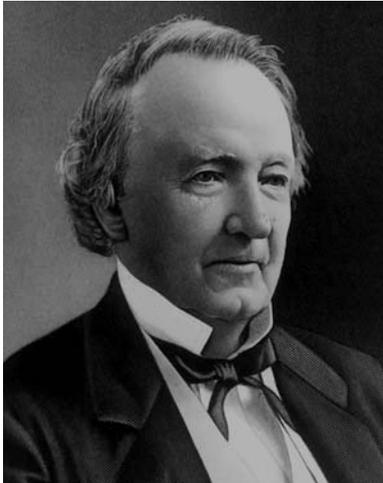


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Introduction



The Missouri Botanical Garden, since its founding by Henry Shaw in 1859, has grown into an international resource for botanical research. Shaw began acquiring material for the herbarium in 1857 with the purchase of the J. J. Bernhardt collection. The first library acquisitions date from 1858, and in 1859 the Missouri Botanical Garden opened to the public. More than 100 years later, in 1972, the herbarium and library collections were relocated to the newly opened John S. Lehmann Building. Then, in the short span of 25 years, the Lehmann Building was filled beyond capacity due to the dramatic expansion of the Garden's research programs. In November and December of 1997 the Research Division moved a large portion of its collections, people, and equipment to the Garden's newest facility, the Monsanto Center, located on campus at 4500 Shaw Boulevard.

From the early 1970's the herbarium has grown from 2.3 million to over 5 million mounted specimens. The library contains now more than 164,000 volumes of monographs and journals, including 9,000 volumes of rare books, and an extensive non-book collection. There are 172 staff members (44 Ph.D.-level scientists and 127 technical and support personnel) and about 45 volunteers in the Research Division.

This year 35 students are enrolled in the Garden's graduate program, 19 of them from other regions including Asia, Australia, and Latin America.

Staff...

In 2001 Bob Magill, Director of Research, celebrated 20 years at MO. New staff members have joined the Garden community since last November. Anthony Brown

(Coordinator, CPC) Alina Freire-Fierro (Senior Herbarium Assistant), Kevin M. James (Information Coordinator of Conservation Programs, CPC), Mary McNamara (Senior Secretary, Herbarium), John Pruski (Assistant Curator), Patricia M. Rush (Manager of Development, CPC), Carol Vauhgn (Secretary, CCSD), Heather C. Wells-Sweeney (Library Assistant), Madeleine Winslow (Herbarium Assistant), and Jessica E. Woo (Senior Herbarium Assistant) are now part of the Research Division. The Division of Communications hired a new Publications Manager, Elizabeth McNulty, who has been giving good coverage of the Research Division in the *Garden's Bulletin*, sent out to the Garden's 30,000+ members. Chuck K. Miller, Jr., is the new Chief Information Officer of the Division of Information Technology. The IT Division works very closely with the Research Division, especially in everything related with information systems and computers.

Our long time secretary of the herbarium, Lois J. Ganss (Senior Secretary), very well liked by all researchers here at MO and other research institutions, retired at the end of last year. Two more people retired from the Research Division after more than 10 years of service, Renate L. Kheim (Plant Mounter) and Eloise Cannady (Data Processor).

Ihsan Al-Shehbaz has been appointed Head of the newly created Department of Asian Botany. James S. Miller has been named the William L. Brown Curator in Economic Botany. Several people were promoted last year: Charlotte Taylor and Elsa Zardini are now Curators, Guanghua Zhu and Tatyana Shulkina have been promoted to Associate Curators, Armand Randrianasolo is now Assistant Curator, Sandy Lopez is now Administrative Assistant, and Andy

Colligan is now Archives Librarian. Peter Keefner will be working for the Bolivia project, and Sharon Bodine has started working with the Tanzania Project.

Events...

The 49th Annual Systematics Symposium, "The Genetics of Conservation," coordinated by P. Mick Richardson and moderated by Kathryn Kennedy and Barbara Schaal (Washington University) will be carried out this Fall 2002. Jan Salick and James S. Miller, in collaboration with Gayle Fritz (Washington University) and Cheryl Asa (St. Louis Zoo), organized the workshop entitled "Intellectual Imperatives in Ethnobiology" in the Spring of 2002. The event included 36 participants, from 10 countries. In December 2001 the Missouri Botanical Garden, in collaboration with the Royal Botanic Gardens, Kew sponsored and organized the four day workshop "Linking Ecology and Horticulture to Prevent Plant Invasions." The workshop attracted about 65 people from England, Australia, New Zealand, and the U.S.A., and included eight featured speakers and presentations and two discussion sections.

News...

2002 marks the 20th anniversary of the publication of *News from MO*. According to the first issue published in 1982, the Division of Research had 22 Ph.D.-level researchers, 23 support staffers, 8 graduate students and 8 volunteers. Marshall R. Crosby was the Director of Research, and Nancy R. Morin was the Administrative Curator of the Herbarium. The projects and their directors at that time were: Africa (Peter Goldblatt), New Caledonia (Gordon McPherson), Bolivia (James C. Solomon), Mesoamerica (Gerrit Davidse), Nicaragua (W. Douglas Stevens), Panama (W.G. D'Arcy †), and Peru (A.H. Gentry †). The Missouri Botanical Garden welcomes the Botanical Society of

America (BSA), an organization of professional plant biologists with about 2,500 members from 51 countries, that will soon be relocated to the Garden's grounds. The Society publishes *The American Journal of Botany*, *The Plant Science Bulletin*, *a Guide to Graduate Study in Botany in the U.S.A. and Canada*, and other occasional publications. The BSA will be housed temporarily in existing buildings on Garden grounds, but eventually it will move to the Commerce Bank Education

Eckel will continue doing historical research in botany, as well as research on vascular plants. Both will be involved in research, education, and public service.

In addition to their long standing commitment to floristic, monographic, and curatorial research, the scientists at MO have greatly expanded their participation in conservation activities, studies of medicinal and other useful plants, ethnobotanical research, and the development of information technology for botanical



PHOTO BY JACK JENNINGS

Center, a new building sponsored by the William T. Kemper Foundation and Commerce Bank, to be located at the corner of Shaw Boulevard and Kingshighway.

The Garden also welcomes several researchers who are moving to St. Louis: Shirley and Alan Graham, formerly at Kent State University, Ohio. Shirley Graham will continue working on systematics of Lythraceae, and Alan Graham will continue working on paleobotany. Richard H. Zander and Patricia M. Eckel, formerly at the Buffalo Museum of Science, New York, will continue doing bryology research. Zander will continue working for the *Flora of North America* project and

data management. An overview of research activities at MO and a directory of its Research staff, associated university faculty, graduate students, research associates, and honorary curators follows. For more information on any aspect of research at the Missouri Botanical Garden, we invite you to visit us on the Web at <www.mobot.org/MOBOT/research>

Ecuador is the smallest of the Andean countries of South America. With a land area of approximately 252,000 km², continental Ecuador (excluding the Galápagos Islands) is about the size of the state of Colorado. With a human population of about 12 million, Ecuador is also the most densely populated country in South America.

Ecuador is well known among biologists and conservationists as one of the “megadiversity” countries, along with others in South America such as Colombia, Peru, and Brazil. Ecuador is exceptional in that such a large number of animal and plant species are found in a relatively small area (Ecuador covers about 0.2% of the Earth’s continental land mass). More than 16,000 species of higher plants are known from Ecuador, about 5% of the world’s total, and about as many plant species as in the continental United States, an area more than 30 times larger – and the number of plant species in Ecuador continues to grow rapidly as new species are discovered and described.

Continental Ecuador is traditionally divided into three geographic regions, each of which occupies about one-third of the country: the Pacific coastal lowlands in the west, the Andes mountain range in the center of the country, and the Amazon lowlands in the east. Most of the human population of Ecuador is found in the intermontane valleys in the Andean region (including Quito, the capital city) and in the Pacific coastal lowlands (including Guayaquil, the major port and largest city).

Missouri Botanical Garden has been carrying out programs of botanical research and inventory, institutional development of Ecuadorian herbaria, and professional training of Ecuadorian botanists, since the 1970s. Calaway Dodson (then a professor at the University of Miami) established the Río Palenque field station in the Pacific lowlands in the early 1970s. Alwyn Gentry (1945–1993), then a young curator at the Garden, began to work with Dodson on the flora of the Río Palenque site, which they

published in 1978. Dozens of species new to science, most of them local endemics, were described from Río Palenque, which protects one of the last remaining patches of natural forest in the Guayas River basin.

Calaway Dodson has studied the orchids of Ecuador since 1957 when he did fieldwork there for his doctoral thesis; through his work Ecuador has more known species of orchids than any other country – over 3,300 species documented so far, about 700 of which were described by Dodson himself or with co-authors. Three volumes of Dodson’s five-volume illustrated synopsis of Ecuadorian orchids have been published to date.

David Neill began residence in Ecuador as a Garden curator in 1985 and has been there ever since. His work has concentrated on helping to develop the National Herbarium of Ecuador (QCNE), to conduct hands-on training for Ecuadorian botanists and students and, together with Ecuadorian colleagues, to carry out botanical inventories in selected areas throughout the country. His wife, Ecuadorian botanist Mercedes Asanza, is a staff member of the QCNE herbarium and botany professor at Universidad Central del Ecuador. Neill and Asanza are founding members of the Jatun Sacha Foundation, an Ecuadorian NGO that now owns three private biological reserves and operates two more through agreements with the landowners. They are also founding members of the Ecuadorian Foundation of Botanists, FUNBOTANICA.

In the mid-1980s, the National Herbarium (QCNE) consisted of a few thousand specimens; the holdings have increased to 165,000 mounted specimens in 2002 and continue to grow at about 10,000 collections annually. The herbarium has also acquired a basic botanical reference library



PHOTO BY DAVID NEILL

Entrance to the Amazon Plant Conservation Center and Ishpingo Botanical Garden, in the Amazonian region of Ecuador. This botanical Garden has brought into cultivation native Amazonian plants that are used as medicines, dyes, food and handicraft materials. The center also carries out agroforestry research and extension programs with participation by local farmers, with emphasis on the use of nitrogen-fixing legume trees combined with crops to maintain soil fertility in the tropical rain forest areas of Ecuador. This program has been sponsored by the Garden with financial support from the Liz Claiborne and Art Ortenberg Foundation.

over the years, with over 3,000 volumes. It now serves as the principal center in the country with public access to information on Ecuadorian plants and is visited daily by researchers and students.

The Garden's work has been instrumental in the development of the QCNE herbarium, including construction of the herbarium building in 1992, which was financed through a grant from the Garden.

During the late 1980s and early 1990s much of the Garden's floristic inventory work in Ecuador, conducted jointly with the QCNE herbarium, was carried out in the Amazon lowlands, often in association with petroleum development activities. For instance, during 1992–1994 a 120-km road and oil pipeline was built through primary forest in Yasuní National Park and the Huorani Indigenous Reserve. Herbarium specimens were collected daily for two years as the pipeline right-of-way was cleared, yielding 7,000 collections and a number of species new to science.

The botanical inventories in Ecuador provided baseline information that contributed to the establishment of new national parks and reserves including, for example, the Sumaco Napo-Galeras National Park (now a UNESCO Biosphere Reserve) on the eastern slopes of the Andes and the Mache-Chindul Ecological Reserve in the Pacific coastal range. Other areas inventoried by QCNE and the Garden in recent years include the Awá Indigenous Territory on the western Andean slopes near the Colombian border, and Llanganates National Park and Antisana Ecological Reserve in the high Andes. At present, botanical inventory work is focused on the Cordillera del Cóndor region, an eastern outlier of the Andes along the Ecuador–Peru border. This is a joint program of the Garden, the QCNE herbarium, the University of Loja herbarium, and the indigenous Shuar Federation.

The Garden's programs have also included community-level conservation work such as the development of the Amazon Plant Conservation Center at Jatun Sacha Biological Station in



PHOTO BY DAVID NEILL

Botanical exploration of the Cordillera del Cóndor, in the Río Quimi watershed at 1600 m: Mélida Shiki, a young Shuar woman from Gualaquiza, who later spent some time at the Ecuadorian National Herbarium; Ricardo Tsakimp, a Shuar ethnobotanist and healer (curandero); and Tanya Montenegro and Martha Cuascota, MO/QCNE internship students. With them there are three Ecuadorian soldiers who were from the nearby military post. Expedition supported by the National Geographic Society.

lowland Amazonian Ecuador. The Center carries out research on agroforestry and sustainable use of native Amazonian plants, and conducts agroforestry extension programs with local farmers.

The Garden is also assisting in the development of the new Quito Botanical Garden as a center for *ex-situ* conservation of Andean plants in the capital city. Shannon Smith, Director of the Garden's Horticulture Division, helped in the planning of the Quito garden, and Edwin Narváez, the Quito Garden's Technical Director, received training as a horticulture intern at the Garden in St. Louis during the summer of 2001.

The herbarium of the University of Aarhus, Denmark (AAU), has also carried out botanical inventory and training programs in Ecuador for several decades, in collaboration with the Catholic University herbarium (QCA) in Quito, and more recently with the University of Loja herbarium (LOJA) in southern Ecuador. For a number of years Aarhus botanists and graduate students directed the QCA herbarium and taught botany at the Catholic University. Among the Danish visiting botanists was Peter M. Jørgensen who, after completing his

doctorate at Aarhus, came to the Garden to work on the compilation of the *Catalogue of the Vascular Plants of Ecuador*. This work was published in 1999 as a collaborative effort of the Garden, Aarhus University, the Catholic University in Quito, and the National Herbarium of Ecuador. Jørgensen and Ecuadorian botanist Susana León-Yáñez edited the *Catalogue*, and 239 taxonomic specialists contributed to the work, which documents the more than 16,000 plant species in Ecuador. Jørgensen's wife, Ecuadorian botanist Carmen Ulloa Ulloa, is also an Assistant Curator at the Garden.

A rather astonishing fact emerged from the publication in 1999 of the *Catalogue*: more than 4,000 plant species new to science were described from Ecuador during the 25-year period from 1973 to 1998—a rate of one new species published every two days. The rate of discovery and description of new species from Ecuador shows no sign yet of slowing down, so the total of known species in Ecuador will continue to increase.

The Garden's programs in Ecuador have provided professional training in plant systematics and conservation biology to more than 50

Ecuadorian biologists, foresters and agronomists. Most of these Ecuadorians participated in the floristic inventory programs with the QCNE herbarium. During 1998–2001 the training was formalized in a post-graduate internship program, supported by the Liz Claiborne and Art Ortenberg Foundation. A total of 23 Ecuadorian university graduates participated in the nine-month internships, receiving hands-on training in research and botanical inventory methods, plant taxonomy and identification, herbarium methods, and aspects of conservation biology. The Ecuadorian graduates of these training programs are now applying their knowledge gained during the internship program, working in research, teaching, and conservation programs in a number of public and private institutions and universities in Ecuador. The Garden has also provided financial support and mentoring for undergraduate thesis projects in botany for more than 20 Ecuadorian university students over the years.

The Garden in 2002 initiated a new training program in Ecuador, jointly with zoologists from the Wildlife Conservation Society. With support from the Liz Claiborne and

Art Ortenberg Foundation, the program will provide training in conservation biology and natural resource management to representatives of two indigenous groups whose territories include extensive areas of biologically diverse forests: the Awá in northwestern Ecuador and the Shuar in the southeast. Upon completion of the two-year training program, the participants will work for their

respective indigenous organizations in conservation, wildlife, and forest management programs to benefit their local communities and protect natural habitats in their ancestral territories.

Three Ecuadorian students have completed master's degrees at UMSL, with theses in systematic botany in conjunction with the Garden: Aída Alvarez, who is now working on a doctorate at The New York Botanical Garden, Susana León, now a professor at the Catholic University in Quito, and Alina Freire-Fierro, now on the Garden staff in St. Louis. The Garden's program currently sponsors two graduate students working on master's degrees in botany at the University of Missouri-St. Louis: Homero Vargas of the National Herbarium of Ecuador, and Tanya Montenegro of the Guayaquil Botanical Garden. Several other Ecuadorian students have completed graduate studies in Ecology and related disciplines at the UMSL Biology Department under the auspices of UMSL's International Center for Tropical Ecology.



PHOTO BY DAVID NEILL

David Neill (center) with Carlos Chimbo and Carlos Chamba, Ecuadorian students from the forestry school at the University of Loja. Their undergraduate thesis on tree phenology in this montane forest in southern Ecuador is supported by the Liz Claiborne and Art Ortenberg Foundation.



PHOTO BY DAVID NEILL

Weinmannia auriformis Z. Rogers (Cunoniaceae), originally collected by David Neill in 2001, and recently described in *Novon*. This species is known only from the Cordillera del Cóndor mountain range in southern Ecuador.

Africa and Madagascar

Africa and Madagascar

North America

Mesoamerica

South America

Asia

Bryophytes

Araceae

Iridaceae

Onagraceae

Rubiaceae

*Linnaean Plant Names
Typification Project,
LPNTP*

*Index to Plant
Chromosome Numbers*

Applied Research

MO's Africa and Madagascar programs are headed by Porter P. Lowry II from his base at P. Peter Goldblatt, the B. A. Krukoff Curator of African Botany, currently divides his time between the field, MO, and his home in Portland, Oregon. MO's collections from continental Africa are the largest in North America and now number almost 750,000, with more than 18,000 new specimens being accessioned each year. Over 10,000 gift and exchange duplicates are distributed annually, mostly to herbaria with special interests in the African flora. Botanists and institutions wishing to receive material for study should contact Roy Gereau. African material from other institutions would be very welcome. The Garden's program focuses its efforts on the study and conservation of the tropical flora and vegetation throughout Africa, with special emphasis on Gabon, Madagascar, and Tanzania. Additional interest in Cameroon, both Congos, Equatorial

Guinea, and the unusually rich temperate flora of southern Africa.

Gabon: The Garden's collaboration with the Herbar National du Gabon (LBV), a branch of Gabon's Centre National de Recherche Scientifique et Technologique (CENAREST), has expanded over the last several years. Initial efforts began with the National Cancer Institute collecting program and were soon followed by Gordon McPherson's checklist of the Lopé-Okanda Reserve. This checklist can currently be accessed at www.mobot.org/MOBOT/research/lope_int.html. Gretchen Walters, John Stone, and Adam Bradley, in collaboration with staff from LBV, have conducted bioprospecting work under a contract with Sequoia Sciences. For these collections, sites are always chosen that are poorly known botanically, including the northern Monts de Cristal, the southern Mayumba area, and the lower Batéké Plateau, thus contributing significantly to the baseline of herbarium material from



PHOTO BY GEORGE SCHATZ

Curator Porter P. Lowry II (center) heads the Garden's Africa and Madagascar Department, coordinating research and exploration, conservation, and training activities in several countries. He is shown here with Malagasy colleagues Johnny Rabenantoandro (left) and Roger Bernard.

Gabon. Evolving from this work is the recently begun inventory of the lower Batéké Plateau, an area previously unknown botanically.

Madagascar: The Garden's research and conservation activities in this biologically fascinating island are directed by Porter P. Lowry II, with Christian Camara serving as in-country Permanent Representative. George E. Schatz is the project's research botanist based in St. Louis, and Christopher Birkinshaw is the resident Technical Advisor in Antananarivo. Lalao Andriamahefarivo coordinates the local research program, oversees a network of Malagasy local collectors trained under MO projects, and manages specimen processing. Schatz's *Generic Tree Flora of Madagascar* was recently published jointly by MO and K, providing an important new resource for students of the island's flora that expands on the pioneering work of the eminent French forester René Capuron. A ceremony to launch the book was held on April 29, 2002 at the Malagasy Embassy in Washington, D.C. A series of papers on *Takhtajania perrieri*, the only Winteraceae in the Africa/Madagascar region, appeared in the *Annals of the Missouri Botanical Garden*. A recently completed NSF-funded project allowed Garden staff, in

collaboration with P, TAN, and TEF, to computerize information on the approximately 12,000 species of Malagasy plants. Sylvie Andriambololona and Jeannie Raharimampiona in Madagascar and Kendra Sikes at MO were assisted by Anne-Elizabeth Wolf at P; to date they have captured over 70,000 specimen records, most of which are geo-referenced, making them useful for GIS analysis. Sikes manages nomenclatural and specimen data and processes collections received from Madagascar, and along with Schatz, M. Lescot (P), and others, has compiled a comprehensive Gazetteer <www.mobot.org/MOBOT/Research/madagascar/gazetteer> of plant collecting localities in Madagascar. Gordon McPherson, Lowry, and Schatz received a three-year NSF grant to conduct a botanical inventory of selected remnant stands of Madagascar's highly threatened and species-rich east coast littoral forests. Johny Rabenantoandro, one of the resident botanists in Madagascar, is coordinating most of the fieldwork, and Soafara Andrianarivelo is responsible for data capture at TAN and TEF.

