



The Plant Press



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Botany Profile

The Guiana Shield: 20 Years and Counting

By Vicki A. Funk

The Biological Diversity of the Guiana Shield (BDG) program has operated in the National Museum of Natural History for over 20 years and although the program interacts with many departments and bureaus across the Smithsonian Institution, it is closely associated with the Department of Botany. The goals of BDG are 1) to document, study, and preserve the biodiversity of the Guiana Shield, 2) to provide the opportunity for excellent scientific research, and, 3) to make information generated by these studies useful for conservation and education.

The Guiana Shield is a distinct geological unit that underlies the northeastern corner of South America and includes much of the area east and south of the Orinoco River and east and north of the Rio Negro and Rio Amazonas. The area includes Bolívar, Amazonas, and Delta Amacuro states in Venezuela; most of Guyana, Surinam, and French Guiana; parts of northern Brazil; and parts of southeastern Colombia. The area has many unusual ecosystems including the famous tepuis of Sir Arthur Conan Doyle's "The Lost World" and the unique "Greenheart" forests of Guyana, all of which have high endemism.

The Shield's igneous-metamorphic basement was laid down in several events from 3.6 to 0.8 billion years ago. This granitic basement is easily observed in the many black "hills" of granite that dot the landscape across the Guiana Shield and is also exposed on some of the mountains and massifs. Between 1.6 and 1 billion years ago, sedimentary covers

of sand were successively laid down and cemented during thermal events. The resulting quartzite and sandstone rocks are known today as the Roraima formation. Some recent work has suggested that the eastern rocks are the oldest; this would make the Pakaraima Mountains of Guyana and the eastern parts of Venezuela older than the remainder of the Roraima formation.

The area is dotted with tepuis, the steep-walled table mountains prominently featured in photos and films, many of which support a unique flora and fauna. The easternmost peaks reach heights around 2,000 meters and include Mt. Ayanganna and Mt. Wokomung in Guyana. The highest tepui, Sierra de la Neblina, exceeds 3,000 meters and is located in the western part of the Shield on the border of Venezuela and Brazil. Many other tepuis have summits between 2,000 and 2,400 meters. A large, mid-elevation, sandy plateau between 400 and 1,500 meters, the Gran Sabana, occupies southeastern Venezuela and adjacent parts of Guyana (where it is named the Rupununi Savanna) and Brazil and there are also variously-sized areas of lowland white-sand savanna scattered throughout the Guiana Shield (e.g., Berbice Savannas of Guyana).

There are well-known floras for only a few parts of the Guiana Shield, such as Mount Roraima (Venezuela, Guyana, Brazil), the Iwokrama-Mabura Hill area and Kaieteur (Guyana), Tafelberg (Surinam), and Saül (central French Guiana). Most areas, such as the lowland forests and tepui slopes, are very poorly known.

Likewise faunal studies are in short supply so while birds and mammals have been studied in a number of places, the vast majority of the Shield remains under explored.

BDG is a field-oriented program that has been operating since 1983 (federally funded since 1987). Originally confined to botany and Guyana, the least well-known, most biologically diverse of the three Guianas, the program has since been expanded to include faunal studies and field work in the other parts of the Shield. From 1986-1998 the BDG maintained full-time plant collectors in Guyana and each year approximately six major expeditions were organized, and other expeditions, involving a total of 20-30 visiting scientists took place. The continued budget cuts of the 1990s made it impossible to continue the practice of full-time field work, and the program shifted to sending resident collectors to Guyana for 4-6 months each year or having a series of targeted expeditions. In recent years there have been resident collectors for butterflies and moths, ants, birds, and plants.

In many ways modern day field work resembles the legendary trips of old. For although it is easier on both ends of the trip (e.g., airplanes) and we collect new types of data (e.g., DNA samples, GPS coordinates), the major part of field work is essentially the same as it was during the time of Humboldt (1799-1804) and Spruce (1849-1864): a lot of

Continued on page 12

Visitors

Wenyang Wu, Philipps University, Germany; *Nolana* (Solanaceae) (2/28/06-2/27/08).

