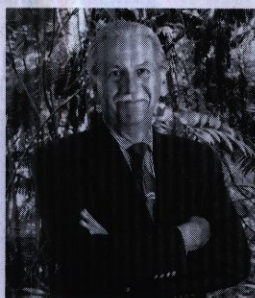
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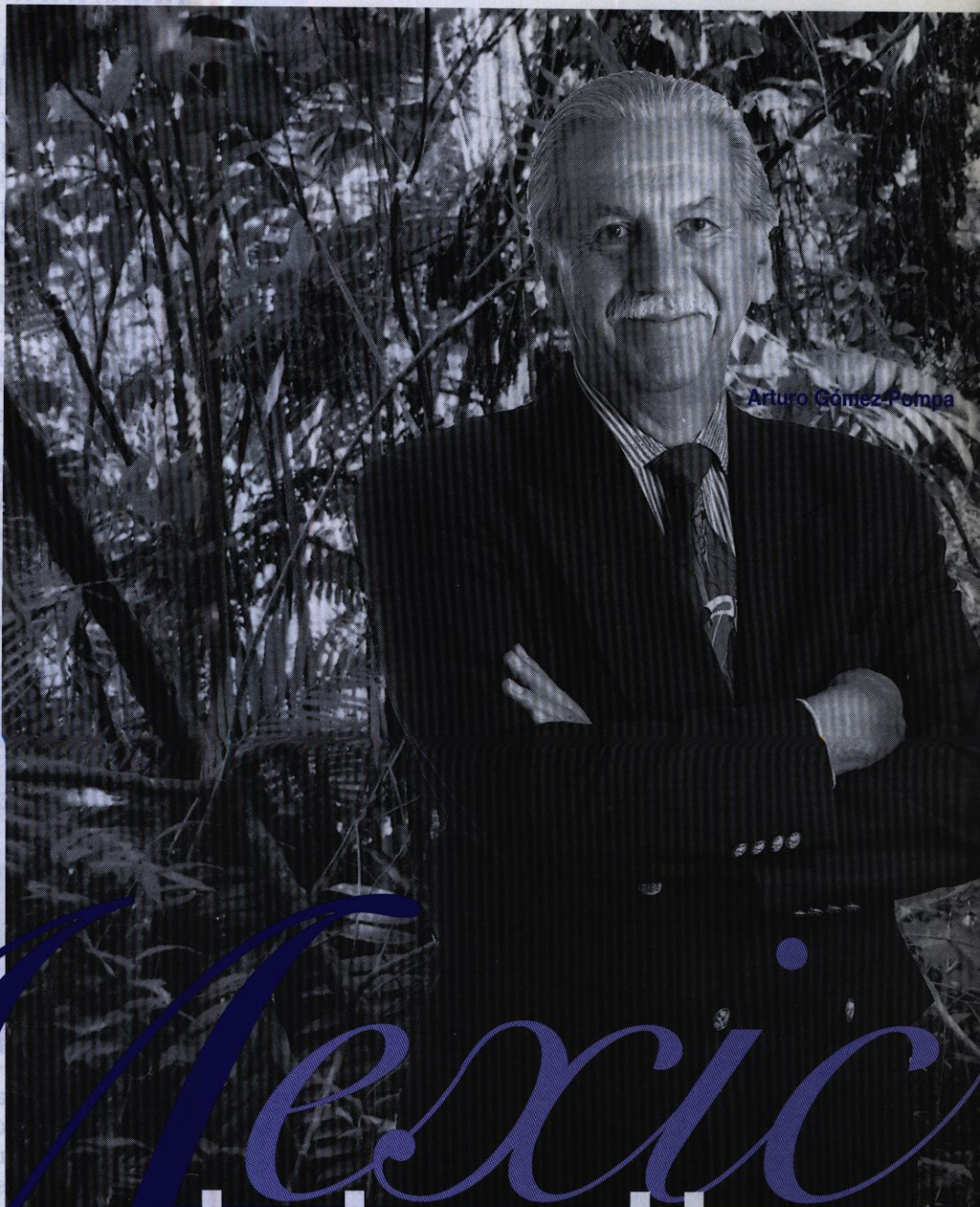
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UCR creates
the world's
richest online
resource of
tropical plant
data with the
Plant Resource
Information
Library and
Brings



Scientific biodiverse

to the world



iversity world

By Kathy Barton

An archaeologist in Central America hears by word of mouth about the recent discovery of an ancient agricultural zone in the Yalahau region of Quintana Roo, Mexico, and wants to learn more.