The project will help identify littoral forest sites that must be conserved to protect the hundreds of species restricted to this highly specialized habitat. In collaboration

with the Garden's Center for Conservation and Sustainable Development, the staff has selected sites for two pilot projects to develop conservation initiatives with the local population, and a Conservation Officer has been hired locally. Schatz and Lowry, in collaboration with A.-E. Wolf and others at P, have completed taxonomic revisions of 11 genera in Madagascar's endemic families, providing a taxonomic framework for threat analyses of the ca. 100 species concerned. Field studies of several genera have been completed by Malagasy graduate students working under the direction of Birkinshaw and faculty of the Université d'Antananarivo. A preliminary analysis of three families has already been published, and ongoing work will lead to the production of a Red Data Book highlighting those groups that are of special conservation importance. A recent grant from the Critical Ecosystems Partnership Fund (CEPF) will allow to expand the analysis to include a representative sample of the entire flora, which will be used to define floristic regions and centers of endemism and to identify Priority Areas for Plant Conservation. The CEPF-funded project is being coordinated by Raharimampiona and Andriambololona; Marina Rabarimanarivo and Noro Ravololomanana are assisting with data entry. A proposal has also been prepared in collaboration with staff at K to establish a new vegetation map of Madagascar using satellite imagery and extensive ground-truthing with field botanists. Birkinshaw has now completed his NGS-sponsored botanical expeditions to the isolated Tsaratanana massif, Madagascar's highest mountain.

Richard Razakamalala is helping with general specimen identification. Richard Randrianaivo is responsible for natural product collecting for the National Cancer Institute and is conducting his graduate studies on the genus *Mimusops* (Sapotaceae). Birkinshaw is working with Fidy Ratovoson and Mamy Andrianjafy (both with a



PHOTO BY DANIEL HARDER

Madagascar has six native species of baobabs, *Adansonia*. Garden researchers have been active on the island since 1972.

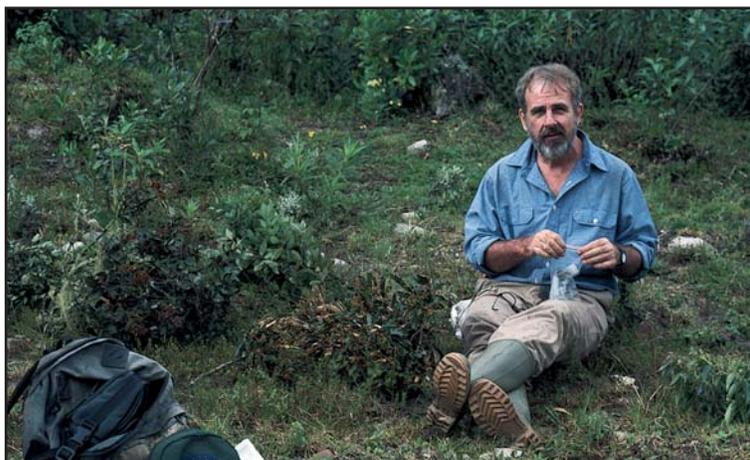


PHOTO BY BRUCE GRAY

Curator Henk van der Werff, Deputy Director of Research, is one of the world's few specialists in Lauraceae, the laurel family, which includes hundreds of species of tropical trees valued for their timber, spices, and fruits. He has described 124 species new to science.

"Diplome d'Etude Approfondie"—a Master's equivalent degree) to coordinate MO's participation in an International Cooperative Biodiversity Group project that involves bioprospecting in areas adjacent to the Zahamena reserve and will produce a florula of that protected area. Hery Andriambolantsoa has assisted with preparing the treatment of the pteridophytes. W. Douglas Stevens, in collaboration with Jens Klackenberg (S), Sigrid Liede (University of Bayreuth), and Michael Gilbert (BM), has completed a treatment of Apocynaceae: Asclepiadoideae for the *Flore de Madagascar*, and James Miller has revised Boraginaceae, with both groups now scheduled for publication. Gordon McPherson is revising three subfamilies of Euphorbiaceae (Phyllanthoideae, Acalyphoideae, and Euphorbioideae) for the *Flore*; Henk van der Werff is treating Lauraceae; Lowry is working on Araliaceae; and Schatz is revising Annonaceae and several other groups, with plans to treat Ebenaceae as well.

Schatz and Lowry have also completed revisions of Malagasy *Buxus* and *Brexia*. Miller's inventory of the Marojejy Massif is nearing completion, with the publication of several new species from the area. Armand Randrianasolo, a former post-doc at MO and Ph.D. student, was promoted to Assistant Curator.

He has finished a series of papers on Anacardiaceae and was appointed Executive Secretary of the newly established IUCN Madagascar Plant Specialist Group. Research activities are conducted under collaborative agreements with TAN, TEF, and ANGAP (the National Association for the Management of Protected Areas). Financial support for the Garden's Madagascar program is provided by the Liz Claiborne and Art Ortenberg Foundation, the John D. and Catherine T. MacArthur Foundation, the National Science Foundation, the Critical Ecosystems Partnership Fund, the National Geographic Society, and LWO, Inc. The Garden's activities in Madagascar aim to generate high-quality collections from critically under explored areas, to

contribute to conservation planning and implementation by identifying priority areas for plant conservation and highly threatened species, and to assist and train Malagasy scientists and students. Requests for plant material or additional information should be directed to Schatz at MO, or to Lowry at P (Laboratoire de Phanérogamie, Muséum National d'Histoire Naturelle, 16 rue Buffon, 75005 Paris, France).

Tanzania: The three-year integrated training program run by MO, in collaboration with the National Herbarium of Tanzania (NHT), was completed in January 2000. The training program, which included the development of a network of resident collectors throughout the country and in-service training for the country's botanists, was started with support from the John D. and Catherine T. MacArthur and the Liz Claiborne and Art Ortenberg Foundations and coordinated by Peter B. Phillipson (GRA), then on leave to MO. Roy Gereau participated in the training activities, providing instruction in plant identification and field techniques. Gereau has completed his phytogeographic study of the Lake Nyasa Climatic Region, and an annotated checklist of the plants of the region is now ready for publication in a forthcoming volume of the *Monographs in Systematic Botany from the Missouri Botanical Garden* series.



PHOTO BY PETER PHILLIPSON

Garden botanist Roy Gereau (center) and staff of the National Herbarium of Tanzania conduct a workshop in plant identification and herbarium techniques for local plant collectors.

A floristic checklist of the Gombe National Park will be published in the same volume of the *Monographs* series. This project will be in collaboration with D. Anthony Collins, Research Director at Gombe National Park, Gereau, Frank M. Mbago (DSM), and training program alumni Grace Gobbo and Canisius Kayombo. This checklist is based on a vegetation survey of the park that they conducted as part of a long-term study of habitat utilization by chimpanzees and baboons, in collaboration with Anne Pusey and Craig Packer of the University of Minnesota. In collaboration with NHT and an extensive network of Tanzanian and international institutional partners, Gereau and Lowry are planning plant inventory and conservation assessment projects in key areas throughout the country, including the Albertine Rift area of western Tanzania, the Eastern Arc mountains, and the remnant coastal forests.

North America

Flora of North America: The *Flora of North America* is a collaborative project to provide information in printed and electronic form on the vascular plants and bryophytes growing spontaneously in North America north of Mexico. Four volumes—an introduction, the ferns and gymnosperms, the first 32 families of dicots, and the first of five

volumes covering the monocots have already been published. This information with many additional files and links to other sites is available at <hua.huh.harvard.edu/FNA/families.html>. Volume 22 was published in March 2000 and contains treatments for 30 families of monocots with 89 genera and 423 species; 174 (41%) of the species are endemic to the flora area and 71 (17%) are introduced species. Plant groups in Volume 22 include palms, aroids, banana- and ginger-relatives, rushes, bromeliads, duckweeds, and many other important groups of aquatic monocots. *Flora of North America* Volumes 26 (Liliales and Orchadales) and 23 (Cyperaceae) are being finalized for publication. In the second half of 2002, treatments based on original observations, as well as a critical evaluation of existing literature, are being written by specialists throughout the world. The Garden is one of several editorial centers for the Flora in the U.S. and Canada. Altogether, more than 30 U.S. and Canadian institutions participate in the project.

James L. Zarucchi is Managing Editor at the Flora of North America office at the Garden. Claire Hemingway is working as FNA Technical Editor in St. Louis, and Doug Harrison, Pat Harris, and Lois Ganss assist part-time with manuscripts. Yevonn Wilson-Ramsey continues as Art Director on a part-time basis, and Barbara Alongi, Bee Gunn, John Myers, Libby

Zimmermann, and Susan Reznicek are contributing illustrators.

The FNA Editorial Center for Bryophytes will be established at the Garden, and Richard H. Zander and Patricia M. Eckel will complete their assigned treatments of North American bryophyte genera for FNA. Zander will continue to be the Lead Editor for the Bryophytes volumes for *Flora of North America*.

Research Associate Richard C. Keating is working on an illustrated field manual of the Spanish peaks region in Huerfano and Animas Counties, Colorado; the geological history of the region will be contributed by Gordon N. Keating of Los Alamos National Laboratory. R. Keating is also working on an illustrated guide about the history and natural history of Pere Marquette State Park, Jersey County, Illinois. The guide will also include the upland flora prepared by Alice DeJarnett, a former graduate student at Southern Illinois University-Edwardsville.

Missouri: The *Flora of Missouri* project, an ongoing effort to update and compile information on the state's flora, is jointly sponsored by the Missouri Botanical Garden and the Missouri Department of Conservation. One of its main goals is a three-volume revision of former MO curator Julian A. Steyermark's *Flora of Missouri*, first published in 1963. Information from the 1990 *Catalogue of the Flora of Missouri*, published in the *Monographs in Systematic Botany from the Missouri Botanical Garden* series, has been computerized and is updated regularly. The 586 plates of new art prepared for the *Flora* were computerized in 1996. An expanding database of specimen label data for use in preparation of county dot maps presently contains about 95,000 records from MO and other Missouri herbaria. In late February 1999, the project reached a milestone with the publication of Volume 1 of the revised Steyermark's *Flora of Missouri*, which includes the introductory chapters and treatments of nearly 800 species of

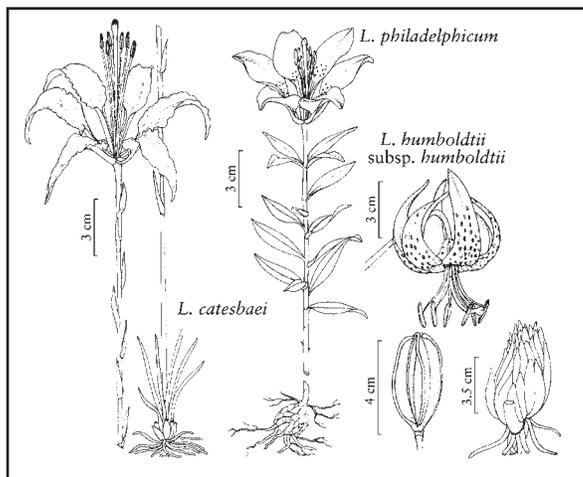


ILLUSTRATION BY YEVONN WILSON-RAMSEY

Partial plate of *Lilium* from the upcoming *Flora of North America*, Volume 26.



PHOTO BY GEORGE YATSKIEVYCH

Lilium philadelphicum (Liliaceae) was recently rediscovered in Missouri, 160 years after the last known collections in the late 1840s.

pteridophytes, conifers, and monocots. This volume was published by the Missouri Department of Conservation in collaboration with the Missouri Botanical Garden Press. The remaining two volumes, which will include treatments of the dicot families, will follow in about three years. In contrast to the first volume, Volumes 2 and 3 will include selected treatments by outside contributors. Botanists continue to increase MO's holdings of the state's flora by about 5,000 specimens per year.

The *Flora of Missouri* project is directed by George Yatskievych. He is assisted by David Bogler and Kathleen Wood. Kathleen Wood is working as a project assistant for the *Flora*, and before that, she volunteered for George Yatskievych, starting in August 1997. Nancy Parker and Research Associate Bill Summers continue to volunteer their services to the project.

Mesoamerica

Flora Mesoamericana:

Gerrit Davidse, Co-editor, directs the Garden's participation in this project. The *Flora Mesoamericana* project is an international collaborative program organized by the Missouri Botanical Garden (MO), the Universidad Nacional Autónoma de México (MEXU), Mario Sousa S., Co-editor, and the Natural History Museum (BM), London, Sandra Knapp, co-editor.

Mesoamerica is defined by the project to include all the Central

American republics (Panama, Costa Rica, Nicaragua, El Salvador, Honduras, Guatemala, Belize) and five Mexican states east of the Isthmus of Tehuantepec (Chiapas, Tabasco, Campeche, Yucatán, and Quintana Roo).

Cooperative planning and participation of Mesoamerican botanists are major features of the project. The *Flora Mesoamericana*, one of the largest synoptic Floras ever attempted, is being published in Spanish by Universidad Nacional Autónoma de México in seven volumes and on the World Wide Web in a non-book format with individual pages for each Mesoamerican vascular plant name. These pages are linked to other names, descriptions, keys, illustrations, voucher specimens, maps, and other databases, as appropriate. Images of Mesoamerican plants, including many type images, also appear on the project's Websites. In addition to its richer content, the electronic version is updated as new data become available and, therefore, slowly advances beyond the printed volumes. See the *Flora Mesoamericana* home page for more details

<www.mobot.org/MOBOT/FM>.

In 1994, Volume 6 was published in Mexico City. This volume covers about 40% of the monocots, including Poaceae, Cyperaceae, Bromeliaceae, and most aquatic monocot families. Volume 1, dealing with the ferns and fern allies, was co-edited by

Ramón Ribat† (UAMIZ) and Robbin Moran (NY) and published in 1995. Manuscripts for Volume 4, dealing with 34 families of dicots, are still being received from contributors and are being edited and translated. However, completed treatments of these dicot families are being published on the Web as they are finished prior to the publication of the volume. Also, many other families pertaining to other volumes are actively being worked on, and a number of these families have been completed and published on the Web. The most recently published families are Alzateaceae, Basellaceae, Bataceae, Brunelliaceae, Clethraceae, Combretaceae, Cornaceae, Ebenaceae, Garryaceae, Gunneraceae, Hamamelidaceae, Mitrastemonaceae, Myricaceae, Nyssaceae, Oleaceae, Platanaceae, Plumbaginaceae, Polemoniaceae, Primulaceae, Punicaceae, Quiinaceae, Rhizophoraceae, and Styracaceae.

Other *Flora Mesoamericana* staff members include Fred Barrie, who is based at the Field Museum (F) and works as an Associate Editor and Contributor. Robert L. Dressler, based at the University of Florida in Gainesville (FLAS), works on the largest family in the *Flora*, the Orchidaceae. Jeany Davidse is the Project Coordinator and among other activities, she places the completed treatments on the Web and creates the numerous links related to information. She also works on many type collections,



PHOTO BY GERRIT DAVIDSE

Chusquea subtessellata (Poaceae) flowering in the high paramo of Costa Rica.



John Pruski, Assistant Curator, a new staff member for the *Flora Mesoamericana* project, will continue to work with the generic treatments of the sunflower family, *Compositae* (or *Asteraceae*).

continues databasing nomenclature and *exsiccatae* records, and does the general processing of newly acquired collections. Teri Bilsborrow, in preparation for imaging, has databased and verified most of the Mesoamerican type collections at MO and has also contributed many *exsiccatae* records. *Exsiccatae* records from the herbarium are systematically entered as part of the effort to update the computerized checklist of accepted species. Based on MO specimens, she has recently completed recording label data from at least one specimen for each country and each of the five Mexican states for all Mesoamerican species. With input from the entire MO team, *exsiccatae* databasing will now shift to more fully document the distribution of all Mesoamerican species with as much detail as possible, especially emphasizing those specimens with detailed locality data and geographical coordinates. A new project that has just been implemented in early 2002 is to voucher each accepted Mesoamerican species with an image of a good herbarium specimen. These images will supplement other kind of illustrations such as field photographs of living plants and line drawings, but in some cases will be the only visual representation of a species. We have begun with sedges and grasses.

John Pruski, formerly of the Botany Department of the Smithsonian Institution (US), has

joined the Garden staff as an Assistant Curator and is a specialist in the *Compositae* (sunflower family or *Asteraceae*). He coordinates, edits, and writes treatments of *Compositae* genera for the *Flora*. He also works on the Web version of the *Flora* <www.mobot.org/MOBOT/FM>.

The *Compositae* in Mesoamerica are represented by more than 1000 species. Fourteen of the 15 tribes present in tropical America are found in Mesoamerica. Dozens of specialists are contributing treatments to the flora, about 28 generic treatments have been written by Pruski or submitted to him by contributors. Identifications by Pruski of expedition material have resulted in detection of two genera and several species that are newly reported in Central America. The two generic additions are *Riencourtia* (formerly known only from South America) and the largely African genus *Crassocephalum* (formerly known only in the Americas from the West Indies). Although the coordination of the *Compositae* flora is just beginning, it is anticipated that in the next year all submitted manuscripts will be reviewed, edited, and translated into Spanish. Additionally, it is planned that treatments of two smaller tribes will be completed by Pruski.

The project has four very dedicated volunteers who specialize in the indicated areas of the database: Virginia G. Laschober (types, synonymy, distribution); John

S. Skinner (nomenclature, types); Bruce Phillips and Shirley Anton (*exsiccatae* records).

Nicaragua: Olga Martha Montiel coordinates the Garden's continuing activities in Nicaragua, where the work is ongoing on several fronts. W. Douglas Stevens, Olga Martha Montiel and Robert Magill are working on the analysis of the conservation status of the Nicaraguan flora. The work is based on the data accumulated during the preparation of the published *Flora de Nicaragua*. The conservation analysis, like the *Flora* itself, will be unique and comprehensive. A project to publish an illustrated manual of the ferns of Nicaragua is underway. It will treat about 600 species of ferns known from Nicaragua. The manual is being prepared by Alba Arbeláez.

Costa Rica: Barry Hammel and Michael H. Grayum coordinate the Garden's program in Costa Rica. The main goals of the program are to collect in poorly known areas, computerize plant collection records, and prepare a Spanish-language field guide, the "Manual de Plantas de Costa Rica" in collaboration with researchers from the Herbario Nacional de Costa Rica (CR) of the Museo Nacional, and the Instituto Nacional de Biodiversidad (INB). The Manual will comprise five volumes, 1 and 2 for monocots and 3 to 5 for dicots. Volumes 1 and 2 (Monocotyledons) will be published later this year or early in 2003. Carmen Ulloa Ulloa assists with scientific editing, and Mary Merello, Project Coordinator, works with the plant collections, updates the database, and helps with family treatments.

The offices of the project are currently located at INB. Silvia Troyo continues working full-time on illustrations for the Manual, preparing at least one diagnostic drawing per genus. Cecilia Herrera edits text and translations. Nelson Zamora, Head of the Department of Botany at INB, and Jorge Gómez-Laurito of the University of Costa Rica are important contacts

South America

and major collaborators in Costa Rica. Alfredo Cascante and Joaquín Sánchez of the Museo Nacional are collaborating, as are all curators at INB. Costa Rican botanists continue to visit MO and consult the library and herbarium to supplement and advance their treatments and contributions to the Manual. Alex Rodríguez (INB) visited MO earlier this year to work on his Asteraceae, Passifloraceae and Urticaceae treatments.

Among the most exciting discoveries that have come to light within the past year, though still incompletely resolved, two are worthy of mention here. One is a new species of Anacardiaceae, closely related to, if not *Tapirira* with small peltate scales! This, apparently, would be the first New World species in the family with such scales. Collections of this entity had been misidentified by Manual collaborators as *Tapirira myriantha* ever since it was first collected on the Osa Peninsula in 1990. The other find is a species of Marcgraviaceae from the Pacific slopes of the Cordillera de Talamanca, found in conjunction with work done in the Río Savegre drainage. This one, a probable new species of *Ruyschia*, is perhaps closely related to the Peruvian *R. pavonii*. If indeed it is new, it will be the first new species described in that genus from Costa Rica in over 60 years.

World Wide Web products of the Manual project, including a checklist with color images of most families and a specimen database with dot maps, a quarterly newsletter, a gazetteer, and sample treatments can be accessed at <www.mobot.org/manual.plantas>. The quarterly newsletter, "The Cutting Edge," edited by Michael Grayum, Barry Hammel, and Nelson Zamora, provides updates about the state of the project and is available at <www.mobot.org/MOBOT/research/Edge/welcome.shtml>. See also the Manual's home page at INB, <www.inbio.ac.cr/papers/manual_plantas/index.html> where most of the monocot draft treatments (all under Volume I) are presented.