Hui Ren, South China Botanical Garden; Vitaceae (5/7/06-4/1/07).

Konstantyn Romaschenko, National Academy of Science of Ukraine; Poaceae, Stipeae (11/30/06-5/30/07).

Oscar Vargas, Universidad de los Andes, Colombia; *Diplostephium* (Asteraceae) (12/9/06-1/13/07).

Ki-Oug Yoo, Kangwon National University, South Korea; Coryloideae and Vitaceae (12/12/06-12/11/07).

Cody Hinchliff, Washington State University; Cyperaceae of Guianas and United States (1/1-1/7).

Jim Cohen, Cornell University; *Lithospermum* (Boraginaceae) and related genera (1/2).

Niki Papavramidou, University of Thessaloniki, Greece; Greek medicinal plants of antiquity, *Historia Plantarum* collection (1/5-2/28).

Matthew Cimino, Salisbury University; Soil sampling of herbarium specimens (1/7).



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Erik Krause, Emory University; **Kevin Gress**, University of Texas, Arlington; **Josh Propp**, University of Texas, Austin; Medicinal plants of antiquity (1/8-1/12).

Daniel Stancik, Charles University, Czech Republic; *Festuca* (Poaceae) (1/8-2/8).

Charlotte Riggs, Wesleyan University; Plant conservation (1/8-2/20).

Mary Stensvold, National Forest Service; North American *Botrychium* (Ophioglossaceae) (1/9; 1/12).

Doug Ripley, US Air Force retired; Image processing (1/10).

Carl Taylor, National Science Foundation; North American *Dryopteris* (Dryopteridaceae) (1/12).

Jorge Perez, Universidad Nacional de Colombia; Neotropical *Prunus* (Rosaceae) and Colombian Rosaceae (1/21-3/23).

Tamara McKimmie, **Marcia Sprules** and **Leslie Valenza**, Earthwatch Institute; Medicinal plants of antiquity (1/22-1/26).

Ling Zhang, Xishuangbanna Tropical Botanic Garden (XTBG), Chinese Academy of Sciences; Instant Identification System (1/22/07-1/21/08).

Mary Byrne, Bureau of Land Management; Seeds of Success Exchange Program (1/23).

Lisa Leno, George Mason University; Internship interview (1/23).

Nancy Mulry, Independent researcher; Volunteer interview (1/25).

Monica Reardon, George Mason University; Mexican ethnobotany (1/29).

John Page Cotton, **Jeffrey Leon**, **Sam Raker** and **Bryan Randolph**, George Washington University; Medicinal plants of antiquity (1/29-6/30).

Dylan Burge, Duke University; Recent and fossil *Paliurus* (Rhamnaceae), paleobotany of type specimens (2/13-2/16).

Ihsan Al-Shehbaz, Missouri Botanical Garden; Brassicaceae (2/13-2/16).

Nick Turland, Missouri Botanical Garden; Flora of China (2/13-2/16).

Peter Lowry, Missouri Botanical Garden; Araliaceae (2/16).

Steffi Ickert-Bond, University of Alaska, Fairbanks; Altingiaceae (2/19-3/1).

Four Seasons Garden Club, Washington, DC; Tour of Botany greenhouses (2/24).

Lawrence Stritch, United States Department of Agriculture; Endangered Puerto Rican trees (3/1).

John Mitchell and **Susan Pell**, New York Botanical Garden; Anacardiaceae (3/1-4/1).

Lei Xie, Chinese Academy of Sciences; *Clematis* (Ranunculaceae), *Circaea* and *Fuchsia* (Onagraceae) (3/1/07-2/1/09).

Maureen Murphy, University of Maryland; Wilkes project (3/5-3/9).

Chang Liu, Idaho State University; Myodoraceae (3/9-3/14).

Yaowu Yuan, University of Washington; Verbenaceae (3/9-3/14).

Tom Wendt, University of Texas; *Polygala* (Polygalaceae) (3/12-3/14).

Continued on page 5

Travel

Pedro Acevedo traveled to Raleigh, North Carolina (2/1 – 2/2) to attend the dissertation defense of graduate student Alexander Krimps at North Carolina State University.