In northern Europe, an environmental activist lobbying to establish a natural reserve wishes to cite Mexico's Tropical Forest Action Plan as a model for how the biodiversity of unique habitats can be preserved, studied and utilized for the benefit of indigenous populations.

A grower in Australia wants to identify an unknown Mexican cycad received as exchange from another grower, while an avocado specialist wants to see the original type collection of a wild persea in Chiapas.

A junior high school student in the United States researching a term paper on tropical rain forests needs to know which tree species are found in the Great Peten region of Belize, Guatemala, and Mexico—one of the world's most diverse tropical habitats.

For each of these hypothetical scenarios, the answers are just a few computer keystrokes and mouse clicks away in the Plant Resources Information Laboratory at the University of California, Riverside. Scientists, environmentalists and students from around the world—typically between 30 and 50 each day—visit the World Wide Web site created, updated and maintained by UCR Professor of Botany Arturo Gómez-Pompa, visiting scientist Ed Plummer, and UCR graduate student Hoyt Heaton.

Since its debut on the Internet in early 1995, the UCR-based web site has become perhaps the world's richest online resource of information on the biological diversity of tropical Mexico. On one recent holiday, the site had 69 visits, with almost 80 percent of the inquiries coming from non-UCR computer users. Web denizens from throughout the world

regularly visit, including those from such countries as Spain, Brazil, South Africa, Korea, New Zealand and Sweden.

"There is a great need to document the biodiversity of the tropics," says Gómez-Pompa, an authority on tropical rain forest ecology, management and conservation. "What computer technology and the Internet allow us to do is to share the information that is developed by scientists working in Mexico with as wide an audience as possible. The more that people are aware of the rich environment there, the better position we are in to save those plants that are in danger of extinction."

Mexico, known as a "mega-diversity" nation, is home to an estimated one-tenth of all the world's plant species—about half of which are endemic only to that nation. As such, it has become a major arena for efforts to preserve tropical rain forests which, in many areas, are threatened by opening lands for grazing and agriculture.

The tropics contain an untold number of plant species that may prove useful in the development of new pharmaceuticals or enhanced crops. "Every species is a chemical factory that may provide crucial medicines or raw chemicals for industry," says Gómez-Pompa. "We know up to now about 50,000 organic compounds. This is a very low figure. In one well-known species, the tobacco plant, several thousand organic compounds have been described. How many more are out there? Our number of researchers to study this immense unknown chemical library is very low. The only option is to conserve as much as we can, train more scientists, and develop faster and more efficient technological tools to study the different levels of plant diversity."

Gómez-Pompa became a world leader in the development of innovative technology for the study of botany long before personal computers became indispensable in scientif-

The tropics contain an untold number of plant species that may prove useful in the development of new pharmaceuticals or enhanced crops.



ic research. As a professor at the National Autonomous University of Mexico in the late 1960s, he recognized the value that the emerging computer technology could bring to the

field of botany. He created a textual database of botanical resources in Mexico's state of Veracruz at a time when a single mainframe computer that required a climate-controlled environment contained less memory than most of today's laptops.

"At the time, the director of the computer center of the National University of Mexico was looking for projects to justify the use of that first computer," Gómez-Pompa says. "I provided a project."

As computer technology advanced, he added images to the botanical database to assist with plant identification and scientific data from museums in other countries to expand its scope.

The technological activities of Gómez-Pompa's lab have since broadened to include an array of scholarly and educational missions associated with the unique plant communities of Mexico, all under the umbrella of the Plant Resources Information Laboratory.