Argentina: The cooperation and exchange of information between the Missouri Botanical Garden and the National Council for Scientific and Technological Research of Argentina (CONICET) for the study of the flora of Argentina continues according to the terms of the agreement of scientific cooperation signed by the two institutions. This agreement was made possible through the interest and enthusiasm of the late Armando Hunziker (CORD), former director of the Flora of Argentina program; currently, this project is under the direction of Ana M. Anton. Fernando Zuloaga (SI) and his collaborators have prepared a computerized floristic checklist of the vascular plants of Argentina. This initiative began as a joint project of the Instituto de Botánica Darwinion and the Missouri Botanical Garden. The checklist is a published catalogue and a permanently maintained and routinely updated computer database at the principal herbaria in Argentina. The *Catálogo de la Familia Poaceae en la República Argentina*, the first volume of the *Catálogo de las Plantas Vasculares de la República Argentina*, was published in 1994, and the second volume containing the pteridophytes, gymnosperms, and monocots appeared in 1996. The third and

final installment of the catalogue, a two-volume set containing the dicots, was published in June 1999. Zuloaga has now begun, also as a joint project with the Missouri Botanical Garden, a checklist for the Southern Cone (Argentina, Chile, Paraguay, Uruguay, and southern Brazil), a massive collaboration of institutions from the countries involved; so far, more than 150 families have been updated and entered in the database of this project. Robert Magill assists in the coordination of the project from St. Louis.

Bolivia: The general floristic inventory of Bolivia, initiated in 1981, continues in close cooperation with a variety of Bolivian institutions. In February 2001 Steve Churchill took up residence in Santa Cruz, where he continues the Garden's collaboration with the Museo Noel Kempff Mercado (USZ). Churchill collects bryophytes in Bolivia, as part of the ongoing moss flora of the Andes, a project funded by the National Science Foundation. An important priority for Churchill is to collect vascular plants, as well as bryophytes, in major regions of Bolivia. In addition, emphasis is being placed on training for Bolivian students, helping them to develop thesis projects (which have been supported in part by Liz Claiborne



PHOTO BY JAMES SOLOMON

In Bolivia, the Garden's resident botanist collaborates with local institutions to carry out explorations, floristic studies, and a botanical training program. Shown: *Puya raimondii* (Bromeliaceae), Cerro Comanche, Bolivia.

and Art Ortenberg Foundation) and taking them along in the field. Luzmila Arroyo, a Bolivian scientist who finished her Master's degree at the University of Missouri-St. Louis in the Fall of 2000, coordinates the training program in Bolivia. Her other activities include an inventory of two lowland forest plots, one each in Cochabamba and Santa Cruz, and directing and preparing a florula for the cerrado region of Huanchaca.

A recent focus for field activities is the Madidi region covering the National Parks Madidi, Pilón Lajas, and Apolobamba and surrounding areas. The area is located on the northeastern side of the Andes and the adjacent alluvial plain of northern Bolivia in the Department of La Paz. The Madidi region includes the juncture of four biogeographical regions. To the north and northwest are the humid forests of the southwest Amazon/Tambopata region that includes most of southern Peru. To the west, the Peruvian montane forest has a varied topography that supports formations ranging from rain forest to elfin cloud forest. To the east and southeast, the Bolivian Yungas and Chapare regions are similarly diverse, with a super-humid climate. The ecosystems to the northeast are characterized by vast expanses of open savannas crossed by corridors of gallery forest. The National Herbarium (LPB) is collaborating on the inventory, and an office has been established in the National Herbarium. Peter M. Jørgensen and

Steven Churchill direct the project, but the project is largely being executed by Renate Seidel, Narel Paniagua, and Alfredo Fuentes, with participation of Carla Maldonado, Alejandro Araujo, Víctor Cardona, Alfredo Bascopé, and Diego de la Quintana.

Catalogue of the Vascular Plants of Bolivia: In early 1999 the Garden signed an agreement of scientific cooperation with the Herbario Nacional de Bolivia (LPB), the Herbario Nacional Forestal Dr. Martín Cárdenas (BOLV), and the Museo Noel Kempff Mercado (USZ) to produce a checklist of the vascular plants of Bolivia following the successful model employed for the Ecuador checklist. Mike Nee (NY) will play a significant role in the project, along with Stephan Beck, Mónica Morães, Xenia Villavicencio (LPB), Susana Arrázola (BOLV), and Mario Saldías (USZ). Peter M. Jørgensen coordinates the project, with the assistance of Luzmila Arroyo. A large number of Bolivian botanists participate in the project, which is funded by a grant from the Andrew W. Mellon Foundation. A Web version of the catalogue is also planned.

Chile: The Garden is collaborating with the Universidad de Concepción (CONC), Chile, the National Herbarium of Chile (SGO), the Botanische Staatssammlung of Munich, Germany, and the Ohio State University in the preparation of

the *Nueva Flora de Chile*. This work will cover the vascular flora of that country. The flora of Chile has a remarkably high degree of endemism in several biogeographically unusual continental areas: the Atacama desert in northern Chile is one of the world's driest deserts; the central zone of Chile, with its Mediterranean climate, is unique in South America; and wet, cool, temperate southern Chile is home to ancient forests where relictual groups from Gondwanaland still grow.

The *Nueva Flora* revises a work completed in 1854 and will be written with the help of more than 40 collaborators from around the world. Two volumes have already been published: Volume 1 (1995) includes introductory chapters on the history of collecting, biogeography, ecology, and evolution of the Chilean flora, plus taxonomic treatments of the ferns and gymnosperms; and Volume 2 (2001) presents taxonomic treatments of the first set of dicot families, the Magnoliidae. Charlotte Taylor coordinates the Garden's involvement in this project.

Colombia: The Garden's activities in Colombia are coordinated by Olga Martha Montiel, assisted by Rosa Ortiz. The Garden has inventories underway at several sites in Colombia, some of which were begun by the late Al Gentry. Colombia comprises a wide variety of ecosystems including dry, near-desert formations, seasonally moist forest, rain forest, edaphically dry zones, and montane forests. The Garden's current efforts are concentrated on particular, representative sites. These include the Bajo Calima Region in western coastal Valle Department, in collaboration with Myriam Monsalve (CUVC) and the Río Escalarete Reserve, where an inventory is being conducted by Wilson Devia (TULV) and Charlotte Taylor with support from the National Geographic Society. Although these sites are only a few dozen kilometers apart, they share only about 65% of their plant species. The two sites are located in the Chocó biogeographic region,



PHOTO BY CHARLOTTE TAYLOR

Chile, the Andes near San Pedro de Atacama.

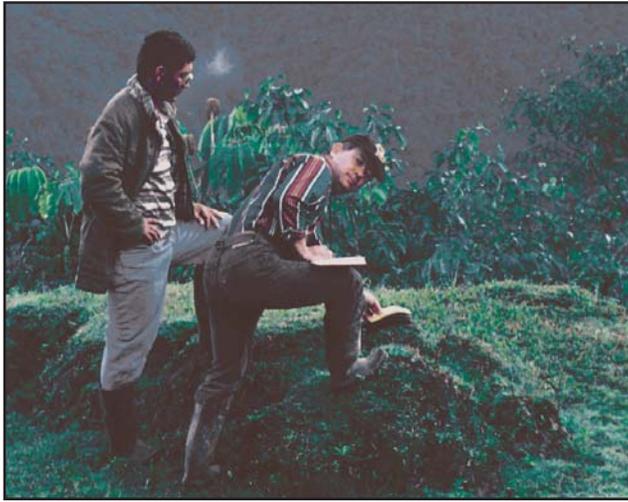


PHOTO BY CHARLOTTE TAYLOR

Colombian botanists Juan Adarve (left) and Wilson Devia (right) of the Tuluá Botanical Garden in the mountain forests near El Cairo in the western Andes of Colombia.

one of the least known and least studied regions of South America. Their checklists are being put up on the Web

<www.mobot.org/MOBOT/Research/southamericaprojects.shtml>, family by family, as they are compiled. The Garden also continues working on identifications of collections from La Planada Reserve in the mountains of southwestern Colombia.

Checklist of the Department of Antioquia: Currently, the Garden, in collaboration with the University of Antioquia and the Antioquia Herbarium (HUA), is preparing an Annotated Checklist for the Vascular Plants of the Department of Antioquia in the northwestern part of the country. Ricardo Callejas (HUA) and Olga Martha Montiel direct the project, assisted by Rosa Ortiz and Alvaro Idárraga (HUA). The Garden also continues more general collaboration with botanists from institutions throughout the country.

Ecuador: In collaboration with the National Herbarium (QCNE) of the Ecuadorian Museum of Natural Sciences in Quito, the Garden is carrying out an intensive program of botanical inventories, development of the QCNE herbarium, and professional training of Ecuadorian botanists and conservation biologists. An Ecuadorian non-profit

conservation and research organization, the Jatun Sacha Foundation, also collaborates with the Garden on several projects. The program in Ecuador is coordinated by David Neill.

In mid-2002, botanists from the Garden and National Herbarium of Ecuador, together with zoologists from the Wildlife Conservation Society, initiated a 2-year training program in conservation biology and natural resources management for representatives of two indigenous ethnic groups in Ecuador. Four Awá and four Shuar are participating in the conservation biology training program, which includes hands-on instruction in carrying out floristic and faunal surveys, wildlife and forest management, evaluation of environmental impacts, use of geographic information systems and other information tools for conservation planning, and development and implementation of community-level natural resource management plans. The Awá-Shuar training program is supported by the Liz Claiborne and Art Ortenberg Foundation, which also supports a program of applied research and extension in agroforestry at the Amazon Plant Conservation Center and Ishpingo Botanical Garden, located at the Jatun Sacha Biological Station in Amazonian Ecuador.

The Garden is also carrying out an extensive program of floristic inventories in the Cordillera del Cóndor region along the Ecuador-Peru border, in collaboration with the National Herbarium, the University of Loja herbarium, and the Shuar Federation. This work was supported by a grant from the National Geographic Society during 2000–2002, and will continue in future years.

The flora of the sandstone table mountains of the Cóndor region includes many local endemic plants as well as some genera that are disjunct from the sandstone *tepui*s of the Guayana Highlands of southern Venezuela. Botanists from the Jatun Sacha Foundation and the Shuar Federation are carrying out botanical inventories in the Cordillera de Cutucú, located to the north of the Cóndor region.

The QCNE herbarium continues to grow rapidly in number of collections and now exceeds 165,000 mounted specimens; in 2002, QCNE received the botanical specimens and part of the library of Ecuador's former forestry department herbarium, QAME.

A number of Ecuadorian botanists are technical staff members of the National Herbarium: Mercedes Asanza, Ximena Aguirre, Carlos Morales, and Museum employees Efraín Freire, Elsa Toapanta, and María de los Angeles Simbaña. Inés Padilla and Mercedes Asanza recently published a color guide to the cultivated trees and shrubs in Quito. Botanists and foresters are staff members of the Jatun Sacha Foundation: Walter Palacios, Linder Suin, Milton Tirado, Juan C. Ronquillo, Nixon Revelo, and Angel Alvarado. Fernando Nicolalde left Jatun Sacha for a fellowship at The New York Botanical Garden. Jatun Sacha also now administers the Ecuador Conservation Data Center (CDC), which includes staff botanists Marcia Peñafiel and Germán Toasa. Volunteer Penny Steffen helps entering data of Ecuadorian types.

Paraguay: A consortium of five Paraguayan institutions and the

Missouri Botanical Garden is developing the *Inventario Biológico de Paraguay*. This project provides a unique opportunity to develop an understanding of Paraguayan biodiversity as a solid basis for conservation. The Inventory will consist of a comprehensive database of the plants and animals of Paraguay that includes all existing information on the nearly 350,000 specimens of flora and fauna housed primarily at natural history museums outside Paraguay. The database, which will incorporate Geographic Information System features, will be made available on the Internet and published as a printed catalogue. The five institutions with which the Garden collaborates are the National Museum of Natural History of Paraguay-DIB/MNHN (PY) of the Secretariat of Environment, the School of Chemical Sciences (FCQ), the School of Exact and Natural Sciences, the School of Postgraduate Studies of the National University of Asunción, and the Botanical Garden and Zoo (AS) of the Municipality of Asunción. Elsa Matilde Zardini coordinates activities for the Garden's program in Paraguay, where she resides. The institutional coordinators for the *Inventario Biológico de Paraguay* are Isabel Basualdo (General Coordinator; see Research Associates), Reinilda Duré Rodas (PY), Fátima Mereles (FCQ), Bonifacia Benítez (School of Exact and Natural Sciences), Lidia Pérez de Molas and Darío Pérez Chena (Postgraduate Studies), Blas Rafael Pérez Maricevich and Germán González Zalema (AS), and Isabel Gamarra de Fox and John Kochalka (Fauna, National Museum).

The Checklist of Vascular Plants of Paraguay by the consortium of Paraguayan institutions mentioned above and the Garden will be available soon on the Internet through the Garden's W³TROPICOS. Nélida Soria (FCQ) is ready to start entering Asteraceae data into TROPICOS from Paraguay; and data from TROPICOS helped Lidia Pérez de Molas to write a thesis about the management plan for Acahay Massif with which she obtained a Master's degree from the

European Union with the highest distinction. Robert Magill advises and provides scientific help for the checklist project from St. Louis.

The National Geographic Society and collaborating institutions support collecting activities in Paraguay, most recently in the proposed Biosphere Reserve "Gran Chaco Americano" these include fauna studies under the coordination of Isabel Gamarra de Fox and a project to catalogue the bryophytes. María Teresa Florentín Peña (PY) and Steve Churchill are collaborating on the later project which is supported by The Nature Conservancy.

In St. Louis, the coordinator for the Paraguay project is Tatyana Shulkina.

Peru: The Peru project, funded primarily by the Andrew W. Mellon Foundation and the John D. and Catherine T. MacArthur Foundation, is focused both on the completion of the Flora of Peru and on detailed floristic surveys of important biological reserves. It is directed by Assistant Curator Rodolfo Vásquez from his base in Oxapampa (Pasco Department). Vásquez is currently working on the "Flora del Río Cenepa, Amazonas, Perú" in collaboration with researchers from Perú, Venezuela, and the U.S.A.. In collaboration with Rocío Rojas, he is finishing a virtual flora of Peruvian Amazonia, a document that will include 1,200 full-color pictures. Starting this year, Vásquez and Peruvian botanists Rocío Rojas, Abel Monteagudo, Luis Valenzuela, and Washington Galiano, from the Universidad Nacional San Antonio Abad del Cusco, are running a project on the floristic diversity of five Protected Natural Areas from southern and central Amazonian Peru: Yanachaga-Chemillén National Park, San Matías-San Carlos Protected Forest, Yanasha Communal Reserve (all in Central Amazonian Peru); Machu Picchu Historical Sanctuary and Vilcanota-Urubamba Valley (both in the Cusco Department), and Cusco Amazónico Ecological Reserve (Madre de Dios Department).

This ambitious project includes three programs: training of undergraduate students and young scientists in botany, ecology, and conservation; development of strategies for sustainable development; and exploration in basic botany and ecology.

The Peru program works thanks to agreements that the Missouri Botanical Garden has with the Universidad Nacional Mayor de San Marcos, Lima, Universidad Nacional de Trujillo, Trujillo, and the Universidad Nacional San Antonio Abad del Cusco, Cusco. Additionally, the Garden is about to sign agreements with the National Institute of Natural Resources (INRENA) and with local NGO's in order to implement the Machu Picchu Biological Reserve. Jon Ricketson coordinates the Peru project in St. Louis with the aid of volunteer Mary Bard.

Venezuela: The *Flora of the Venezuelan Guayana*, initiated by the late Julian A. Steyermark, is the main focus of the Garden's activities in Venezuela. It is directed by Paul Berry (WIS), and Kay Yatskievych is the Coordinating Editor at MO. The third editor is Bruce Holst (SEL). Also contributing family or generic treatments to the series are over 200 specialists from 23 states and Washington, DC, in the U.S.A. and 22 other countries. Volume 1, the Introduction, and Volume 2, which includes all pteridophytes and the first 11 families of the seed plants, were published by Timber Press in Fall 1995 and reprinted by Missouri Botanical Garden Press in July 1999. MBG Press also published four succeeding volumes: Volume 3 in May 1997, Volume 4 in February 1998, Volume 5 in July 1999, and Volume 6 in February 2001. Volume 7 is expected to go to press sometime near the end of 2002. The series will consist of a total of nine volumes. Habit drawings of nearly 5,000 of the 9,400 species in the flora have been completed by Bruno Manara. Volunteer Shirley Flavin is scanning the drawings. Volunteer George Thornburgh helps with all aspects of

editing and preparing the final camera-ready copy for publication. In addition to their editorial duties, Berry, Yatskiyevych, and Holst are also contributing treatments of various families to the *Flora*. The Venezuelan Guayana is the subject of the Garden's 2002 calendar insert.

Asia

The Department of Asian Botany was recently created, and it will coordinate our activities in Asia, including the *Flora* of China, the *Flora* of Pakistan, the Vietnam project, and eventually New Caledonia. Ihsan Al-Shehbaz has been appointed Head of this Department.

Flora of China: The Missouri Botanical Garden is the coordination center for the *Flora of China*, a project to publish a revised flora in English for the first time. The joint Editorial Committee, co-chaired by Wu Zhengyi (Kunming) and Peter H. Raven, met August 27–28, 2001, at the Kunming Institute of Botany, Yunnan, China. The non-Chinese members of the committee met in Paris in January 2002, and will meet again in St. Louis in December. The next joint Committee meeting will take place in Kew, United Kingdom, in May 2003. The *Flora* is written by Chinese authors in direct collaboration with taxonomic authorities outside China. Guanghua Zhu replaces Ihsan as Project Co-director for *Flora of China* (along with the other Co-director Yang Qiner in Beijing). Information about the approximately 30,000 species of Chinese vascular plants from the *Flora of China* Website, which is maintained at Harvard, can be reached at <flora.huh.harvard.edu/china>. Four project centers were established in China at the Institutes of Botany in Beijing, Kunming, Guangzhou, and Nanjing, and six editorial centers were set up at Harvard University, the California Academy of Sciences, the Smithsonian Institution, the Royal Botanic Gardens at Edinburgh and at Kew, and the Missouri Botanical Garden. A seventh center at the

Muséum National d'Histoire Naturelle, Paris, was added in 1999. Science Press (Beijing) and Missouri Botanical Garden Press are the co-publishers. A total of 25 volumes of text and 25 of illustrations is planned. The first volume published was Volume 17 (Verbenaceae through Solanaceae) in 1994, followed by Volume 16 (Gentianaceae through Boraginaceae) in 1995, Volume 15 (Myrsinaceae through Loganiaceae) in 1996, Volume 18 (Scrophulariaceae through Gesneriaceae) in 1998, Volume 4 (Cycadaceae through Fagaceae) in 1999, Volume 24 (Flagellariaceae through Marantaceae) in 2000, Volume 8 (Brassicaceae through Saxifragaceae) in 2001, and Volume 6 (Caryophyllaceae through Lardizabalaceae) in 2001. Volume 9 (Pittosporaceae through Connaraceae) will appear in late 2002 and Volume 5 (Ulmaceae through Basellaceae) will appear in 2003. For the *Flora of China* Illustrations, Volumes 17 (1998), 16 (1999), 15 (2000), 18 (2000), 4 (2001), and 24 (2002) have been published so far. Volume 8 will appear in 2003.

On June 3–4, 2002, Michele Funston, George Yatskiyevych, and Nicholas Turland attended the first meeting of the *Flora of China* Pteridophyte Subcommittee in Beijing. This Committee will coordinate the production of the three Pteridophyte volumes for the *Flora* (Volumes 1–3),

which are scheduled for publication in 2009. After the meeting, Funston gave an invited lecture at Wuhan University, Hubei Province, while Yatskiyevych and Turland traveled to Kunming to make a short field trip to northwestern Yunnan Province. The primary goal was for Yatskiyevych to study populations of *Boschniakia himalaica* (Orobanchaceae), a root-parasite of *Rhododendron* (Ericaceae) species.

Guanghua Zhu directs the project and edits the *Flora of China Illustrations*. Nicholas Turland coordinates production of the text volumes and he, Anthony Brach (Harvard University Herbaria), Robert DeFilipps (US), and Orbélia R. Robinson (CAS) are editorial assistants. Michael Gilbert (The Natural History Museum, London), is the project's European coordinator. Rosemary Tanaka provides valuable support to the project, especially in the formatting and production of the camera-ready copy of the volumes. Ihsan Al-Shehbaz, Bruce Bartholomew (CAS), David E. Boufford (A), Joël Jérémie (P), W. John Kress (US), Simon J. Owens (K), Peter H. Raven, Mark Watson (E), and Guanghua Zhu are the non-Chinese members of the Editorial Committee. All systematists who are interested in working on various plant groups for the *Flora of China* project should feel welcome to contact Nicholas Turland (tel.: 314-577-0269; fax: 314-577-9438; e-mail:

PHOTO BY TRENT FOITZ



In addition to his work as the Head of the Asia Department, Senior Curator Ihsan Al-Shehbaz studies the systematics and evolution of Brassicaceae, the mustard family, on a worldwide basis. He has described more than 70 species and 10 genera new to science.