Laurence Dorr and **Dan Nicolson** traveled to Cambridge, Massachusetts (2/20 – 2/28) and to Bronx, New York (3/25

– 3/28) to conduct library research on the final supplements to *Taxonomic Literature*, edition 2 and to use the herbarium.

Robert Faden traveled to London, England (2/23 – 3/24) to conduct research on African Commelinaceae at the Royal Botanic Garden Kew.

Vicki Funk traveled to Guyana (2/24

In my research on conservation biology, I utilize and analyze data from herbarium specimens on a daily basis. Knowing the “who, what, where and when” of collected specimens allows me to assess the conservation status of many species. One aspect of the specimens that I often overlook is the “why.”

Many of the specimens in the U.S. National Herbarium were collected simply because they exist in nature. Yet many of these species were collected because they are quite valuable to humankind. We have your everyday plant species that make life bearable, like chocolate and vanilla (which recently generated many a smile during a tour of the herbarium for my son's pre-K class). But the herbarium also houses specimens of plant species used in cultures far beyond what can be found in a Washington, DC, neighborhood grocery store. Not only are these plants valuable in today's societies, but they have been used for generations and generations.

In this issue of the *Plant Press*, we feature several stories about ethnobotany: the study of the relationship between plants and people. Plants have been used by humans since the dawn of humankind. Ancient texts can tell us quite a bit about which plants were used when. On page 8, Alain Touwaide and Emanuela Appetiti give us insight into their research on the history of ethnobotany. They study the use of medicinal plants in the cultures that flourished around the Mediterranean Sea from Antiquity to the 17th century A.D. Current findings in their fascinating research program tell us much about when food and medicinal plant species were introduced from the New World into the Old World.

Moving up in time, we have a brief story about a new exhibit which recently opened at the National Museum of Natural

History (page 7). Using botanical and anthropological collections, the exhibit tells six stories that describe the manner in which local cultures from the Southwest United States and Mexico used specific plants more than 100 years ago. This exhibit draws on the research of Rusty Russell's group, which was featured in the *Plant Press* in 2006 (Vol. 9, No. 4).

With today's environmental crisis, not only are we losing plant species at an alarming rate, but cultures are quickly disappearing too. Ethnobotany can provide some of the solutions towards sustainable living. This focus was the topic of the Ethnobotanical Summit held at the National Tropical Botanical Garden in Kaua'i at the beginning of the year. The group of ethnobotanists and associated scientists attending the meeting, including our Chair of Botany Warren Wagner, issued a statement, “The Kaua'i Declaration,” about the importance of ethnobotany in today's world, and it is printed here on page 10.

In other news, Vicki Funk provides a 20-year review of the Museum's research program cataloging the biodiversity of South America's Guiana Shield (front page). The Biological Diversity of the Guiana Shield program has been tremendously successful in discovering and describing new species of plants and animals, identifying important regions for conservation, and building and expanding the botanical and zoological collections at the University of Guyana. It will be exciting to see the results of their hard work when the final large checklists are published and the database is completed over the next few years.



Gary Krupnick, Editor

– 3/4) with **Carol Kelloff**, **Cristián Samper**, and **Hans Sues** to look at field sites and review the progress of the Biological Diversity of the Guiana Shield Program; and to Harlingen, Texas (3/26 – 3/29) to collect ethnobotanical collections from Mexico.

W. John Kress traveled to Bronx, New York (1/7 – 1/9) to attend a DNA barcode workshop at the New York Botanical Garden; and to Toronto, Canada (2/5 – 2/6) to meet with DNA barcoding collaborators at Guelph University.

Gary Krupnick traveled to Irvine, California (3/8 – 3/12) to attend a NSF-sponsored workshop “Project Baseline” at the University of California at Irvine.

Mark Littler, **Diane Littler**, and **Barrett Brooks** traveled to Carrie Bow Cay, Belize (3/14 – 3/27) to conduct taxonomic and ecological research on the reef system.

Paul Peterson traveled to Peru and Bolivia (2/28 – 4/10) to collect grass

specimens throughout the two countries.