School children in Mexico are making "virtual" visits to the tropical regions of Mexico to learn about the "living plant fossils" known as

cycads—many species of which are threatened with extinction—with a CD-ROM developed jointly by UCR and Mexico's

standing of the plant communities of particular regions, typically published in books. Utilizing videodisc technology and a computer-aided identification program, the laserdisc version of the "Trees of the Great Peten" contains photographic images and drawings as well as botanical and ecological data on some 500 species of trees of the lowland tropical forests of the Peten region of Guatemala, Belize, and Mexico.

Such optical technology—capable of storing up to 54,000 images on a single 12-inch videodisc—has several advantages over traditional printed floras: More comprehensive treatment can be given the subject of the flora; full-motion video can be included; and the technology facilitates interactivity by allowing the user to easily compare species.

Videodiscs and CD-ROMs do, however, require specialized equipment to use, but prices of players and the computer equipment needed to run them have rapidly dropped, he says.

The "Flora of Veracruz" computerized database project—now headquartered at the Institute of Ecology at Xalapa, Veracruz, and previewed on Gómez-Pompa's UCR Website—was the first in the world and is still one of the most advanced. It strongly influenced creation of a system to preserve the unique botanical resources of Veracruz. "Through that project, we were able to train an outstanding group of tropical botanists that today are the leaders in Mexican botany. The best and most influential research institutions of Veracruz, Estación Biológica Los Tuxtlas of the National University of Mexico and the Institute of Ecology of Xalapa, were created thanks to the Flora of Veracruz project," says Gómez-Pompa.

In addition to demonstrations of the "Video Flora of Veracruz," "Trees of the Great Peten," and "Las Cycadas de Mexico," the UCR Website contains comprehensive factual

Instituto de Ecología with funding from the National Commission for Biodiversity of Mexico. "Las Cycadas de Mexico" takes students through an interactive multimedia computer program that combines video clips, still photographs and drawings, text, and music to present a self-paced lesson on the unique plants, their habitats, and efforts to preserve them.

"This is groundbreaking. In Mexico, CD-ROMs are just making their way into education," says Gómez-Pompa.

Such interactive multimedia is made possible by Compact Disc-Read Only Memory (CD-ROM) computer technology. CD-ROMs—the same size as audio CDs and made of the same material—can store large amounts of video, still pictures, sound and text. Commercially available CD-ROMs hold entire encyclopedias or complex video games, for example.

The Plant Resources Information Laboratory has also taken an unconventional approach in the development of "floras"—botanical guides that provide comprehensive under-



Visiting scientist Ed Plummer, left, and graduate student Hoyt Heaton are cooperating in development of Web program and Website for the Plant Resources Information Laboratory.

and research data on the 3-year-old El Eden Reserve on the northeast portion of the Yucatán Peninsula. The reserve, created by a group of Mexican conservationists led by Gómez-Pompa, is Mexico's first privately owned protected area dedicated to research in biodiversity conservation.

The site reviews the major ecosystems of El Eden and the research projects under way there. It publishes preliminary research results so that scientists around the world can learn of the latest discoveries. "It also allows average people to access the information without having to go find a journal," says Heaton, a graduate student in botany who has major responsibility for creating and maintaining the web site and who has placed the site on numerous Internet

catalogs of sites that contain botanical information.

Also in progress at the Plant Resources Information Laboratory is an online tool to help visitors identify plants unknown to them, says Plummer, who is developing the Web program. A demonstration leads users through a series of questions about an unidentified plant, ultimately providing the user a list of families to which the plant might belong.

Such computer-based technologies developed at UCR are "definitely catching on" in the discipline of botany, says Plummer. "There are many people out there who are aware of the technology and its capacity. As the price goes down, we can make even more use of it."

The popularity of the Plant Resources Information Laboratory is

testament to its usefulness to scientists and students, Gómez-Pompa says. "There are a lot of sites on the web that are nice to look at but have little useful information. What we put on the Web is information that has a purpose."

He has high hopes that computer-based technology can speed up the work of identifying, cataloging and studying the unique biota for conservation and the benefit of the world's population: "We need to know the floras of the world as one fundamental starting point. We need to preserve samples of the ecological diversity of our planet and we need to study those samples as fast as possible and have access to that information."