PHOTO BY DAVID BOUFFORD

Li River, Guilin, Guangxi Province, China.

nicholas.turland@mobot.org).

Flora of China Checklist: The Flora of China Checklist project will provide a computerized synopsis of the almost 30,000 species of ferns and seed plants known from China. The Checklist will contain information on accepted species and recognized infraspecific taxa. These data include the place of publication for accepted taxa, synonyms appropriate for the Chinese flora, and location where accepted names of species appear in published volumes of both the *Flora Republicae Popularis Sinicae* and the English-language *Flora of China* (as applicable), as well as other relevant bibliographic sources. Searches of the *Checklist* can be made at <mobot.mobot.org/W3T/Search/foc.html>. Also included will be the status of species and infraspecies in China (native, endemic, introduced, naturalized, cultivated), their provincial distribution and altitudinal ranges within China and, for non-endemic taxa, their occurrence in countries neighboring China and distribution outside Asia, as well as pertinent notes. Michele Funston is the coordinator of the *Checklist*, and Candy McCandliss provides editorial and multilingual data entry support to the project.

Flora of Pakistan: In early 2000, the Missouri Botanical Garden joined the University of Karachi as co-publisher of the *Flora*

of *Pakistan*, a project begun in 1968 and now nearly 85% complete. Support from the NSF and the Andrew W. Mellon Foundation has made possible the publication of six volumes during the past two years (Iridaceae, Salicaceae, Chenopodiaceae, Polygonoaceae, Cyperaceae, and Asteraceae(I)-Anthemideae), treating some 530 species in 103 genera (951 pages total; all volumes available from the MBG Press). Work on the remaining nine families still unpublished (ca. 12% of all species in *Pakistan*, including the large families Rosaceae, Scrophulariaceae, and the rest of Asteraceae), will be completed within three years by specialists from *Pakistan* and abroad, under the editorial guidance of S. I. Ali and M. Qaiser. A Website for the project <www.mobot.org/MOBOT/research/pakistan> includes information about *Pakistan* and the *Flora* project, as well as access to an electronic floristic database. At this time, only recent volumes are available in this searchable database, but we are seeking additional resources to enable project personnel to scan and database all previously published volumes of the *Flora*. Peter Hoch coordinates Garden participation in this research effort.

Vietnam: The Garden continues to collaborate with the Institute of Ecology and Biological Resources (IEBR) in Hanoi to promote botanical research on the flora of *Vietnam*. In 2001, the Garden received funding from the Henry Luce Foundation to implement a four-year "Integrated Conservation and Training Program" in *Vietnam*. Assistant Curator Jack Regalado, who succeeded Dan Harder, is the new resident staff botanist and coordinator of this program, and Sharon Bodine assists him in St. Louis. The integrated training program will provide multi-tiered instruction for scientists, technicians, students, and forest protection officers in the use of critical botanical information—work that supports initiatives by the Vietnamese government and conservation NGO's to safeguard the country's rich biodiversity. Three other partner institutions, the Institute of Materia Medica (IMM), the Department of Botany of the Vietnam National University (VNU), and the Forest Inventory and Planning Institute (FIPI), have joined the program. By strengthening collaboration among these partner institutions, as well as collaboration between them and international conservation organizations, the Garden's program will help establish a new, integrated approach to conservation of *Vietnam's* rich biotic diversity, incorporating natural resource management in understanding of plants, which are critical to preservation of ecosystems and survival of other endangered organisms. The program will create strong links between research on the flora of *Vietnam*, its practical utility, and ongoing conservation planning and management.

In order to launch the training program, a scientific workshop was held on April 2002, at the Institute of Ecology and Biological Resources (IEBR) in Hanoi. The theme of the workshop was "The Role of Botanical Research and Training in Biodiversity Conservation in *Vietnam*." A total of 76 participants attended this event, including 18

speakers, 41 representatives from five national parks and four protected areas, representatives from academic and government institutions, conservation organizations, and journalists from local newspapers. Botanical training began in earnest in June 2002. Sixteen participants in the recently concluded workshop, especially the conservation officers and park rangers, were recruited to take part in practical training activities in the field. Training materials were translated from English to Vietnamese to facilitate communication. The training sites were the limestone areas of the north and northwest, since these areas are under extreme pressure by detrimental human activity, and these vegetation types have affinities to extinct ones in southern China and may represent the last remaining habitats for the flora and endemic vegetation types. These areas are botanically unexplored. Last year, scientists from Vietnam, the Missouri Botanical Garden, the Royal Botanic Gardens, Kew, and the Komarov Botanical Institute, St. Petersburg, discovered a new genus and species of conifer (*Xanthocypris vietnamensis*) on steep limestone ridges in a mountainous area near the Chinese border (see botanical description in *Novon* 12(2), 2002.)

Based on this significant discovery, the provincial government of Ha Giang Province established the Bat Dai Son protected area, which signifies the first step toward national and international protection. In addition to the cypress, the collaborative team of botanists exploring the area has found about two dozen new orchid species, a variety of interesting new shrubs, and numerous herbs and bulbs, including a half-dozen new species in the Jack-in-the-pulpit family (Araceae). In order to facilitate re-collection of interesting findings, fieldwork will emphasize the collection of well-preserved and pressed specimens with associated locality information verified by Global Positioning System (GPS). A computerized inventory or checklist of the limestone flora of Vietnam will be prepared as the scientific result of this

study. All information from plant collections is available to Vietnamese and other institutions worldwide through the Garden's TROPICOS database <mobot.mobot.org/W3T/Search/most.html> through the Vietnam Botanical Conservation Program's Website <www.mobot.org/MOBOT/research/vietnam/welcome.html>.

In Fall 2002, a new graduate student from Vietnam, Nguyen Quang Hieu, will begin a master's degree program at the University of Missouri-St. Louis. As part of his training, Hieu will work as a half-time research assistant for the Vietnam program. The Garden is proud to sponsor Hieu who will become the first Vietnamese to receive advanced academic training in botany in the United States.

Former Soviet Union: For the past seven years, Russian botanist Tatyana Shulkinina has been a member of MO's Research staff. Thanks to her previous long and distinguished career at Komarov Botanical Institute (LE, St. Petersburg, Russia), the Garden has been collaborating with botanical institutions and gardens of the FSU with Shulkinina's coordination. With funding from the National Geographic Society, Jim Solomon, Tatyana Shulkinina and Georgian botanists conducted fieldwork in the Western Caucasus, one of the world's "biodiversity hot spots." Support by the National Research Council through the Twinning Program resulted in a database of the Georgian Flora. In 2001, the Trust for Mutual Understanding awarded a grant for a project to catalogue and inventory the rare and endangered plants of Western Caucasus. The complete list is now available at <www.mobot.org/MOBOT/Research/georgia/fgfamily.shtml>. The current project supported by the Civilian Research and Development Foundation for the Independent States of the Former Soviet Union (CRDF) is "Informatics for Sustainable Use of Plant Genetic Resources in Georgia," directed by James Miller. Botanists from all three Caucasian Republics have started to collect information for a "Red List of the Caucasus."

Central Asia is another region in the FSU that attracts our attention. This region is botanically rich, including almost 8,000 species. With funding from the National Geographic Society, Tajik botanists arranged field trips and also collected plants for the Garden Herbarium. Khikmat Khisoriev, the Director of the Institute of Botany, Tajik Academy of Science, visited the Garden and became acquainted with the Garden's database system for their future work. In Summer 2002 Jim Solomon and Ihsan Al-Shehbaz will undertake a field trip to the Pamir mountains – "the roof of the world." Dzhumamurad Kurbanov, the Head of the Botany Department of the Institute of Desert Flora and Fauna, Republic of Turkmenia, visited the Garden and worked with Tatyana Shulkinina and Rita Randolph on the preparation of herbarium specimens collected in the field. The collections comprise almost 2,000 specimens of Turkmenian flora.

Bryophytes

Bryophytes have been a part of the MO herbarium since its inception, and the collection included 387,041 specimens at the end of 2001. The past several years have seen tremendous growth; 23,093 specimens were added in 2001, and 2002 should see a similar number added. The Clyde F. Reed Herbarium, purchased in 2001, contains about 35,000 specimens of bryophytes, mostly from the Middle Atlantic states. Repackaging and intercalation of these collections is under way, coupled with databasing of each specimen's label data. The bryophyte collection from LAF, accumulated by the late William D. Reese during his long career there, was moved to MO on permanent loan in late 2001. It is available for study and will also be databased and intercalated into the MO herbarium. About 156,000 of the specimens are recorded in MOST. Searches of bryophytes from TROPICOS can be done at <<http://mobot.mobot.org/W3T/Search/most.html>>.

Bruce Allen continues to work on the *Moss Flora of Central America*. This project complements two other regional moss floras, the *Moss Flora of Mexico* (New York, 1994, 2 vols.) and the *Moss Flora of the West Indies* (New York, 1998, 1 vol. to date). Volume 2 of the *Flora*, Pottiaceae through Orthotrichaceae, is in press through MBG Press, and Volume 3 is under construction now. Allen continues to work on the *Moss Flora of Maine*.

Marshall Crosby continues to update TROPICOS with information for the ongoing *World Checklist of Mosses*. He and John J. Engel (F) are collaborating to bring the *Index Hepaticarum* up-to-date from 1974 through 2000. Crosby is also working on a revised and expanded version of his *Vade Mecum Bryologiae*.

Si He saw volume 6 of the *Moss Flora of China* (Hookeriaceae–Thuidiaceae) through the press in 2002 and has begun working on the next volume (volume 3, Grimmiaceae–Tetraphidaceae). He is also planning a collaborative bryophyte flora of Taiwan with former Garden graduate Tzen-Yuh Chiang (Ph.D. Washington University, 1994, now at National Cheng-Kung University, Tainan, Taiwan). He and Chiang collected in Taiwan and the Iriomote Islands during the summer 2002.

Steve Churchill's studies of Andean mosses have taken him to the

heart of the Andes—he now heads the Garden's cooperative programs in Bolivia, where he will reside for the next several years. Churchill is the middle author of the *Guide to the Bryophytes of Tropical America* (New York, 2001) with Rob Gradstein (GOET) and Noris Salazar-Allen (PMA).

Robert Magill, Director of Research, continued his studies for the fourth (and final) fascicle of his moss flora of southern Africa and made improvements in the MOST databasing programs.

Michelle Price defended her Ph.D. dissertation, a revision of *Holomitrium* and related genera, in February 2002. A revision of the wholly unrelated genus *Rhynchostegiopsis* was recently published in the *Annals of the Missouri Botanical Garden*. Zacharia Magombo finished his Ph.D. on a study of the moss family Diphysciaceae and has recently submitted the papers based on his dissertation to *Novon*, *Journal of Bryology*, and the *Journal of the Hattori Botanical Laboratory*.

Research Associates: Carl Darigo (St. Louis) continued collecting and identifying North American mosses. He has begun a specimen-based, county-level checklist of the mosses of Missouri, based on the collections in MO, which include those from SMS, mostly collected by Paul L. Redfearn Jr. Robert R. Ireland,

Jr. (Annandale, VA), has begun identifying his recent collections from Chile and is preparing treatments of several genera for *Flora Neotropica*. Richard H. Zander and Patricia M. Eckel, who have recently come to the Garden, will continue to work on bryophytes taxonomic treatments and phylogenies as well as historical/archival, and botanical Latin research.

The bryophyte library contains an extensive collection of reprints, particularly those of William Campbell Steere, purchased in 1978. Volunteer Dolly Darigo recently completed organizing the most recently donated reprints of Bob Ireland and Frank Bowers. Many of these will be formed into bound volumes with tables of contents.

Greg Pedano has overall responsibilities for incoming and outgoing shipments (loans, exchanges, etc.), filing specimens, and generally keeping the herbarium in order and the flow of work smooth. Moss packeters Leonardo Mourré and Carol Hebblethwaite, assisted during the summer by Collin Cantwell (who also databased collections from the Reed Herbarium), continued to provide yeomen's service as they quickly and neatly labeled and packeted all manner of bryophytes from all corners of the world. In addition to keeping the bryologists and bryophyte program together administratively, Barbara Mack added material to the bryophyte specimen database, which now numbers about 156,000 records, or about 40% of the collection, by entering information from a large number of existing specimens, especially from Latin America.

PHOTO BY ROBERT MAGILL



Bogs are formed over millennia by the growth of mosses, especially *Sphagnum*, or peat moss. Its specialized cells absorb and hold tremendous amounts of water.

Araceae

Thomas B. Croat, P. A. Schulze Curator of Botany, concentrates on taxonomic, systematic, and ecological studies of neotropical Araceae. Because of his efforts, the Missouri Botanical Garden has become a principal center of research in Araceae, with the largest collection of herbarium material and

the most species-rich collection of living material in the world. A number of major revisions have been completed by Croat, including *Anthurium* and *Philodendron* for Central America, and complete revisions of *Syngonium* and *Anthurium* sect. *Pachyneurium*. Currently, Croat is finishing the revision of *Rhodospatha* and Central American *Dieffenbachia*. The already finished preliminary revision and keys of the latter genus will become available on the Garden's Website prior to its final publication. Together with Richard Wunderlin and Richard Mansell (University of South Florida, Tampa), and based on the original contribution of the late Mark Moffler, Croat is finishing the revision of *Homalomena*. Other revisionary work is being carried out on *Chlorospatha* in collaboration with Lynn Hannon (University of South Florida, Florida). A revision of *Anthurium* sect. *Semaeophyllum* is being carried out in collaboration with UMSL student Mónica Carlson, whose co-advisors are Peter Stevens and Tom Croat.

Floristic revisions of selected families have been carried out throughout Latin America. These include, for example, the *Flora of Barro Colorado* in Panama and the Burica Peninsula in Panama and Costa Rica. A preliminary treatment of the Araceae of Bolivia has been recently published with Michael Kessler. Additional floristic projects with Araceae are being carried out in Central America where Araceae treatments are being prepared for the *Flora of Veracruz* and *Flora del Valle* in Mexico as well as for the *Flora Mesoamericana*.

Recent fieldwork in South America involved several different projects. In Brazil fieldwork was done in late 2001 in the State of Acre for the Araceae treatment for the *Flora of Acre* being carried out by Doug Daly (NY). A report on that expedition is available on the Website of the International Aroid Society at <www.aroid.org>.

Croat's work involves not only fieldwork, but also collaboration with other researchers of Araceae, as well as guidance to undergraduate and

graduate students. In Brazil Croat serves on the Advisory Committee of Marcus Nadruz, who is doing a revision of *Anthurium* section *Urospadix* series *Flavecentiviridia*.

Croat has been working with Colombian collaborator Marcela Mora, who is studying the Araceae of the Flora of Cabo Corrientes. Mora visited the Garden in May and June 2002 to work with Croat on new species from this region. Other collaborative efforts in Colombia involve describing new species of *Spathiphyllum* with Felipe Cardona (Universidad de Antioquia, Medellín), and the preparation of a revision of *Dieffenbachia* for Colombia with Marta Patricia Galeano (Universidad Javeriana in Bogotá). With Jorge Jácome, formerly at the Universidad Nacional in Bogotá and now a graduate student in Göttingen, Germany, Croat is working on an Araceae treatment of the Bogotá region in Cundinamarca Department. The above-mentioned team of Colombian researchers is collaborating with Croat on a Checklist for the Araceae of Colombia, the richest flora for Araceae in the Neotropics.

A major effort is being made in Ecuador to do the Araceae for the country in collaboration with Richard Mansell and Lynn Hannon. A preliminary checklist of the species names has been completed and is available to anyone interested. A new project in Ecuador will begin between late July and late September 2002, with further floristic studies in Ecuador, this time on the Araceae of the Parque Nacional Sangay in the Cordillera Oriental on the eastern slopes of the Andes in central Ecuador. The florula projects mentioned above are all a prelude to the completion of the Araceae treatment for the *Flora of Ecuador* being carried out with collaborator Richard Mansell. Croat and Mansell have developed a Webpage for the Araceae of Ecuador available at <zulu.cas.usf.edu/bio/mansell/aoe2>. Currently about 25% of the published species for the flora have been described in detail and have *exsiccatae* included. In Ecuador

Croat has advised Jimena Rodríguez de Salvador (Pontificia Universidad Católica del Ecuador, Quito) working on Araceae, and currently serves on the Advisory Committee for Gladys Benavides (Universidad Central del Ecuador, Quito), who is doing her thesis on a comparative study of three different local floras on the western slopes of the Andes in Pichincha Province. Croat is also collaborating with German students Holger Krefth and Nils Sommers (University of Bonn, Germany) who are doing an ecological study of the Araceae of Tiputini Biodiversity Station in eastern Ecuador.

In Peru Croat serves on the Advisory Committee of Jorge Ligan (Universidad Nacional Mayor de San Marcos, Lima) who is doing a taxonomic and population analysis of the Araceae in the "Reserva Ecológica Cuzco Amazónico" in Madre de Dios Department.

Croat visited Bolivia in 2000 to do fieldwork in preparation for completing a treatment of the Araceae for the Checklist for the Flora of Bolivia working in collaboration with Amparo Acebey (LPB). A paper being completed with Acebey will describe a number of new species in Bolivia in advance of the completion of the checklist being carried out by Peter M. Jørgensen and collaborators. In addition, Croat is working with Henning Sommers and Christoph Nowicke (University of Göttingen, Germany) on an ecological study of the Araceae of Bolivia.

Other staff involved with Araceae include Michael Grayum, who has revised the Araceae for the "Manual de Plantas de Costa Rica," as well as *Philodendron* subgenus *Pteromischum*. Guanghua Zhu revised *Dracontium*. The living collection of more than 6,500 Araceae, managed by horticulturist Kathy Pauley, along with its associated computerized database, is the source of much new information on the biology and taxonomy of this diverse family.

Research Associate Richard C. Keating continues to work on the anatomy of Araceae and other Angiosperm families. The treatments



Marcela Mora (Colombia) and Thomas Croat pressing plants at the Estación Biológica El Amargal (Pacific coast of Chocó, Colombia).

of Araceae and Arecaceae are in press in Volume 10 of *Anatomy of the Monocotyledons* (Oxford University Press). This work treats the anatomy of *Acorus* and the 106 genera of Araceae, which now include the 5 lemnooid (duckweed) genera. During 2001 he published studies on *Eryngium yuccifolium* (Apiaceae), *Tubocapsicum* (Solanaceae), and *Alloschemone* (Araceae). Keating, in collaboration with James Fralish and David Close (Forestry Department of Southern Illinois University-Carbondale), and Philip L. Keating (Indiana University), has also started working on the correlation of structural character evolution in *Salix* (Salicaceae) with the solar flux as one moves toward the pole.