Rusty Russell traveled to Baltimore, Maryland (2/2) to conduct library research at the Maryland Historical Society; to Philadelphia, Pennsylvania (2/9) to conduct research on the Wilkes Project at the Academy of Natural Sciences; and to Cambridge, Massachusetts (3/1 – 3/3) to attend the Earth-watch Conference as co-principal investigator on the Plants and People Through the Ages project.

Stanwyn Shetler traveled to Richmond, Virginia (3/3) to chair the annual workshop of the Virginia Native Plant Society at the University of Richmond.

Laurence Skog traveled to Sarasota, Florida (1/15 – 1/23; 3/5 – 3/10) to conduct research on Gesneriaceae at the Marie Selby Botanical Gardens.

Alice Tangerini traveled to San Miguel d'Allende, Mexico (3/18 – 3/25) to conduct artistic studies on endangered plants at the El Charco del Ingenio

Botanical Garden.

Alain Touwaide and **Emanuela Appetiti** traveled throughout Australia (2/17 – 3/9) to conduct research and make presentations; and to Miami, Florida (3/22 – 3/25) to attend the annual meeting of the Renaissance Society of America.

Warren Wagner traveled to Kaua'i, Hawaii (1/25 – 2/6) to conduct research and to serve as moderator for an ethnobotany summit held at the National Tropical Botanical Garden, Kaua'i; and to Miami, Florida (2/23 – 2/28) to make a presentation on the McBryde Science Program for Hawaiian and Pacific plant studies at the National Tropical Botanical Garden board meeting.

Jun Wen traveled throughout Madagascar (3/19 – 4/12) to conduct field research on the Vitaceae.

Elizabeth Zimmer traveled to Baltimore, Maryland (3/30) to present a research talk to the Department of Biology at Johns Hopkins University.

Staff Research & Activities

In February, **Emanuela Appetiti** traveled throughout Australia. In Sydney, she worked with Alex Barlow on Aboriginal territorial issues, including the alimentary and therapeutic uses of plants. In Uluru, she conducted fieldwork on medicinal plants used by the local Aboriginal communities. In Alice Springs, she visited the Desert Park where she spent the day with the local Aboriginal Curator for Medicinal Plants. At the Center for Arid Zone Research of the CSIRO she met with the librarian and the Program Officer. She visited the Olive Pinks Botanic Garden and did fieldwork at Stanley Chasm. Appetiti delivered a lecture "Medicinal Plants in Antiquity – Ethnobotany of the Old World," at the Queensland Herbarium located at the Botanic Garden Mt Coot-tha, Brisbane. With **Alain Touwaide**, she visited the Marks Hirschfeld Museum of Medical History of the Medical School of the University of Queensland, and the Australia Zoo and hospital created by the late "Crocodile Hunter" Steve Irwin.

Touwaide delivered four lectures in Australia in February. In Sydney, he presented "Venoms and Poisons in Antiquity" at the Research Seminar of the Department of Classics, University of Sydney; "What Did Ancient Greeks Know About Renal Diseases?" at the New South Wales Renal Group; and "Being Cured and Treated in Classical Antiquity," for the annual Ben Haneman Memorial Lecture held at the New South Wales State Library sponsored jointly by the Library and the New South Wales Society for the History of Medicine. In Brisbane, he made a presentation at the Medical School of the University of Queensland on "Epidemiology of Antiquity."

On 15 March, Touwaide delivered a talk "The Modern Middle Ages: Manuscripts and Diseases, from West to East" at Georgetown University, College of Arts and Sciences, Medieval Studies Program.

Robert Faden worked on African Commelinaceae at the Royal Botanic Gardens Kew 23 February to 24 March. His goal

was the completion of the account of the genus *Cyanotis* for the *Flora of Tropical East Africa*, and he succeeded. In addition to the usual problems of working with dried specimens of this family (poorly preserved flowers and lack of capsules and seeds), the flowers, capsules and seeds of this genus, even when available, have few taxonomically useful characters for species differentiation. In contrast, the underground parts of *Cyanotis* species are very significant, yet they are often left in the ground by collectors. Species of *Cyanotis* tend to be under-collected in part because their succulent leaves are difficult to dry. Faden also worked on Commelinaceae for a Flora of Angola checklist that is being prepared in Lisbon (LISC). Herbarium specimens were checked at Kew and the Natural History Museum for records of Angolan plants.