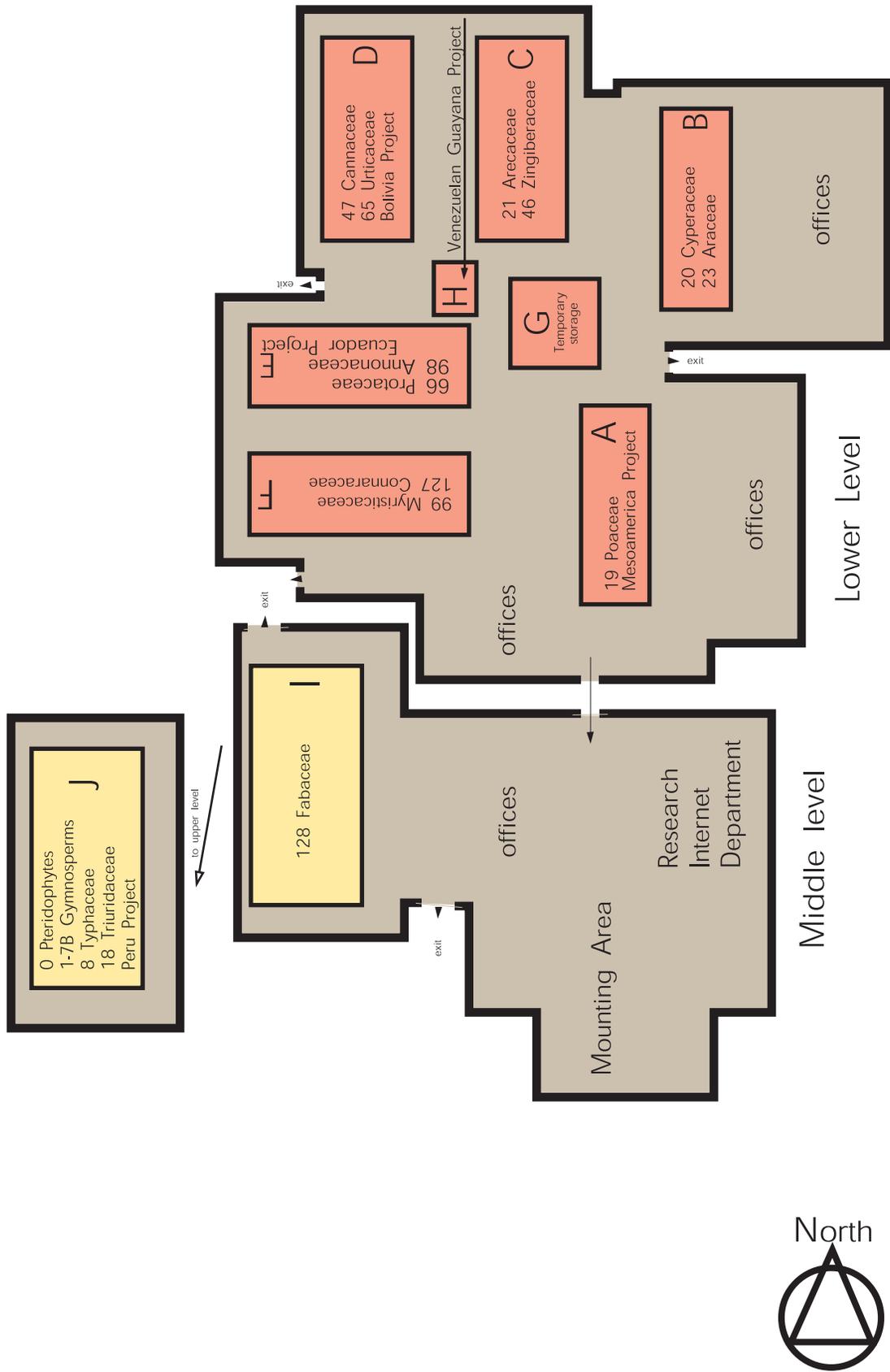
Iridaceae

Peter Goldblatt, Senior Curator and B. A. Krukoff Curator of African Botany, works largely on African plants and is a specialist on the systematics, biology, and phylogeny of the Iridaceae and related families of the petaloid monocots. His work is concentrated in southern Africa, an important center of evolution and diversification of petaloid monocots, including two-thirds of the estimated 1,800 species of Iridaceae. Goldblatt has completed systematic accounts of the Iridaceae for *Flora Zambesiaca*

(100 species, 1993), *Flora of Somalia* (six species, 1995), *Flora of Tropical East Africa* (74 species, 1996), and for the *Flora of Ethiopia* (27 species, 1998). Working with J. C. Manning (National Botanic Institute, Kirstenbosch), Goldblatt also published a generic flora account for the Iridaceae of southern Africa in 2000. Together Goldblatt and Manning have recently completed a comprehensive synoptic flora of the southern African winter-rainfall zone, the Cape flora region, entitled *Cape Plants*. This part of the southern African subcontinent has almost half the total species of vascular plants that occur in southern Africa, about 9,000 species, some 69% of them endemic. All of southern Africa, about ten times greater in area, has some 21,500 species. A summary of their account of the cape flora appeared in volume 89(2) of the *Annals of the Missouri Botanical Garden* in 2002. In the New World, Goldblatt has completed accounts of the Iridaceae for *Flora Mesoamericana*, *Flora de Nicaragua*, *Manual de Plantas de Costa Rica*, and *Flora of the Venezuelan Guayana*. These treatments were prepared with J. E. Henrich. An account of the Iridaceae for *Flora of North America* is now in press and Goldblatt contributed several genera of the family, plus the key and family description. Goldblatt is now working with Marcela Celis

from Colombia on South American *Libertia*, *Cipura* and other genera.

Goldblatt and Manning have an active research program, funded by the National Geographic Society, studying the pollination systems in the Iridaceae. They have completed studies of *Lapeirousia* (40 species), southern African *Gladiolus* (165 species), *Ixia* (ca. 50 spp.), *Sparaxis* (15 spp.), and *Romulea* (ca. 80 spp.), all of which exhibit a wide range of pollination systems, including two novel systems involving different genera and species of long-proboscid flies in the horse fly (Tabanidae) and tangle-veined fly (Nemestrinidae) families of the Muscidae. These flies are the primary or sole pollinators of many species in both genera. Hopliine beetle pollination, another novel pollination system known only for southern Africa, is particularly well developed in *Ixia* and *Sparaxis*. The presence of these specialized pollinators and their associated guilds of plant species have permitted the diversification and radiation of species of most genera of Iridaceae into niches that apparently do not exist outside southern Africa. Goldblatt and Manning are also documenting several different guilds of plant species and their associated long-proboscid fly pollinators that have now been discovered across the entire southern African region (this pollination system is presently unknown in tropical Africa). Three separate guilds of long-proboscid flies encompassing 14 species have been identified that are associated with different suites of plant species that occur in different parts of southern Africa or are active at different times of the year. The guilds invariably include two or more species of Iridaceae, often from different genera of the family, species of *Pelargonium* (Geraniaceae), and occasionally Amaryllidaceae, Orchidaceae, and Scrophulariaceae. Goldblatt and Manning are now extending their pollination studies to the genera *Babiana* (ca. 80 spp.), *Hesperantha* (ca. 80 spp.), and *Moraea* (ca. 195 spp.). The sub-Saharan African *Hesperantha* is particularly

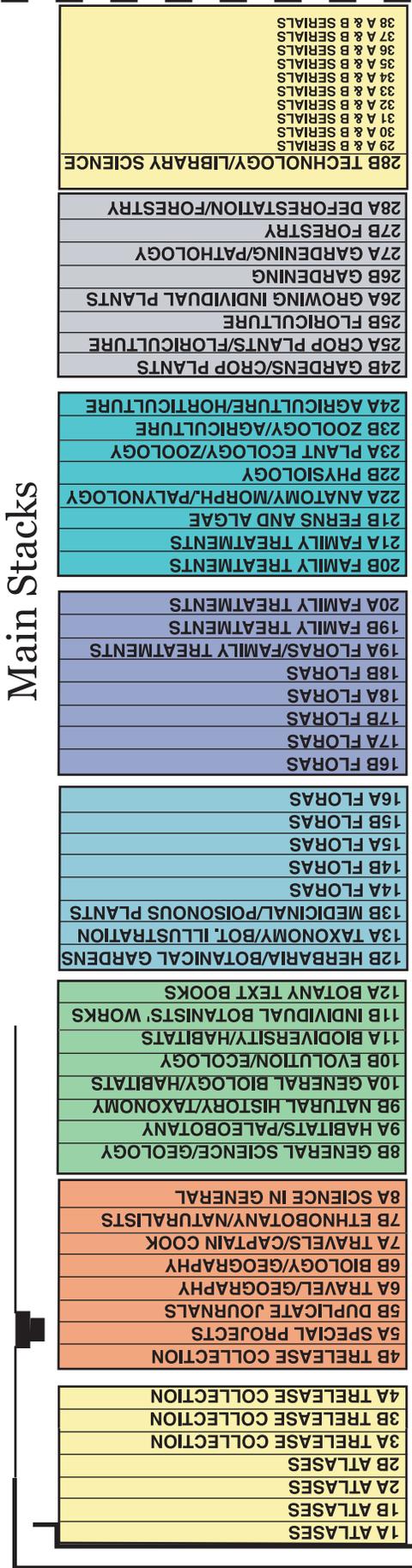


**Lehmann Building
Herbarium Compactors** Not to Scale
LM/KH

Middle level

Lower level

Main Stacks



Maps

Books

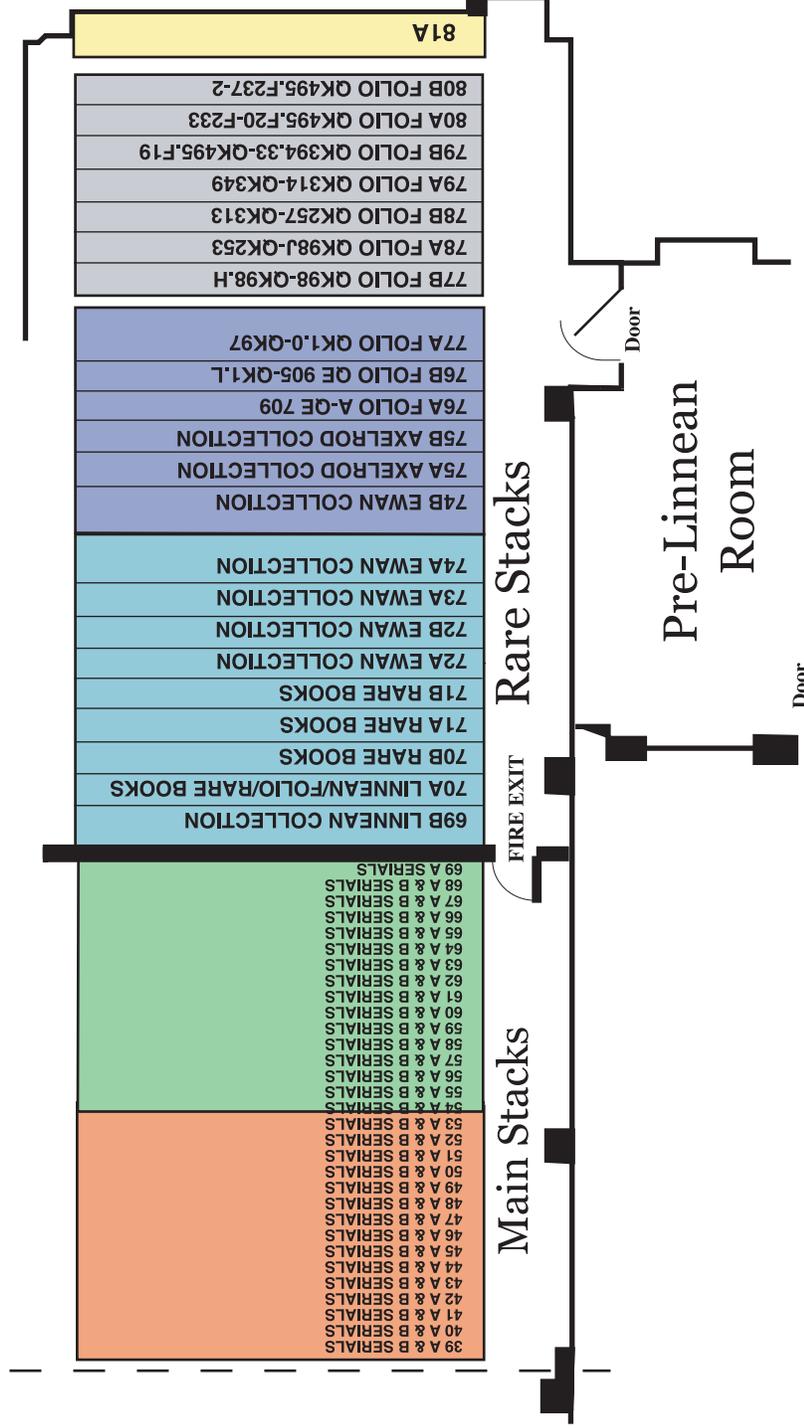
Serials

Reference Area

Monsanto Center 4th floor Library Compactors

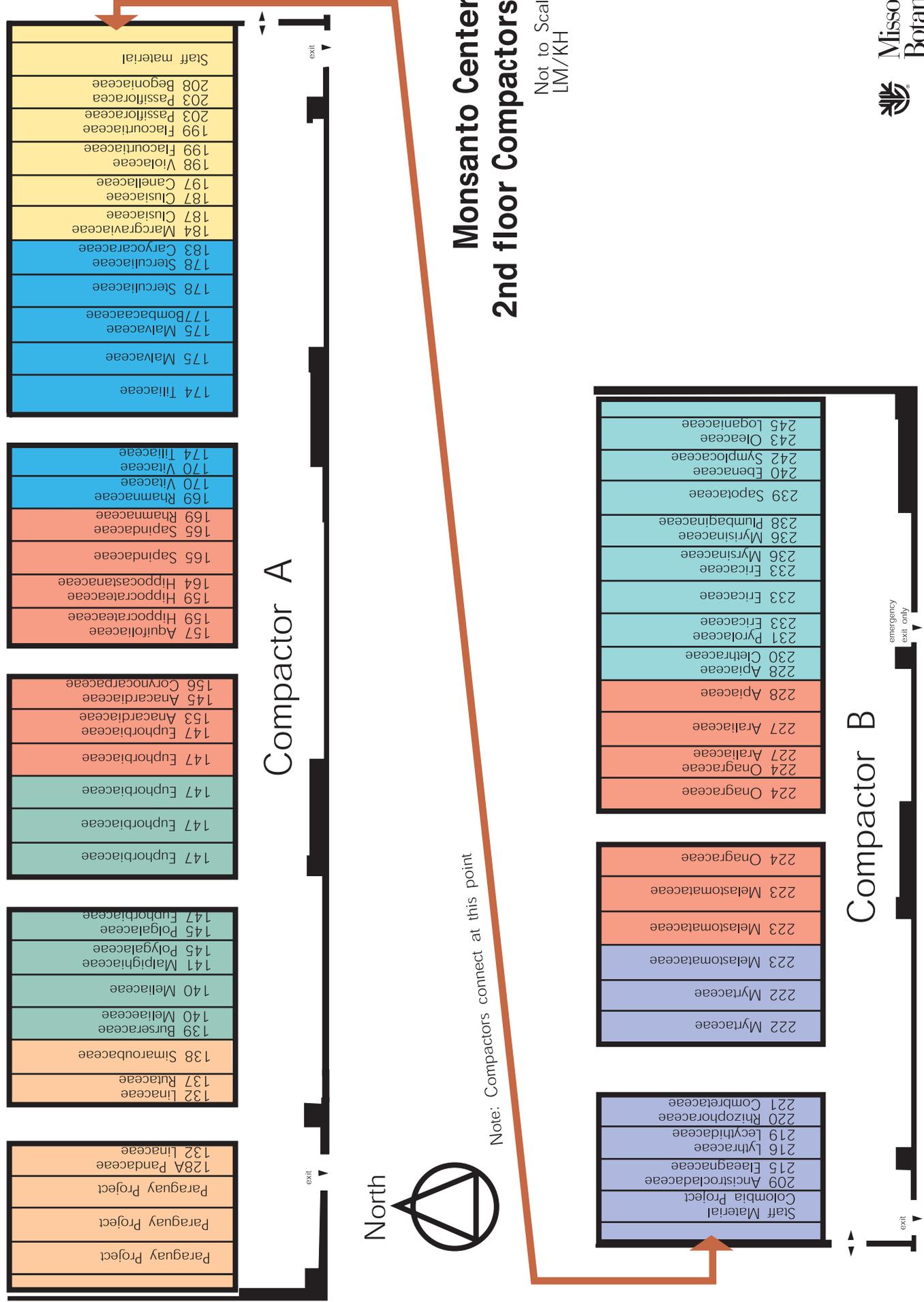


Not to scale
LM, HW-S, AND ZT 2002



Monsanto Center 2nd floor Compactors

Not to Scale
LIM/KH



interesting, as different species exploit long-proboscid flies or settling moths for their pollination, the latter unique in the family, as well as nectar-foraging anthophorine bees, and scarab beetles.

Work on the systematics of the large genus *Gladiolus* was completed in 1998. A monograph of the genus in tropical Africa (83 species) was published by Goldblatt (Timber Press, 1996) and a second monograph, coauthored with Manning, dealt with 163 species in southern Africa. This work was released in 1998 (Fernwood Press, Cape Town) and included 144 sumptuous watercolor paintings. *Gladiolus* is now believed to comprise some 260 species, 250 in sub-Saharan Africa and Madagascar and ten more in Eurasia. Southern Africa is the center of diversity of the genus, and 160 of the 165 species that occur there are endemic, while tropical Africa has 76 endemic species of *Gladiolus*. The basic pollination system for the genus is one using long-tongued anthophorine bees with nectar as a reward. Within the genus, frequent shifts in the pollination system have occurred, giving rise to pollination by sunbirds, noctuid and sphingid moths, long-tongued flies, a butterfly, and in a few instances, monkey beetles or short-tongued, pollen-collecting female bees. Comparison of the pollination systems with the infrageneric classification developed by Goldblatt and Manning suggests that at least 27 separate instances of a shift in pollinator have taken place.

Goldblatt is working with Mark W. Chase (K), Paula Rudall (K), and Gail Reeves (NBG) on the generic phylogeny of the Iridaceae. DNA sequences of four plastid DNA regions have provided valuable data on generic relationships, and their results were published in *American Journal of Botany* late last year. The results will be combined with information from morphology and anatomy to analyze the family phylogeny. Other molecular studies of plastid DNA sequences have shown conclusively that several African genera (including *Galaxia*, *Gynandriris*, and *Homeria* of the

tribe Homeriinae are nested in the larger genus *Moraea* and accordingly have been sunk in that genus, leaving *Moraea* with some 195 species. A preliminary phylogeny that includes 70 species recently published in *Molecular Phylogeny and Evolution* shows that *Moraea* diverged from its sister genus *Ferraria* about 25 mya, that is, at the end of the Oligocene, but that the major radiation of the genus occurred less than 10 mya, at the end of the Miocene and in the Pliocene, when the African climate rapidly became drier and strongly seasonal, a regime that favored the evolution of geophytic plants.

Goldblatt and Manning have also published local wildflower guides for local regions in South Africa, and their most recent guide, *Fairest Cape Wildflowers*, was published in June, 2000. This volume, published in South Africa and distributed by Timber Press in Europe and North America, covers a large portion of the floristically rich Cape flora region. Goldblatt & Manning contribute regularly to popular journals that deal with African flora and natural history and have articles published in *Africa and Veld and Flora*. The *Color Encyclopedia of Cape Bulbs*, a complete account of the extraordinarily rich bulbous flora of the Cape region co-authored by Goldblatt, Manning and D. Snijman (National Botanic Institute, Kirstenbosch) will be published this fall by Timber Press (Portland, OR). The extensively illustrated work deals with over 1,100 species of several monocot families including the Amaryllidaceae, Colchicaceae, Iridaceae, Hyacinthaceae, as well as some smaller families.

Onagraceae

Research on the plant family Onagraceae has been a part of the overall research program at the Missouri Botanical Garden ever since Peter Raven first arrived in 1971 and is now under the direction of Peter Hoch. One exciting recent aspect of this project was the discovery of a

new genus and new species of Onagraceae, described by M. Socorro González E. and Warren L. Wagner in *Novon* 12(3). As part of a new initiative to finally clarify the phylogeny of the family, Hoch, MO Honorary Curator Jorge V. Crisci (La Plata, Argentina), Ken Sytsma (Madison), and Robert Raguso (Columbia, SC) were awarded Smithsonian Andrew W. Mellon Fellowships in Structure and Evolution of Terrestrial Ecosystems, to work in collaboration with Rachel Levin, Warren Wagner, and E. A. Zimmer of the Smithsonian Institution, on intensive phylogenetic analyses of Onagraceae. The first of several molecular analyses (*rbcl* and *ndhF*) by Levin *et al.* strongly supports the monophyly of the family, a close relationship between the subtropical genus *Fuchsia* and the circumboreal *Circaea*, and a sister relationship between *Lopezia* and the new genus. However, it suggests that *Gongylocarpus* (two species in Mexico) no longer falls within the tribe Onagreae, and that considerable generic realignment may be necessary within the rest of tribe Onagreae, particularly involving the large genera *Camissonia* and *Oenothera*. Additional studies using more sequences and more taxa are in progress. With Crisci and Liliana Katinas (La Plata, Argentina), Hoch and Wagner are also pursuing analysis of the geographical dimension in the evolution of tribes Onagreae and Epilobieae in southwestern North America. These tribes appear to have experienced a dramatic and explosive radiation within this area, designated the Madrean Floristic Region, and today comprise a highly distinctive and prominent group within the region. Raguso's work focuses on the evolution of pollinator specialization, and specifically on detailed studies of scent, nectar, and other floral features relevant to the evolution of hawkmoth pollination in members of Onagreae. Richard Clinebell, a Research Associate working with Hoch and others, is pursuing detailed analyses of insect floral visitors to members of tribe Onagreae, revealing

unexpected complexity and diversity in pollen vectors. The development of a robust phylogeny and comprehensive biogeographical model will enhance the value of both of these complementary pollination biological studies. Re-analysis of the large body of morphological, anatomical, and other data for the family in light of these new phylogenetic hypotheses promises to provide a richly detailed understanding of the evolution of this interesting plant family. A stable generic classification also will provide the foundation for the treatment of Onagraceae for the *Flora of North America*.