On 17 January, **Gary Krupnick** presented a talk about plant conservation and gave a tour of the U.S. National Herbarium to a group of first-year undergraduate fellows visiting from Elon University, North Carolina.

On 8 – 11 March, Krupnick attended the "Project Baseline" organizing workshop at the University of California at Irvine. Project Baseline is a nationwide collaborative effort to gather, freeze and store seed from contemporary plant populations to study evolutionary genetics and global warming.

On 20 March, Krupnick gave a presentation on "Vanishing Pollinators" to the second- and third-grade classes of Burning Tree Elementary School in Bethesda, Maryland.

Dan Nicolson led his spring wild-flower trip to Bear Island (along the Potomac River) on 31 March, for the Botanical Society of Washington.

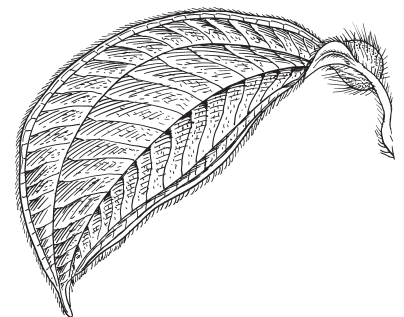
On March 3, **Stanwyn Shetler** chaired the Annual Workshop of the Virginia Native Plant Society at the University of Richmond, Richmond, Virginia. The topic was: "Discovering Virginia, 1607-2007: Bushwhackers, Botanists, and Pioneers." About 100 persons attended. This is one of the ways in which the society is contributing to Virginia's year-long celebration of the 400th anniversary of the founding of Jamestown.

Rob Soreng gave a talk entitled "On the Steppes of Kyrgyzstan," to the Botanical Society of Washington in November, and the Bureau of Land Management office in DC in January, about his collecting trip to the Tien Shan mountain range in August of 2006.

Awards & Grants

Vinita Gowda, graduate student of **W. John Kress**, received a \$500 Heliconia Society International grant for her proposal titled "Nectar study of two native Caribbean heliconias (*Heliconia*: Heliconiaceae) pollinated by sexually dimorphic Purple-throated Carib Hummingbirds." Gowda will be working in the field from 9 March to 4 April in St. Kitts, Dominica and St. Vincent to continue her research on Caribbean *Heliconia*-hummingbird adaptive interactions.

The Smithsonian Institution Women's Committee (SIWC) has provided funding to **Rusty Russell** for continued work on the plant collections of the United States Exploring Expedition, 1838-1842 (the Wilkes collection). These funds (\$34,400) will support continued processing of the collections, research to enhance specimen data, and the development of a web presentation on the Botany website.



New Faces

Jorge A. Pérez-Zabala (Herbario MEDEL, Universidad Nacional de Colombia, Sede Medellín) was a Cuatrecasas Travel Award Fellow at the U.S. National Herbarium from 21 January until 23 March. During his 7-week visit he focused on studying the collections of Rosaceae deposited in U.S. National Herbarium. He examined almost 700 specimens of Neotropical *Prunus* and



Cuatrecasas Travel Award Fellow Jorge A. Pérez-Zabala.

around of 1,000 specimens of Rosaceae of Colombia and adjacent countries. This research visit gave him a better view of these groups as he worked toward his ultimate goals of preparing a taxonomic treatment of *Prunus* for the Flora Neotropica project (hopefully a Ph.D. project) and preparing the catalogue of Colombian Rosaceae.