Rubiaceae

The Rubiaceae are the fourth largest family of flowering plants, with more than 10,000 species found throughout the world and usually comprising at least 5% of the species in any tropical flora. The Missouri Botanical Garden has a strong tradition of study in this family, starting with the work of John D. Dwyer, now retired, and his students and post-doctoral associates on Mesoamerican Rubiaceae. Soon afterward Julian Steyermark (1909–1988), author of extensive taxonomic works on South American Rubiaceae, joined the staff. Currently Charlotte M. Taylor, Curator, is an active

specialist on this family at the Garden, focusing in particular on its New World species. She is currently collaborating on writing taxonomic treatments of this family for several projects and is also studying the systematics of several Neotropical genera. Thanks to this history of Rubiaceae work, the specimen collection and library at the Garden have excellent coverage for this family, especially in the Neotropics.

Among the Rubiaceae projects currently under way at the Garden is preparation of the treatment of this family for *Flora Mesoamericana*, by Taylor and fellow Rubiaceae specialist David H. Lorence (National Tropical Botanical Garden, Kauai, Hawaii), with contributions from Helga Ochoterena-Booth (MEXU), C. Dennis Adams (BM), Lennart Andersson (GB), and Piero Delprete (NY). Taylor is also preparing Rubiaceae treatments for the “Manual de Plantas de Costa Rica” project, the *Nueva Flora de Chile* and the new edition of Steyermark’s *Flora of Missouri*, and she is also updating Steyermark’s original manuscript for this family for the *Flora of the Venezuelan Guayana*. Taylor, together with Luis Rea (LPB), Nérida Bacigalupo (SI), Elsa Cabral (CTES), and others is collaborating in the compilation of a checklist of the Rubiaceae of Bolivia, as well as contributing treatments of individual genera to other projects including the

Flora of the Ducke Reserve in Manaus, Brazil, together with Marina Campos; the Rubiaceae for the *Flora of São Paulo State*, Brazil, coordinated by Sigrid Jung-Mendaçolli of the Agricultural Institute in Campinas; the *Flora of Ecuador* project, coordinated by Lennart Andersson; and the *Flora of the Guianas*, coordinated by Piero Delprete. This taxonomic work has led to the discovery of numerous species previously unknown to science: more than 100 new species of Rubiaceae have been described in recent years from these projects.

The pantropical Rubiaceae genus *Psychotria* is one of the largest genera of flowering plants, with about 1,000 species. Taylor studies the Neotropical species of this group and several related genera, in particular the Neotropical genus *Palicourea*, as well as the Neotropical tribe Coussareae with its two genera, *Faramea* and *Coussarea*. Neotropical *Psychotria* and *Palicourea* together include at least 600 species of shrubs and small trees. These plants grow throughout the Neotropics but they are particularly numerous in the Andes, the mountains of Central America, the Guayana Highlands, and the Amazon basin. *Palicourea* is pollinated by hummingbirds and most of its species are found in mountainous regions, while *Psychotria* is pollinated by bees and is most diverse at lower elevations. *Faramea* and *Coussarea* together include at least 200 species of shrubs and small trees that are pollinated by butterflies and moths; these are diverse throughout wet tropical forests, though only a few species of *Faramea* range into the higher mountain forests. Through ongoing exploration of tropical forests, new species in these groups continue to be discovered with amazing rapidity and regularity. Specimens of Rubiaceae are regularly sent to the Garden for identification by many institutions in Latin America, a practice that enriches both sender and recipient.

During 2001, Taylor has taxonomically treated several genera

PHOTO BY CHARLOTTE TAYLOR



Colombian botanist, Pilar Amézquita, with *Palicourea tamaensis* in the La Planada Reserve, Colombia.

for Mesoamerica and western South America, among them an overview of *Notopleura* (Psychotriaceae), and descriptions of new species of *Gonzalagunia*, *Hippotis*, *Palicourea*, *Pentagonia*, *Psychotria*, and *Sabicea*.

Students also continue the Garden tradition of working on Rubiaceae. Recently finished are Simon Malcomber, who studied the Paleotropical genus *Gaertnera* at Washington University, and Sylvain Razafimandimbison, who studied the worldwide tribe Naucleaeae at the University of Missouri-St. Louis. Alberto Vicentini is currently studying the Neotropical genus *Pagamea* under the direction of Peter Stevens of the University of Missouri-St. Louis.

LPNTP

The Linnaean Plant Name Typification Project, based in the Botany Department of the Natural History Museum in London (BM) and partly supported by the Linnean Society of London (LINN), is headed by Charles E. Jarvis. It is designed to provide a thorough assessment of the typification of each of the approximately 11,000 generic, specific, and varietal plant names published by Linnaeus between 1753 and 1778, and to produce an annotated catalogue containing detailed notes and the citation of all relevant literature for each name. The catalogue is scheduled for publication in 2007, the tercentenary of Linnaeus' birth, and in the meantime, selected parts of the Linnaean project's database, along with type images, will be made available on the Internet. Fred Barrie worked on the project in London for three years until 1993 and later continued to contribute from his Chicago base. The project has already published "A list of Linnaean generic names and their types" (Jarvis et al., *Regnum Vegetabile* 127), which includes the 1,313 validly published Linnaean generic names, the generitype (the ultimate type for each), and 450 new typifications. Nicholas Turland was Barrie's successor on the project from 1994 until he came to MO in 1997,

and was himself succeeded by Steve Cafferty (BM), who continues to work on the project. Turland published three papers with Jarvis and Cafferty in the journal *Taxon* newly typifying over 500 Linnaean names in the families Asteraceae, Fabaceae, and Poaceae, in addition to 27 proposals to conserve or reject Linnaean names. The Project has subsequently published further papers detailing new typifications for the families Lamiaceae and Orchidaceae in *Taxon* and currently has papers typifying names in the Brassicaceae and Rosaceae, in press and those in the Apiaceae, Caryophyllaceae, Ericaceae, and Cyperaceae in advanced stages of preparation. In a collaboration with the Division of Curation of the British Museum's Botany Department, the Project has contributed to the digitization of various herbaria associated with Linnaean names, and these have also been placed online, namely the John Clayton herbarium, Sir Hans Sloane's Jamaican collections, the Paul Hermann herbarium, and the Clifford herbarium, all of which contain many Linnaean types. The Project also has its own set of Websites where it ultimately plans to make available an online database together with images dealing specifically with Linnaean types. The first part of this process will be to upload all generitype and Asteraceae names in late 2002, with plans to add to this progressively until complete. Further details are available on the Linnaean Project and Botany Department Websites at The Natural History Museum <www.nhm.ac.uk/botany/linnaean>.

Index to Plant Chromosome Numbers

Peter Goldblatt is Editor, together with D. E. Johnson (Timber Press, Portland), of the *Index to Plant Chromosome Numbers*, a project funded by the National Science Foundation. For this project, contributing editors throughout the world collect information on original chromosome counts published in the scientific literature, and the data is

assembled in biennial indices published by the Missouri Botanical Garden. An Index covering the years 1996–1997 was released in November 2000. A three-year Index, for the years 1998–2000 is in proof and is expected to be ready for publication in Fall 2002. Marie Johnson works part-time managing data entry and processing for the project. Plant chromosome numbers for the years 1984–1997 are accessible via the Internet through the Missouri Botanical Garden's W³TROPICOS database <mobot.mobot.org/W3T/Search/ipcn.html>.

Applied Research

Natural Products Research

Garden botanists are active in research to discover new pharmaceutical, agricultural, and nutritional products from natural sources. Wendy Applequist, in collaboration with Ikhlas Khan and Brian T. Schaneberg of the National Center for Natural Products Research at the University of Mississippi, is publishing a paper showing that some collections of wild ginger (*Asarum canadense*) contain enough of a toxic chemical, aristolochic acid, to be of some slight concern, at least in theory, which supports the FDA's recent decision to ban the plant from commerce. During fieldwork in Missouri for bioassays, Sharon Bodine and Gretchen Walters recorded *Agalinis viridis* (Primulaceae) a new county record for Missouri.

In partnership with government, private, and university research labs, Garden discovery programs have included activities in Cameroon, the Central African Republic, China, Gabon, Ghana, the Republic of Georgia, Madagascar, Suriname, Tanzania, and the United States.

More than a dozen bioactive chemical compounds new to science, some with interesting therapeutic potential, have been discovered through these programs. In 2001 the Garden was awarded a fourth contract to collect plant samples in

tropical Africa and Madagascar for the National Cancer Institute (NCI) for screening in their drug discovery program. Under the current contract managed by James S. Miller, Head of the Department, collecting will continue in Madagascar in conjunction with collaborators from the Parc Botanique et Zoologique de Tsimbazaza and the Centre National d'Application des Recherches Pharmaceutiques (CNARP) in Madagascar. Richard Randrianaivo is responsible for collecting plants for NCI in Madagascar. Adam Bradley maintains the NCI database and processes the collections. Gordon McPherson identifies NCI specimens. Ruth Ann Bizoff handles numerous administrative details and coordinates activities in St. Louis for the department.

In 1993 the Garden began collaborating with the International Cooperative Biodiversity Group (ICBG), led by the Virginia Polytechnic Institute, on a project designed to stimulate biodiversity conservation in Suriname by demonstrating the value of biodiversity to the country and its people.

In 1998, the project's activities expanded to include Madagascar, in collaboration with CNARP and the Centre National de la Recherche

Appliquée au Développement Rural (TEF). Another partner, Dow Agrosciences, Inc., joined the group to evaluate plants for potential agricultural applications. The ICBG project is sponsored by the National Institutes of Health, the National Science Foundation, and the U.S. Forest Service. The Garden's primary role in the project has been to provide samples of plant species collected from numerous localities. Miller coordinates the Garden's portion of the project. In 1999 the Malagasy government approved another proposal for ICBG activities that was submitted by CNARP, Conservation International, and the Garden. In addition to providing samples for pharmaceutical and agricultural evaluation, this project will generate annotated checklists of the Zahamena and Ankarafantsika reserves.

Chris Birkinshaw coordinates project activities in Madagascar. The goals of the Madagascar project are to: (a) assist in the collection of plant samples to be analyzed for the presence of novel chemicals that are useful in the treatment of human, animal or plant diseases; (b) provide a botanical inventory of the site; and (c) provide floristic guides. The 5-year project is now in its penultimate year, and to date the fieldwork team has

collected around 1,500 samples and a similar number of herbarium specimens. Our collections have included a rarely collected and undescribed species of *Santalum* (Santalaceae), and previously unknown species of *Desmostachys* (Icacaceae), *Meineckia* (Euphorbiaceae), and *Oncostemum* (Myrsinaceae).

The Garden is participating in a project led by the University of Missouri-Columbia and funded by the National Institutes of Health. Garden botanists will identify plant species used as active ingredients in dietary supplements, while researchers from the university will isolate active chemicals, document their efficacy, and study how these compounds act in the human body. The Applied Research program is also running a project through UM-Columbia's Botanical Center to examine historical distribution of *Echinacea* (Asteraceae) in Missouri and ground-truth populations. Two student interns, Michele Miller and Quinn Long, have entered data and will do most of the fieldwork. Their herbarium curator, Robin Kennedy (UMO), has been an invaluable help, and we have also just received advice from a visitor to the Center, Kelly Kindscher of University of Kansas, an echinacea expert with whom we are interested in working on larger-scale surveying projects. One of the Garden's most important contributions to this project will be to produce a manual to help manufacturers of herbal medicines and dietary supplements properly identify the plants that are used to make their products. Wendy Applequist is writing this book, which will present detailed anatomical features of popular plants to assist professionals in confirming the identity of plants in commercial use. The protocols developed for identifying plants used as ingredients in herbal supplements will ensure that desirable species are not confused with look-alikes or contaminated with other species. In connection with this project, Applequist has been doing fieldwork in the United States to collect relevant plant material, with the assistance of Heidi Schmidt and

PHOTO BY HEIDI H. SCHMIDT



Mary Merello collecting plants in the Greater Caucasus Range near the town of Shatili, Republic of Georgia. The Applied Research Department had a collaborative project with Monsanto and the Georgian Institute of Botany to sample plant materials for possible novel chemicals and new pharmaceuticals.

Adam Bradley. Applequist has been doing large experimental plant cultivations at the Shaw Nature Reserve with the assistance of Scott Woodbury and Larry Havermann. Dennis Lubahn (University of Missouri-Columbia) is the Principal Investigator for the project, and James S. Miller coordinates the Garden's participation.

Sequoia Sciences: The Garden is in its second-year partnership with Sequoia Sciences, a natural products chemistry company based in San Diego. Sequoia rapidly produces natural product compound libraries for evaluation in pharmaceutical, biotechnology, and agrochemical discovery programs. Sequoia is extracting samples using rapid purification processes to provide corporate partners with structurally diverse, novel molecules with selective biological activity.

In January 2000, MBG and Sequoia signed a collaborative agreement with Gabon's Centre National de Recherche Scientifique et Technologique (CENAREST) to collect plant samples for commercial development. John Stone and Gretchen Walters, with the assistance of Adam Bradley, are responsible for collecting specimens in Gabon in collaboration with botanists at the Herbarium National du Gabon (LBV). Field efforts have focused on regions that are botanically unknown and in need of inventories. A recent expedition organized by Walters and Bradley to one such region, the Project Protection des Gorilles (PPG) station in southeastern Gabon, has resulted in several potential new species. Future trips to PPG will further document the flora and help researchers better understand the ecology of the rare western lowland gorilla.

Ethnobotanical Research:

Jan Salick, Curator of Ethnobotany, continues her research in Tibetan Yunnan in southwestern China as part of her collaboration with The Nature Conservancy and Chinese botanical institutions. She heads an ethnobotanical project in the Meili Mountains ("Medicine Mountain" in



PHOTO BY JAN SALICK

Holy Tibetan Medicine Mountain with prayer flags fluttering, site of Tibetan Ethnobotany research of Jan Salick.

the Tibetan language), an area important for its alpine and subalpine biodiversity, endemism, and variation. Tibetan and other ethnic minorities have been successful stewards of this biodiversity for millennia. Salick and the other scientists are studying how the indigenous peoples have successfully managed their plant resources and the threats and mitigation of threats posed by overharvesting of useful plants. The long-term goal is to develop, support, and resurrect cultural practices that maintain and enhance biodiversity. Additionally, with the Ford Foundation, the Garden and Kunming Institute of Botany are organizing field training in ethnobotany for Chinese scientists and professional fieldworkers in the Meili area.

Salick, Gayle Fritz (Washington University), Cheryl Asa (St. Louis Zoo), and James S. Miller, received a grant from the National Science Foundation and organized a workshop in the Spring of 2002 on "Intellectual Imperatives in Ethnobiology." Information about the event is available at www.mobot.org/MOBOT/research/applied_research/2002Workshop/welcome.shtml.

There is an immediate need in the rapidly growing field of ethnobiology to define research

objectives: (1) to explore modern methodology for studying plant/animal-people interactions; (2) to quantitatively analyze multidisciplinary data based on hypotheses; (3) to develop interdisciplinary education models for training students of ethnobiology; and (4) to access academic funding sources that are free of controlling disciplinary, commercial, or other agendas. The workshop is producing a bulletin on developments and future goals for research in ethnobiology. The bulletin defines intellectual imperatives in the field for researchers in ethnobiology, as well as supplying information for developing funding consortia. Research proposals are also being prepared as an outcome of the workshop.

Herbarium

Library

Botanical Databases

MBG Press

Systematics Symposium

Graduate Program

Fellowships

Herbarium

As of January 1, 2002 there were 5,219,216 mounted, accessioned specimens in the herbarium (4,832,175 vascular plants and 387,041 bryophytes). During 2001 the herbarium mounted or packeted and accessioned 108,840 specimens; 25,628 specimens were sent on loan, and 19,870 gift specimens were sent to specialists around the world. James Solomon manages the herbarium.

Herbarium functions such as shipping and receiving are performed by Micah Issitt and Madeleine Winslow, and sorting and filing are performed by Jean Digby at the Lehmann Building, and Heidi Threnn at the Monsanto Center. Kristin Pierce works with type specimens and other non-project material. Specimen mounting activities are managed on a daily basis by Gigi Hill, with the assistance of Tom Bernickus, Olga Fomina, Carol Hebblethwaite, Marlene Monroe, Leonardo Mourré, Mary Anne Norton, Anna Spencer, Sally Strange, Lidiya Toropova, Adam Wood, and Laurel Zimmer. Donna Herrera, Carla

Kostelac, and Rita Randolph ably provide data entry and produce labels through the Garden's computer database programs. Mary McNamara, Senior Secretary, handles innumerable telephone calls, visitors, and administrative details for the herbarium.

Ronald Liesner, Curatorial Assistant, sorts Mesoamerican, South American, and Chinese plants to family so they can be sent to specialists. For families without specialists, Liesner identifies accumulated collections to species and at the same time curates the herbarium using new monographs and Floras, cycling through the flowering plant families once every three years. Special requests for determinations from ecologists, anthropologists, etc., are accumulated and processed once a year. Plants without label information (including latitude, longitude, and elevation) will not be identified.

As an aid for research in molecular phylogenetics, the herbarium maintains a collection of plant material specifically intended for DNA extraction. Botanists at the Missouri Botanical Garden collect leaf samples in the field, preserve them in silica gel and ultimately store them at -20°C. Because the samples are carefully prepared and curated, they are likely to give better yields of higher quality DNA than traditionally dried herbarium material. Heidi Schmidt manages the collection. To date, nearly 4,000 specimens have been catalogued and are available for distribution. A searchable database of the DNA material is available at www.mobot.org/MOBOT/research/applied_research/dnabanking.shtml#dna.

Please contact Schmidt (heidi.schmidt@mobot.org) if you are interested in obtaining DNA samples. The Garden also houses living collections of species collected in the wild. To search this collection, go to www.mobot.org/hort/gardens.

Curation and identification of specimens are carried out by the Garden specialists who work with general determinations, bryophytes,



PHOTO BY TRENT FOLTZ

Jim Solomon, Curator of the herbarium, manages the storage, care and use of the Garden's collection. His research interests focus on the flora of the Bolivian Andes and studies of members of Vitaceae, the grape family, and Cactaceae, the cactus family.

PHOTO BY TRENT FOITZ



As a botanical generalist, Ronald Liesner is an expert at sorting plants into families and making preliminary identification to facilitate further study.

pteridophytes and angiosperms. A list of these specialists is at www.mobot.org/MOBOT/research/specialists.shtml.

Visitors: In 2001, the latest year for which there are complete statistics, 234 visiting scientists from the U.S. and 92 from abroad came to the Garden to consult its herbarium and library collections.

There were two long-term visitors who stayed for six months to a year at MO: Alvaro Idárraga (HUA), Checklist of the Flora of Antioquia; and Francisco Javier Fernández Casas (MA), Euphorbiaceae and Loganiaceae for Paraguay.

Visitors who remained at MO for periods of one to six months were Luzmila Arroyo (USZ), Catalogue of Vascular Plants of Bolivia; Moisés Mendoza (USZ), Apiaceae, Araliaceae, Portulacaceae and Iridaceae for the Catalogue of Vascular Plants of Bolivia, Ethnobotany; Magaly Mercado (USZ), Berberidaceae for the Catalogue of Vascular Plants of Bolivia; Fu Deshi (Flora of China); Marcela Celis (COL), Iridaceae of Colombia; Marcela Mora (COL), Araceae of the Chocó region, Colombia; Rosalba Ruiz (HUC), Cactaceae of Colombia; William Vargas (COL); Alexander Rodríguez (INB), Asteraceae, Passifloraceae and Urticaceae for the Manual de Plantas de Costa Rica; Carmen Bonifaz de Elao (Bascom fellow, GUAY), Flora of the "mist" forest, coastal Ecuador; Edwin Narváez (QCNE), botanical gardens

management; Jacob Friedman (Tel-Aviv University, Israel); John Rabenantoandro, Andry Rajosoa, Richard Randrianaivo, Fidy Ratovoson, and Ludovic Reza (Madagascar projects); Daniel Tejero (UNAM), Mexican Pteridophytes; Gloria Calatayud (Bascom Fellow, Universidad de San Antonio de Abad, Peru), Orchidaceae from San Ignacio, Department of Cajamarca, Peru; and Phan Ke Loc (CPNP), Vietnam species identification, cycads, conifers, Illiciaceae, Platanaceae, Fabaceae, and Melastomataceae.

Many visitors stay at the Trelease House or Anderson House, the Garden's guesthouses, during their time here. The individual apartments in the guesthouses are large, comfortable, completely furnished, and have kitchen facilities. The guesthouses are named in honor of William Trelease and Edgar Anderson, former directors of the Garden. Brenda Sneed manages both

guesthouses with the assistance of Barbara Strebler. Please contact Sneed by telephone (314-577-9576), fax (314-577-0830), or e-mail (brenda.sneed@mobot.org) for reservation information and availability. Information for visitors is available at www.mobot.org/MOBOT/Research/visitors/visitors.shtml.