In January, **Ling Zhang** began a one-year Smithsonian postdoctoral fellowship under the sponsorship of **W. John Kress**. She is working on the development of an electronic field guide, or Image Identification System (IIS), that will make it possible for botanists to determine the identity of specimens through automated visual search. Zhang proposes to move beyond the current data sets to address a more challenging domain: the tropical woody flora of Barro Colorado Island, the rainforest preserve of the Smithsonian Tropical Research Institute in Panama. Zhang is an associate professor within the Ecology and Evolution of Plant-Animal Interaction Research Group at the Xishuangbanna Tropical Botanical Garden (XTBG), the Chinese Academy of Sciences (CAS). She received her Ph.D. from Kunming Institute of Botany (KIB), CAS in June 2006. Her doctoral thesis was "Biosystematics and Evolutionary Ecology of Taccaceae."

Announcement of the Cuatrecasas Fellowship Award

The Smithsonian Institution's Department of Botany announces the Cuatrecasas Fellowship Award. This annual competition will usually result in 1-2 awards, each one not to exceed US\$3000. The award is to support work in the spirit of the research of the late José Cuatrecasas, a long time associate of the U.S. National Herbarium. Priority will be given to scientists from Latin America or from elsewhere who work on tropical plants. Funds are to be used to study specimens housed in the U.S. National Herbarium.

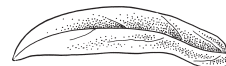
To apply for the award, please submit a short curriculum vitae, a proposal and two letters of support; it is suggested, but not required, that one of the letters be from a scientist at the Smithsonian Institution. Proposals should not exceed two pages in length and should include the following: name and address of applicant, date submitted, specific objective of trip, overall research project, date of trip, and budget. Complete applications should be sent via e-mail, fax, or airmail to Dr. V.A. Funk, Department of Botany Smithsonian Institution, PO Box 37012, NMNH MRC 166, Washington DC 20013-7012 USA; fax: 202-786-2563; e-mail: funkv@si.edu. E-mail is preferred and you should receive a reply confirming that we have received your application. Applications should arrive no later than 1 June 2007 and applicants will be notified of the committee decision no later than 15 June 2007.

Anyone wishing to make a contribution to the José Cuatrecasas Award Fund should send a check to the Chairman of the Department of Botany.

Celebrating Orchids

On 3 March, the Smithsonian Institution's Horticulture Services Division and the U.S. Botanic Garden sponsored a family festival at the National Museum of Natural History in conjunction with the exhibition, *Orchids: Take a Walk on the Wild Side*. Visitors enjoyed an array of activities for the whole family including coloring botanical prints, taking a scavenger hunt with binoculars, watching

orchid-potting demonstrations, asking experts how to grow orchids at home, an orchid murder mystery storytelling and more. Nearly 5,000 visitors participated. **Alice Tangerini** participated by doing demonstrations of orchid drawing. Tattoos of Tangerini's orchid images were printed for the visiting children. Beth Page, Annie Ceccaraini, Barbara Faust, and others from the Horticultural Services Division planned the many activities with the assistance of Hal Banks in the NMNH Office of Guest Services.



Visitors

Continued from page 2

Ashlei Cooke, William and Mary College; **Jessica Hull** and **Amy Storbakken**, Earthwatch Institute; **Christine Regan**, University of Delaware; **Cris Salas**, Eastern Kentucky University; **Carolyn Porrata**, University of Texas; Pacific Islands ethnobotany (3/12-3/16).

Elizabeth Finn, Antioch University; Edward Palmer project (3/12-3/23).

Anderson Oliveira, State University of Rio de Janeiro, Brazil; Invasive plants of Brazil (3/13-3/16).

Chris Puttock, Hawaiian Native Plant Conservation Alliance; Hawaiian Acanthaceae (3/14).

Scott Hoover, New England Botanical Conservatory; **Harry Wiriadinata**, Herbarium Bogoriense, Indonesia; Indonesia Plant Program (3/16).

Antonia Posada, Universidad de Antioquia Colombia; Molecular techniques (3/16-3/18).

Meg Warren, Earthwatch Institute; "Live from the Field" Program (3/23).

Antonio De Natale, University of Naples, Italy; *Diplostegium* (Asteraceae) (3/26).

Emily Caven and **Matt Cimino**, Salisbury University; Southeast Asian desert plants (3/26-3/28).

Brenda Murdock, **Judy Schmidt** and **Peggie Wormington**, Earthwatch Institute; Medicinal plants of antiquity (3/26-3/30).