Herbarium Internship

Program: The Garden, through the various departments, offers unpaid herbarium internships for students and researchers, covering curation and management techniques that can be applied to their own research or home institutions.

Research Websites: In addition to the Websites mentioned throughout this publication, the following provide more information about the Research Division:

Databases on nomenclature, literature, specimens, chromosome numbers, catalogues and floras of angiosperm families: www.mobot.org/MOBOT/Research/aldlb.shtml

Taxonomic treatments, revisions, and/or keys for Angiosperm plant families or genera:

www.mobot.org/MOBOT/Research/generalprojects.shtml

Databases and taxonomic treatments on Mosses:

www.mobot.org/MOBOT/tropicos/most/welcome.shtml

People at MO:

www.mobot.org/MOBOT/Research/people.shtml

Research Visitors Guide:

PHOTO BY ANDREW COLLIGAN



Brenda Sneed, our Logistics Coordinator since starting at the Garden in 1989. Brenda has managed the Research guest housing that began with two apartments and four beds and now totals eight apartments with over 35 beds. Besides working with visitors, Brenda does all the purchasing and many other vital tasks for Research.

<www.mobot.org/MOBOT/Research/visitors/visitors.shtml>

Library

The Missouri Botanical Garden Library supports the research efforts of Garden staff, botany students, and visiting scientists from around the world through its excellent collections and services.

Library collections number more than 164,000 volumes of monographs and journals, including 9,000 volumes of rare books dating from 1474. In addition, the Library contains extensive non-book collections, including Garden records, professional and personal papers of Garden botanists, historic manuscripts, photographs, oral histories, and architectural drawings. Additional information, including the Library online catalogue, is available at <www.mobot.org/MOBOT/molib>.

Because the Library collections are so rich, interlibrary loans are especially important in the Library's mission to disseminate the botanical literature worldwide. One thousand three hundred thirty-three interlibrary loans were made to other libraries in 2001, while only 330 items were borrowed from other libraries.

Connie Wolf, Librarian, is responsible for the overall management of the Library. Doug Holland, Administrative Librarian, supervises staff and is responsible for daily library operations. Linda Oestry, Research Librarian, selects books and journals, oversees the exchange program, and

provides reference services. Zoltan Tomory, Technical Services Librarian, is responsible for cataloging and maintaining the Library's online library system. Julie Crawford catalogs the collections. Andy Colligan, Archives Librarian, is acting head of the Archives. Mary Stiffler is responsible for circulation, interlibrary loans, and patron assistance. Victoria McMichael oversees serials and assists patrons. Heather Wells-Sweeney assists with acquisitions, reference, and circulation. More than 30 volunteers provide valuable assistance in almost every sector of the Library.

In 2001, The Web Group and Library completed the IMLS Leadership grant entitled "Preserving and Digitizing Collections Images: Linking Collection Images and Databases for Public Access." During this two-year project, more than 30,000 herbarium specimens, line drawings, and live plant specimens were digitized and placed on the Web at <www.mobot.org/W3T/Search/image/imagefr.html>.

Rare Books Digitization and Preservation Project. Funded by the Andrew W. Mellon Foundation, this initiative is part of a larger cooperative project to digitize rare and beautifully illustrated books. For results, go to <ridgwaydb.mobot.org/mobot/rarebooks>. Other participating libraries include the Oak Spring Garden Library (Mrs. Mellon's private collection), The New York Botanical Garden Library (NY); Royal Botanic Gardens Library (K); and the Natural History Museum

Library (BM).

St. Louis Research Libraries Consortium (SLRLC): This consortium was formed in 2001 and includes the Missouri Botanical Garden, the Missouri Historical Society, and the St. Louis Art Museum. These three premier St. Louis cultural institutions plan to collaborate on projects that provide enhanced access, control, and preservation for library and archival collections in all three institutions.

The initial SLRLC project is to purchase and implement the shared Innovative Interfaces Library System, which will enable each institution to provide, among many other advantages, simultaneous Internet searches of all three libraries' online book and archival catalogues, digitized texts and images, unique indexes, and Internet searches of the thousands of other Innovative Interfaces libraries. It also positions the libraries to join MOBIUS, the official statewide database of Missouri academic libraries.

Powerful economies of scale result from sharing the costs of the Innovative system three ways. Innovative Interfaces hardware, software, and services start-up costs are \$69,233 per library, as compared to \$130,000 per library if each library proceeds alone. Having one rather than three servers, and sharing other ongoing hardware, software, maintenance, and staff costs will provide even greater annual savings.

The SLRLC also will open the door to future cost-saving collaborative projects, including joint digitization projects, links to other institutional resources, and group access to databases. Increased interaction between these libraries and the ability to search all three collections will inspire projects such as interdisciplinary Web-based teacher resource guides. The shared Innovative Interfaces system will be a powerful and flexible vehicle for displaying information and images drawn from these three rich historical, scientific, artistic, and scientific collections.

The Library began a Library Display and Lecture Series in 2001. Displays and lectures have included talks on Alfred Russel Wallace by Sandra Knapp (BM), Australian orchids by



Library staff members Mary Stiffler and Vicki McMichael examine volumes in the Rare Book Room.

PHOTO BY TRENT FOITZ

Peter Bernhardt (St. Louis University and MO Research Associate), Carl Linnaeus and classification by Peter Stevens (Associated University Faculty), G. Ledyard Stebbins and the Evolutionary Synthesis by Betty Smokovitis (University of Florida), Book conservation by Richard Baker (a highly respected St. Louis book conservator), and ethnobotanical research by Senior Botanist Walter Lewis.

Library staff currently is working with the St. Louis Art Museum on a joint rare books exhibit to be held at the St. Louis Art Museum in 2004. The exhibit will include 38 beautifully illustrated books from the Library's Rare Book Collection. Francesca Consagra (St. Louis Art Museum) and her assistants completed their survey of the rare book collections at MBG. Selected items were photographed, and a review of the conservation issues concerning the use of the selected images is being prepared by Deborah Wender (Northeast Document Conservation Center). The final theme for the exhibition has not yet been fully developed.

Book conservation continues to present a challenge since the loss of the Library's paid conservator in 1995. The Library is working with the Development Division to match a \$250,000 challenge grant given to the Library in 1998 to create an endowed conservator position.

The Library Services Technology Act (LSTA) granted an award of \$20,900 for an archives project to test best practices for digital capture; develop thorough documentation for a Dublin Core-based image database application developed by MBG; show practical applications of an image database by creating a Website that dynamically extracts images from the database; and test best practices in optical storage by evaluating writable DVD formats for storage of "archival" digital images.

Botanical Databases

TROPICOS: The botanical database at the Garden, is a continuously growing and changing resource. The accumulated information on over

909,737 plant names and 1,765,891 herbarium specimens was developed through the actions of a wide variety of floristic, nomenclatural, and bibliographic projects both at the Garden and in collaboration with other institutions. This wealth of information is available on the Internet through W³TROPICOS at the Garden's Website <www.mobot.org>. This site provides access to the vascular plant and bryophyte nomenclatural databases, which also include links to related flora and checklist projects, specimen, type, and chromosome data, habit and specimen images, and distribution maps based on available specimens. W³TROPICOS also provides access to the bibliographic database that contains almost 90,000 titles. These references provide the literature references used within the other databases and can be accessed by author or keyword. A few publications are being used to provide images of rare botanical works. The prototype provides images of each page of the work and access to the place of publication for the name records published in the work. Direct Web access to the specimen database is also possible. Individual specimens can be selected by collector and number or can be displayed from a list of specimens for a country or collection number range. In addition to the usual specimen label information, the specimen display includes a history of determinations for the specimen, thus providing a quick way to check for changes in identification or updates for specimens sent for determination. Records of new plant species or necessary taxonomic changes for Ecuador, Panama, and Peru are continuously updated by Carmen Ulloa Ulloa. She has started working on a new project to update and maintain the Checklists of these countries that were previously published by the Garden as printed *Catalogues*.

A redevelopment project is underway to create TROPICOS II, the next generation of the TROPICOS database. The most exciting development is the transfer of TROPICOS data to INFORMIX relational tables. We have begun developing output options and defining

the next phase of the project. At this time we are testing Web access to the tables through both structured form queries and "write your own" SQL (Structured Query Language) access. The new system is also designed to allow automated queries with XML (Extensible Markup Language) or other formatted output. The next phase, providing input and output functionality to TROPICOS II for all projects and authority file maintenance is under way.

Research Web Group: The Web Group includes the imaging lab, which is currently working on two projects: Rare Books from the MBG Library and Preserving and Digitizing Plant Images.

Rare Books: Funded by the Andrew W. Mellon Foundation, this collaborative project will result in a large database of rare botanical literature. We have selected beautifully illustrated volumes from our collection that will appeal to botanists, art historians, and anyone who enjoys plants. This site includes author biographies, descriptions of the books, and current botanical names (when available). Online at <ridgwaydb.mobot.org/mobot/rarebooks>.

Preserving and Digitizing Plant Images: Linking Plant Images and Databases for Public Access. This project, originally funded by the Institute of Museum and Library Services, was successfully completed in November 2000. This project continues through the support of the Research Division. The purpose of our project is to link plant images with their associated data in TROPICOS and make the images and data available online. Value-added information such as biographies, current names, links to TROPICOS and the USDA PLANTS database are also included. We have created a rich repository of over 35,000 plant images that continues to grow daily. Online at <ridgwaydb.mobot.org/mobot/imls>.

New Websites are continually created. Some of the newer ones include: Vietnam Botanical Conservation Program, several Field Reports, a former graduate student's home page about *Moringa* (Moringaceae), and a GIS Website. To

see projects as they are added, please visit our What's New page at <www.mobot.org/MOBOT/Research/whatsnew.shtml>.

Chris Freeland is the Project Manager and Technical Coordinator for the Web Group and its digital library projects. Beth Owen, Web Content Developer, works with staff to design and develop new material for the Research Website. Leslie Miller, Imaging Coordinator, creates digital imaging standards that Imaging Technicians Fred Keusenkothen and Wendy Westmoreland use to digitize and edit images for the Web. Myriam Fica, Information Systems Technician, continues to provide support for research projects and system users, as well as publishing content for the Web. Volunteer Alexis Lansing validates scientific names for the Rare Book database.

Geographic Information

Systems: During 2001, W³TROPICOS was integrated with ArcIMS software to generate on-the-fly distribution maps available via the Garden's Web Site. This integration of database and mapping technology allows users to extract data from our large database and combine this data with various data layers to produce and print distribution maps. Additional data layers such as elevation and vegetation will be integrated within the next year, as well as the ability to download various data layers direct to the users' PC. We are also entering the arena of remote sensing analysis for use in collection prioritizing and vegetation mapping. Finally, in coordination with several checklists and floras, GIS is being used to analyze gaps in collections, create map distributions for species of conservation significance, and assess the protection status for selected species.

Trish Consiglio is the GIS Analyst for the Research Division, working with Research staff, visitors, and students, as well as designing and administering the Garden's Internet Map Server in coordination with the Web Group. The Garden's GIS lab is equipped with two computers, ArcView software, digitizing tablet, HP Plotter, and reference materials. Software and

training are made possible through the generosity of ESRI.

MBG Press

The past year has been challenging, as many anticipated projects have come to fruition or are actively under way in the journals, Flora projects, Monograph series, and co-publications with other institutions. Some of the highlights include the publication of a new genus and species of conifer from Vietnam in *Novon*, several important contributions in the *Annals*, new volumes in the *Flora of China* (text and illustrations) and *Moss Flora of China* series, and George Schatz's *Generic Tree Flora of Madagascar*.

Journals: The *Annals of the Missouri Botanical Garden*, the Garden's primary scientific journal, contains papers in systematic botany and related subjects. It is issued quarterly and is now in its 89th year of continuous publication. Highlights of the past year include a comprehensive study of the phylogeny and a new subfamilial classification of Poaceae by the Grass Phylogeny Working Group, in *Annals* 88(3); "The Renaissance of the Apocynaceae s.l.: Recent advances in systematics, phylogeny, and evolution," a significant session from the 1999 International Botanical Congress organized by Mary Endress-Fallen (Z) and W. Douglas Stevens, in *Annals* 88(4); and the proceedings of the 2000 Systematics Symposium on Conservation, including an insightful introduction by George Schatz and P. Mick Richardson, in *Annals* 89(2). Major papers by former MO graduate students also appeared in the *Annals*: Michelle Price's "Revision of *Rhynchoslegiopsis* (Leucomiaceae: Musci)" [88(4)] and Sylvain Razafimandimbison's "A systematic revision of *Breonia* (Rubiaceae-Nauclerae)" [89(1)].

For more information about back issues of the *Annals*, or for instructions for authors, see <www.mobot.org/mbgpress>. Tables of Contents, Author and Key Word Indexes, and full-text abstracts of all the articles for issues from 1998 to the present for both the *Annals* and *Novon*

are available on the Web at <apt.allenpress.com>. Full-text articles for the *Annals* (with a 5-year moving window) and early issues of the *Annual Report* are available on the Web at <www.jstor.org>.

Novon, a journal for botanical nomenclature, is in its 12th successful year of publication. One of the highlights in *Novon* this past year was the publication of a remarkable new conifer genus and species of Cupressaceae from Vietnam, described by Aljos Farjon et al. and collected by former MO staffer Dan Harder, N. T. Hiep, P. K. Loc, L. V. Averyanov, George Schatz, and Sharon Bodine. In addition, four genera (including the new conifer) and 145 species were described as new to science, and over 170 new nomenclatural combinations were made from summer 2001 through summer 2002. *Novon* is issued quarterly and is included in the subscription price of the *Annals*; individual copies are also available for purchase through MBG Press Orders. For more information, or for the instructions for authors, see <www.mobot.org/mbgpress>.

Books: *Flora of China Illustrations, Volume 4, Cycadaceae through Fagaceae*, was published in September 2001. This volume, edited by Guanghua Zhu, Nick Turland, Ihsan Al-Shehbaz, and colleagues, accompanies text volume 4, published in 1999. Included are representatives of the Cycadaceae, Ginkgoaceae, Araucariaceae, Pinaceae, Taxodiaceae, Cupressaceae, Podocarpaceae, Cephalotaxaceae, Taxaceae, Ephedraceae, Gnetales, Casuarinaceae, Saururaceae, Piperaceae, Chloranthaceae, Salicaceae, Myricaceae, Juglandaceae, Betulaceae, and Fagaceae.

Flora of China, Volume 6, Caryophyllaceae through Lardizabalaceae, edited by Ihsan Al-Shehbaz, Nick Turland, Mike Gilbert, Guanghua Zhu, and colleagues, appeared in December 2001. The eighth volume, numbered 6 in the series, treats the Caryophyllaceae, Nelumbonaceae, Nymphaeaceae,

Cabombaceae, Ceratophyllaceae, Eupteleaceae, Trochodendraceae, Tetracentraceae, Cercidiphyllaceae, Paeoniaceae, Ranunculaceae, Circaeasteraceae, and Lardizabalaceae families, represented in China by 1,382 species. The first seven volumes, vols. 4, 8, 15, 16, 17, 18, and 24, were also published by MBG Press, in collaboration with Science Press, Beijing, and are available through <www.mobot.org/mbgpress>. Standing orders to the series are available upon request.

Flora of China Illustrations, Volume 24, Flagellariaceae through Marantaceae, was published in May 2002. This volume accompanies text volume 24, which was published in 2000, and includes representatives of the Flagellariaceae, Restionaceae, Centrolepidaceae, Xyridaceae, Eriocaulaceae, Bromeliaceae, Commelinaceae, Pontederiaceae, Philydraceae, Juncaceae, Stemonaceae, Liliaceae, Amaryllidaceae, Taccaceae, Dioscoreaceae, Iridaceae, Musaceae, Lowiaceae, Costaceae, Zingiberaceae, Cannaceae, and Marantaceae. Standing orders to the series are available upon request.

Moss Flora of China, Volume 6, Hookeriaceae through Thuidiaceae, edited by Si He [Editors in Chief are Gao Chien and Marshall Crosby], was published in May 2002. China has about 2,500 species of mosses constituting the richest and the most diverse moss flora in the North Temperate zone. *The Moss Flora of China*, English version, is a series of eight volumes dealing with all mosses known to be native to or naturalized in China. Volume 6 (the third in the series to be published) treats 189 specific and infraspecific taxa. The following families are treated: Hookeriaceae, Symphyodontaceae, Leucomiaceae, Hypopterygiaceae, Theliaceae, Fabroniaceae, Leskeaceae, Anomodontaceae, and Thuidiaceae. Volume 1 was published in 1999, and Volume 2 was published in 2001.

Monographs in Systematic Botany from the Missouri Botanical Garden: Under our *Monograph series*, several

publications have come out or are due out of print soon. Our prolific Senior Curator, Carlyle Luer, has been hard at work again this past year. *Icones Pleurothallidinarum XXII, Systematics of Masdevallia, Part Three*, authored and illustrated by Carlyle Luer, was published in November 2001 as *Monograph in Systematic Botany from the Missouri Botanical Garden Volume 86 (MSB 86)*. *Masdevallia Part Three* continues with subsections *Masdevallia* and *Minutae*, together containing about another 100 species, each with at least one black-and-white illustration in addition to the text, citation of collections, and distribution maps. A loose-leaf edition is also available.

Icones Pleurothallidinarum XXIII: Systematics of Masdevallia, Part Four, also by Carlyle Luer, came out in July 2002 as MSB 87. *Icones 23* continues in the same format as Parts One, Two, and Three, and includes a few more than 100 species comprising three more subsections in *Masdevallia*: *Caudatae*, *Oscillantes*, and *Saltatrix*, each with keys to the species. All species are described on an odd-numbered side of the page with a full-page illustration on the reverse, the even-numbered side. Some smaller illustrations of variations are included. As before, a loose-leaf edition for the convenience of re-arranging pages is available.

Luer's *Icones Pleurothallidinarum XXIV: A First Century of New Species of Stelis from Ecuador*, came out in July 2002 as MSB 88.

In the works for publication in late summer/autumn 2002:

Global Patterns of Plant Diversity: Alwyn H. Gentry's Forest Transect Data Set, by Oliver Phillips (University of Leeds, U.K.) and James Miller, is in press as MSB 89. This volume summarizes the data from each of Al Gentry's 226 transect sites on six continents, on which he collected data for over 22 years. It includes environmental and diversity information and a taxonomic summary of the species that were encountered. The volume also provides full context for the information including a discussion of the history of Gentry's transect studies, an in-depth description of the

methodology used to collect the data, a summary of the patterns arising from the overall results, and a summary of the significance of the studies. A sampling of Gentry's slide collection is reproduced in color.

Moss Flora of Central America Part 2, Pottiaceae–Orthotrichaceae, by Bruce Allen, is in press as MSB 90. Central America, with an estimated of 913 species of mosses, has one of the richest moss floras in the world. Part 2 of the *Moss Flora of Central America* treats 286 species. Each species is fully described, discussed, illustrated (some for the first time), and its Central American distribution is mapped. Families and genera are fully described, and all taxa are keyed. This volume contains major treatments on *Macromitrium* (31 species), *Bryum* (27 species), *Brachymenium* (16 species), *Leptodontium* (14 species), and *Breutelia* (14 species) that should prove useful throughout tropical America. [Part 1, Sphagnaceae–Calymperaceae, was published by MBG Press in 1994 as MSB 49.]

Co-publications: The *Generic Tree Flora of Madagascar*, by George Schatz, was co-published by Kew and MBG Press in November 2001. This book is a practical field manual for the identification of the 500 total genera of native and naturalized Malagasy trees, representing approximately 4,220 species. Identification keys emphasize vegetative and gross morphological features, and nearly all genera are illustrated by outstanding line drawings. The book contains full descriptions of all genera, distribution information, key characteristics, up-to-date taxonomic references, and over 3,000 Malagasy vernacular names. A French edition of this Flora, with translation by Lucienne Wilmé, is also available as *Flore Générique des Arbres de Madagascar*.

La Botánica en el Nuevo Milenio, Memorias del III Congreso Ecuatoriano de Botánica (Proceedings of the 3rd Ecuadorian Botanical Congress), edited by Alina Freire-Fierro and David A. Neill, was published in May 2002 as "Publicaciones de la Fundación Ecuatoriana para la Investigación y el Desarrollo de la Botánica, FUNBOTANICA No. 4," in

collaboration with MO and QCNE. Fourteen articles from the 2000 meeting in Ecuador are contained in this volume. Topics include Ecuadorian gymnosperms, especially Ephedraceae, *Lachnagrostis* (Poaceae), *Scleria* (Cyperaceae) from Venezuela, Ecuadorian *Polylepis* (Rosaceae), the conservation status of the Galápagos flora, herbarium techniques, Andean Lake macrophytes, forest composition and ecological studies in Costa Rica, Colombia, and Ecuador, Amazonian lianas, and soil conservation. Multinational articles are variously written in English and Spanish.

Flora of Pakistan, No. 205, Polygonaceae, by M. Qaiser, a co-publication with the University of Karachi, Pakistan, appeared in July 2001. This volume includes the Polygonaceae family, represented in Pakistan by 19 genera and 103 species. It includes a map of the districts of Pakistan and grid system as well as keys and 30 illustration pages.

Flora of Pakistan, No. 206, Cyperaceae, by I. Kukkonen, another co-publication with the University of Karachi, Pakistan, appeared in October 2001. This volume includes the Cyperaceae family, represented in Pakistan by 22 genera and 179 species, of which many are weeds. It includes a map of the districts of Pakistan and grid system as well as keys and 36 pages of illustrations.

MBG Press began co-publishing the *Flora of Pakistan with Volume No. 202*. Previous fascicles are available through Rubina Abid (Department of Botany, University of Karachi, Pakistan) <flora@super.net.pk>.

A Treasure of Masdevallia is another orchid series from Carlyle Luer, and volume 26 was published in May 2002. In the same format as all 25 preceding fascicles, 20 as *Thesaurus Masdevalliarum*, and the last five as *A Treasure of Masdevallia*, 15 species are presented each with a full-color, watercolor painting in natural size by Stig Dalström. A page with description and discussion in both English and German faces the painting, and citation of specimens, a distribution map, and at least one black and white illustration occupy the reverse. The German translations are by Fritz

Hamer, author of the *Orchids of El Salvador and Orchids of Nicaragua*.

The Spanish translation of the St. Louis International Code of Botanical Nomenclature, a co-publication between MBG Press and the Darwinian Institution in Argentina (SI) will come out of print by late fall. The publication was coordinated by Roberto Kiesling and had the input of several Spanish and Latin American botanists who did the translation: Roberto Kiesling (SI), Cecilia Ezcurra and Irma Gamundí (BCRU), Ginés López and Félix Muñoz-Garmendi (MA), and Juan Martínez Laborde (Escuela Superior de Ingenieros Agrónomos de Madrid); and the correction: Sergio Archangelsky (BA), Fernando Chiang (MEXU), Alina Freire-Fierro (MO), Irma Gamundí, Daniel Giuliano (LP), Roberto Kiesling, Juan Martínez Laborde, Susana Martínez and Jorge Wright (BAFC), and Mario Souza (MEXU).

Staff of MBG Press Editorial Office, located on the third floor of the Monsanto Building: Victoria C. Hollowell is the Scientific Editor and Head of the Press, Amy S. McPherson is Managing Editor, Diana Gunter is Associate Editor, Aida Kadunic is Senior Secretary, and Barbara Mack, Administrative Assistant, is Text Formatter for titles in the Garden's book series and assists in manuscript preparation for the two journals.

MBG Press Orders, currently located in the Garden Gate Shop: Sales of MBG Press titles are handled by Brian Gardner. To order a book or to request information about a title, call 314-577-9534; Fax: 314-577-9591

e-mail: mbgpress@mobot.org;
<www.mobot.org/mbgpress>.

Systematics Symposium

The 49th Annual Systematics Symposium to be held on October 11–12, 2002, will feature a distinguished group of experts who will address the topic of "The Genetics of Conservation." The symposium will have a good mix of animals, plants, experiments, theory, and provocative ideas. Barbara Schaal (Washington University), and Kathryn Kennedy (Center for Plant Conservation) will moderate the session. The speakers

and their talks will be: Rob DeSalle (American Museum of Natural History), "Genetic structure and conservation in animals"; Tzen-Yuh Chiang (Cheng-Kung University, Taiwan), "Phylogeography and conservation of rare Asian species"; Michael Purugganan (North Carolina State University), "Hawaiian Silverswords: speciation and conservation"; Michele Dudash (University of Maryland), "Genetic structure and fitness in *Mimulus*"; Mitch Cruzan (University of Tennessee, Knoxville), "Genetic structure of central and marginal plant populations"; Barbara Schaal (Washington University), "Conservation genetics of natural and introduced plant populations"; and Steven O'Brien (Evening Speaker, National Cancer Institute), "Conservation genetics of large animals." P. Mick Richardson continues as the coordinator of the Symposium, with the assistance of Alina Freire-Fierro, Sandy Lopez, Mary McNamara, Brenda Sneed, and Azemina Zeljkovic.

Graduate Program

The Missouri Botanical Garden offers a broad-based program of graduate studies in systematic botany in cooperation with Washington University (WU), Saint Louis University (SLU), University of Missouri-St. Louis (UMSL), and Southern Illinois University at Edwardsville (SIUE). The Manager of the Graduate Program is P. Mick Richardson. Students apply to and enroll at one of these universities and complete the degree requirements of that school, but have full access to the staff, facilities, laboratory, and research opportunities available at the Garden. The exceptional faculties and programs at these universities in population biology and genetics, ecology, and molecular biology, combined with the excellent herbarium, library, greenhouse facility, and research staff at the Garden, make this a unique and stimulating graduate program. The Garden's strong commitment to tropical research provides students with outstanding opportunities for field-oriented studies. Peter H. Raven, Director of the Garden, is Engelmann Professor of Botany at Washington

University, and many of the Curators are adjunct faculty members at one or more of the participating universities. A student can work under the direction of any regular or adjunct faculty member at his/her university. Students may pursue master's or doctoral degrees at the University of Missouri-St. Louis, Washington University, and Saint Louis University, and a master's degree at Southern Illinois University at Edwardsville.

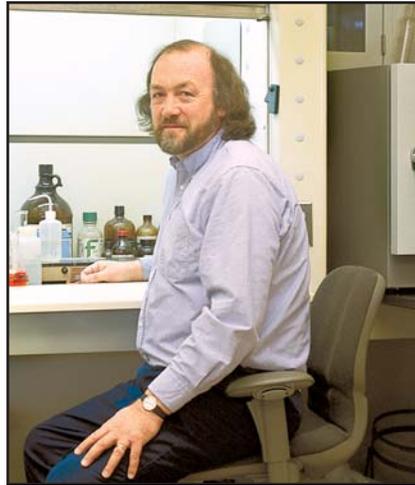
The doctoral program at the University of Missouri-St. Louis continues to gain strength, with many new faculty members being hired in recent years, including Susanne Renner and Peter Stevens. UM-St. Louis also hired Elizabeth Kellogg as the E. Desmond Lee and Family Endowed Professor in Botanical Studies, which has strengthened the area of molecular systematics in the program.

International Center for Tropical Ecology Fellowships and Raven Fellowships in Tropical Biology support several of the University of Missouri-St. Louis students. Baltzer, Bascom, Bovard, Layton, and Smeltzer Fellowships are awarded each year as appropriate. Funds from the Andrew W. Mellon Foundation support Ph.D. students in taxonomy. Several Latin American students have support from the Academic and Professional Programs for the Americas (LASPAU). Washington University has Graduate Assistance in Areas of National Need (GAANN) funding to support Ph.D. students. UM-St. Louis has received endowment funds from the Christensen Fund to support graduate students from tropical countries who are interested in plant conservation.

There are currently 35 graduate students from the U.S.A. as well as Australia, Bolivia, Brazil, Bhutan, China, Colombia, Ecuador, Indonesia, Mexico, Nicaragua, Taiwan, Venezuela, and Vietnam. All of them have Garden advisors or co-advisors (see Directory).

Four students received their doctoral degrees in 2001–2002: John Gaskin (WU, Raven/Schaal, "Phylogeography of *Tamarix*, Tamaricaceae," currently a postdoc with the USDA); Shing-Fan Huang (UMSL, Raven/Ricklefs, "Phylogeny and historical

PHOTO BY TRENT FOLTZ



*P. Mick Richardson, MBG
Head of the Graduate
Program, and Coordinator
of the Annual Systematics
Symposium.*

biogeography of *Acer*, Aceraceae," currently in Taiwan); Zacharia Magombo (UMSL, Magill/Kellogg, "Systematic and biogeographic studies of the moss family Diphysciaceae M. Fleisch.," currently at the National Herbarium of Malawi); Michelle Price (UMSL, Magill/Kellogg, "A systematic study of the moss genus *Holomitrium* Brid., Dicranaceae, Musci. A study of taxonomy, biogeography and phylogeny," currently at the Conservatoire et Jardin Botaniques de la Ville de Genève), and three received their master's degrees: Sara Fuentes (UMSL, Al-Shehbaz, "Taxonomic revision of the genus *Pennellia*, Brassicaceae," currently a Ph.D. student at UMSL); Ken Hiser (UMSL, Kellogg, "Systematics of *Ixophorus*, Poaceae"); and Lishu Qu (UMSL, non-thesis degree, currently studying computer science at the University of Missouri-St. Louis).

The students maintain a Website at <www.mobot.org/gradstudents/welcom.html> and this contains e-mail addresses of current and recent students. For further information about graduate study at the Garden, write to P. Mick Richardson, Manager of Graduate Studies (e-mail mick.richardson@mobot.org). Requests for application materials for the associated universities should be directed to the individual schools as follows: The Division of Biology and Biomedical Sciences, Campus Box 8072, Washington University, 660 South Euclid, St. Louis, Missouri 63110, U.S.A. <dbbs.wustl.edu>;

Biology Department, Saint Louis University, 3507 Laclede Avenue, St. Louis, Missouri 63103, U.S.A. <www.slu.edu/colleges/gr/index.html>; Biology Department, University of Missouri-St. Louis, 8001 Natural Bridge Road, St. Louis, Missouri 63121, U.S.A. <www.umsl.edu/divisions/artscience/biology/index.html>; or Department of Biological Sciences, Southern Illinois University, Edwardsville, Illinois 62026, U.S.A. <www.siu.edu/CAS>. For information on the Graduate Record Exam (GRE) <www.gre.org>, and for students from non-English speaking countries, information about the Test of English as a Foreign Language (TOEFL) is available at <www.toefl.org>, potential students should write to Education Testing Service <www.ets.org>, Rosedale Road, Princeton, New Jersey 08451, U.S.A.

The research and teaching of Peter Stevens, Associated University Faculty at MO and Professor at UMSL, continue to be interwoven. Last fall he taught North American plant families, a course that depends heavily on plant material from the Garden. During the laboratory students look not only at floral morphology but also at seed and vegetative anatomy. Such is the state of our knowledge that plenty of original observations can be made on material growing in the Garden, and last fall's course was no exception. Sectioning the nodes of just a few species of Melastomataceae suggested that conventional wisdom about this feature in Myrtales needs correcting. We also

found that the patterns of thickening and staining in the testa cells of *Proboscidea* (Martyniaceae) were of both considerable beauty and taxonomic interest.

In the Spring term Stevens taught systematic theory with Toby Kellogg (Associated University Faculty at MO and Professor at UMSL), a course that turned out to be particularly memorable because of the fascinating discussion sections. The multinational contingent at the course made short shrift of several of the papers claiming to integrate systematics and conservation. In the course, the use of morphology in phylogenetic analysis naturally has a prominent place, but it is clear we do not really understand how effective it is. Hence during the term he began to grapple with this difficult problem, a task in which former WU/MO graduate student Simon Malcomber has joined.

In the late spring of 2001, with the indispensable help of Hilary Davis, a Website on Angiosperm phylogeny was opened <www.mobot.org/MOBOT/research/APweb/welcome.html>. Here characterizations of all orders are linked to a conservative tree that is the basis of the Angiosperm Phylogeny Group's consensus classification (published in the *Annals* 85(4) in late 1998). Characterizations for all plant families and many higher level branching points were provided. In general, features varying in flowering plants are placed on the tree at the level at which they may have evolved.

In the spring of 2002, again with Hilary's help, a large number of changes were made, over 20 ordinal trees added, lists of genera in most families were provided, more links to images established, and so on. The goal of this site is to help in teaching and research at a time when ideas of relationships are still somewhat in a state of flux and there is no way for most people to stay abreast of developments in our understanding of phylogeny. Hilary's work was suitably acknowledged when *Science* picked the site as one of its choices of neat sites to visit!

Fellowships

Elizabeth E. Bascom Fellowship: In 1999 the Garden created the Elizabeth E. Bascom Fellowship for Latin American women in botany. This program provides travel grants for periods of one to six months at the Garden. The fellows have access to the herbarium, the library, and the Garden's botanical database TROPICOS. Last year's recipients of the award were: Carmen Bonifaz de Elao (Ecuador); Judit Caballero (Bolivia); Gloria Calatayud (Perú); and Ileana Velázquez (Nicaragua). The Bascom Fellowship Committee was very pleased to receive many excellent proposals again this year. The results of the 2002 competition were announced in August, and there will be another call for applications in the spring of 2003. We encourage all interested potential applicants to contact Kathy

Hurlbert (kathy.hurlbert@mobot.org) and check <www.mobot.org/MOBOT/Research/jobs.shtml> and <www.mobot.org/MOBOT/Research/bascom.shtml> for further information.

Alwyn H. Gentry Fellowship:

In 1999 the Garden created the Alwyn H. Gentry Fellowship for Latin American researchers on South American botany. This program provides travel grants for periods of one to three months at the Garden. The fellows have access to the herbarium, the library, and the Garden's botanical database TROPICOS. The awardees of this year's competition were announced at the end of August. All interested potential applicants should contact Kathy Hurlbert (kathy.hurlbert@mobot.org) and check <www.mobot.org/MOBOT/Research/gentryfellowship.shtml> for more information.

Graduate Fellowships supported by the MacArthur Foundation:

In 1999, with support from the John D. and Catherine T. MacArthur Foundation, the Garden offered two fellowships to enable outstanding Bolivian students to earn a master's degree in botany at the University of Missouri-St. Louis. The fellowship is designed to strengthen capacity for scientific research and biodiversity conservation in Bolivia. The fellowship recipients were Lupita Sánchez (Santa Cruz, Bolivia), and Rodrigo Ríos (La Paz, Bolivia). Both students were admitted to the two-year master's program in Biology at the University of Missouri-St. Louis for the fall 2000 semester, and both will finish their master's theses and earn their degrees in the Fall of 2002.

PHOTO BY CARMEN ULLOA ULLOA



Gloria Calatayud, an MBG's Bascom Fellowship holder, works on the orchids of the San Ignacio area in the Department of Cajamarca in northern Peru.

CCSD

*Center for
Conservation and
Sustainable
Development,
CCSD*

*Center for Plant
Conservation,
CPC*

The Center for Conservation and Sustainable Development (CCSD) was established at the Garden in 2001 to promote the use of the scientific information and expertise gathered by Garden researchers to benefit conservation and sustainable development internationally. In concert with the Research Division and other divisions of the Garden, the Center is working to (a) provide scientific data to communities and decision makers concerned with conservation; (b) expand the Garden's programs of botanical training for conservation to strengthen capacity in other countries; (c) develop community organizations in the countries where Garden scientists conduct research that can serve as anchors for research, conservation, and sustainable development activities; and (d) support policy initiatives related to conservation.

Over the past year, the Center has begun to develop new applications for TROPICOS that will extract the most pertinent data and present it in a format that will help conservationists and policymakers best use that information for conservation or promote sustainable use of natural resources. Several partnerships with other science and conservation organizations have been initiated, and the Center proposes to hire additional expert staff to assist in research and analysis of the Garden's information resources. The Garden is currently developing applications whose primary purpose is to assist conservation efforts in Madagascar and Nicaragua and has near-term plans for Tanzania and Ecuador.

Jason Bradford of the CCSD staff has been working on expanded applications of the plot data the Garden has amassed over the years, particularly in the Andean region of Latin America. Bradford and colleague Lee Hannah (Conservation

International's Center for Applied Biodiversity Science) organized a workshop entitled "A Collaborative Research Effort in Climate Change, Biodiversity and Ecosystems for the Tropical Andes," held at the National Center for Ecological Analysis and Synthesis (NCEAS) at the University of California, Santa Barbara. Several projects and proposals have resulted from this effort. Bradford recently received a grant from the National Science Foundation's Biocomplexity program to work on an integrated strategy to understand and model biodiversity and climate on the eastern slopes of the Andes in Peru and Bolivia.

The CCSD recently sponsored a seminar and workshop at the Garden on the World Conservation Union's (IUCN) standards for preparing red lists of endangered species worldwide. During the two-day event, Craig Hilton-Taylor and Wendy Strahm from the IUCN's Species Survival Commission's offices in the United Kingdom and Switzerland, and Simon Stuart, SSC representative at Conservation International's Center for Applied Biodiversity Science, discussed and explained the red list protocols developed by IUCN, and explored how Garden researchers can collaborate with IUCN. Armand Randrianasolo, whose research focuses on the Malagasy flora, reviewed progress at the Garden toward establishing a SSC Madagascar Plant Specialist Group, and additional opportunities for Garden participation in the SSC's work were identified.

An enduring feature of the Garden's work in other countries is its commitment to strengthen human capacity for scientific research, especially in those biologically rich tropical countries that often lack the trained scientists they need to gather and analyze information on their flora and fauna. Education is always critical to the future of a nation and to understanding and preserving its

natural resources. The Center is supporting efforts to train people who want to make conservation work their lifelong careers and to help them find jobs where they can use their training. In Tanzania, for example, the Center is paying tuition and expenses for four promising graduates of the Tanzania Botanical Training Programme at the Forestry Institute in Olmotonyi. These students, who have participated in the Garden's field training and herbarium curation courses, will obtain their professional certificates and gain access to better opportunities for employment in conservation-related posts.

New fundraising initiatives for the Center have focused on raising additional money for the training program. With support from the Christensen Fund, the Center is initiating a coordinated training program in the Andean countries of Ecuador, Peru and Bolivia.

The creation of jobs is a crucial factor for conserving wildlife. In Madagascar, where the Garden maintains a regional office staffed by local employees, the Center has hired a Malagasy conservation officer to assist in conservation efforts in the country's eastern littoral forest, and to work with endemic and threatened species elsewhere in the country. In the littoral forest, this new staff member and others will assist communities to conserve and sustainably use their forest resources. To help disseminate information on plant conservation in Madagascar to local institutions and other concerned organizations, the Center is supporting the publication of a quarterly newsletter on plant conservation and research in the country in French, Malagasy, and English.

The Center also has been increasing MBG's influence on national and international policy for conserving plants. We have funded and otherwise supported the Global Taxonomic Initiative (GTI) under the Convention on Biological Diversity (CBD). Through this, we have undertaken a major role in implementing the new international

plant conservation strategy adopted by the CBD. Other members of the staff include Kathy Hurlbert, Administrative Coordinator, and Carol Vaughn, Secretary.

CPC

Since its arrival at the Garden in January 1991, the Center for Plant Conservation (CPC) has continued to build its program to conserve the rare plants native to the U.S. The core CPC program is the National Collection of Endangered Plants, maintained in a nationwide network of 33 participating institutions. The National Collection now includes 592 rare U.S.A., taxa, making it the largest living rare plant conservation collection in the world. The National Collection is maintained to provide materials for restoration and recovery of imperiled plants in the wild and also serves research and education needs in conservation. Currently CPC participating institutions are involved in approximately 70 restoration projects nationwide. CPC also works to provide technical assistance and develop best conservation practices in plant conservation for a wide array of users. Education and advocacy for plant conservation are also important components of their program. CPC institutions and the National Office work with local botanists in various regions nationwide to examine priorities and develop funding and program strategies to implement conservation action. Particular areas of concern are those regions of the U.S. with high plant diversity and rarity (currently Hawaii, California, Texas, Florida, and Puerto Rico). CPC maintains a central database that includes information on over 8,700 U.S. taxa, of which approximately two-thirds are classified as being of some level of conservation concern by the U.S. Fish and Wildlife Service, The Nature Conservancy, or the CPC.

The CPC program is directed by Kathryn Kennedy, President and Executive Director. She is assisted by Donna Key, Administrative Assistant. Kevin James is the Conservation

Programs Information Coordinator. Patricia M. Rusch is the Development Manager. The CPC is governed by a national Board of Trustees, chaired by C. W. Eliot Paine. The Board now includes 23 members from 12 states and Great Britain. A National Science Advisory Council, chaired by Barbara A. Schaaf of Washington University, advises CPC on scientific program development.

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- Chen Jia-rui** (Beijing, China),
- Mireya Correa** (Panama City, Panama),
- Jorge V. Crisci** (La Plata, Argentina),
- Luis Diego Gómez** (San Vito, Costa Rica),
- Enrique Rentería** (Medellín, Colombia),
- Mario Sousa** (Mexico City, Mexico),
- Armen Takhtajan** (St. Petersburg, Russia)
- Wu Pan-cheng** (Beijing, China).



Cobaea scandens Cav. (Polemoniaceae). Species native to Mexico and naturalized or cultivated in the Americas, Europe, Asia, Africa and New Zealand.

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