US Acquires Nebraska Collection: Who Says You Can't Go Home Again?

In the summer of 2004 Robert Kaul from the University of Nebraska contacted **Vicki Funk** to see if the US National Herbarium would be willing to accept specimens from China and the Philippines that had been sent to Charles Bessey. The Nebraska herbarium had decided to concentrate on the Midwest and wanted to find an appropriate home for these collections. With **Rusty Russell's** agreement and the Biological Diversity of the Guiana Shield Program (BDG) taking care of the specimens, she accepted the offer and 9,610 mounted specimens arrived over the next several months. Funk then had to decide which specimens would stay at US, and which specimens would be shipped to other herbaria.

Nearly all of the specimens were identified. **Carol Kelloff** arranged all the specimens by family, and the largest groups were the ferns, Moraceae, Euphorbiaceae, Fabaceae, Rubiaceae, Poaceae, and Meliaceae. Other families had fewer specimens—for instance specimens of the Compositae filled only three bins of a herbarium cabinet.

Many specimens will remain at US. Using the Compositae as an example, 60-70% will remain, with five specimens being types. Most of the material in the Compositae was originally from the "Canton Christian College Herbarium" (now Zhongshan University in Guangzhou, also formerly Lingnan University) and was collected by C.O. Levine (1887-1928). Prior to this donation, US had only about half of Levine's collections. The *Index Herbariorum – Collectors* volume says that Levine collected mainly in Kwangtung (now known as Guangdong, 1916-1928). They list A (Arnold Arboretum) as having 3,500 specimens and that CANT (South China Agricultural University, Guangzhou) may have the original; US is not listed as having any specimens. A web search turned up only one mention of Levine papers (at Harvard) and these need to be checked. The donation also had many collections by A.D.E. Elmer (1870-1842), mostly from the Philippine

Islands. According to the *Index Herbariorum – Collectors* volume, Elmer collected around 12,000 numbers in the Philippines (1903-1917) and US received 4,200. He died in a prison camp in Manila during WWII. Additional collectors include a few specimens by Clements, Wenzel, Merrill and some others.

The final totals were 923 duplicate sheets to be sent to PE (Beijing) to help balance our trade deficit, and 3,370 to be held for exchange to PNH (Manila). The remaining 5,317 specimens have been stamped and filed into the US National Herbarium except for most of the 700 or so types which are waiting to be databased and imaged. The Department is grateful to the staff at US who worked on some of their favorite families and to Funk and Kelloff for their coordinating skills. BDG contractors **Marilyn Hansel**, **Sara Alexander**, and **John Dodge** stamped sheets, checked the herbarium for duplicates, and filed specimens. This project was a group effort by the Department and the herbarium has benefited from it.

Drawing Plants in Mexico

Alice Tangerini was part of a group of 12 botanical artists from the Washington, DC, area who traveled to San Miguel d'Allende, Mexico, 18-25 March, for a

week of fun and artistry. One of the objectives of the trip was to visit a local botanical garden to photograph and sketch endangered cactus species. Tangerini had made arrangements for the artists to take a two-hour tour of El Charco del Ingenio Botanical Garden located on the outskirts of San Miguel.

Giving the tour was Mario Mendoza, horticulturist for the garden. Mendoza focused on endangered cactus species that are listed on a national list of endangered plants of Mexico and on the IUCN Red List of Threatened Species. After the tour the artists photographed, sketched and painted the cactus species. The artists took many photographs in order to continue their work back in the United States. Mendoza also introduced the DC artists to local San Miguel botanical artists who indicated they would like to collaborate in the future on teaching classes in botanical art at El Charco.

The artists who participated in the trip were students and teachers of a certificate program in botanical art at the Corcoran School of Art; Tangerini represented the Smithsonian Institution. The artists illustrated the cactus species for possible inclusion in a traveling show titled, "Losing Paradise, Endangered Plant Species Here and Around the World," to be presented by the American Society of Botanical Artists (ASBA). The exhibit is



Alice Tangerini draws a cactus at El Charco del Ingenio Botanical Garden. (Photo by Marcia DeWitt)

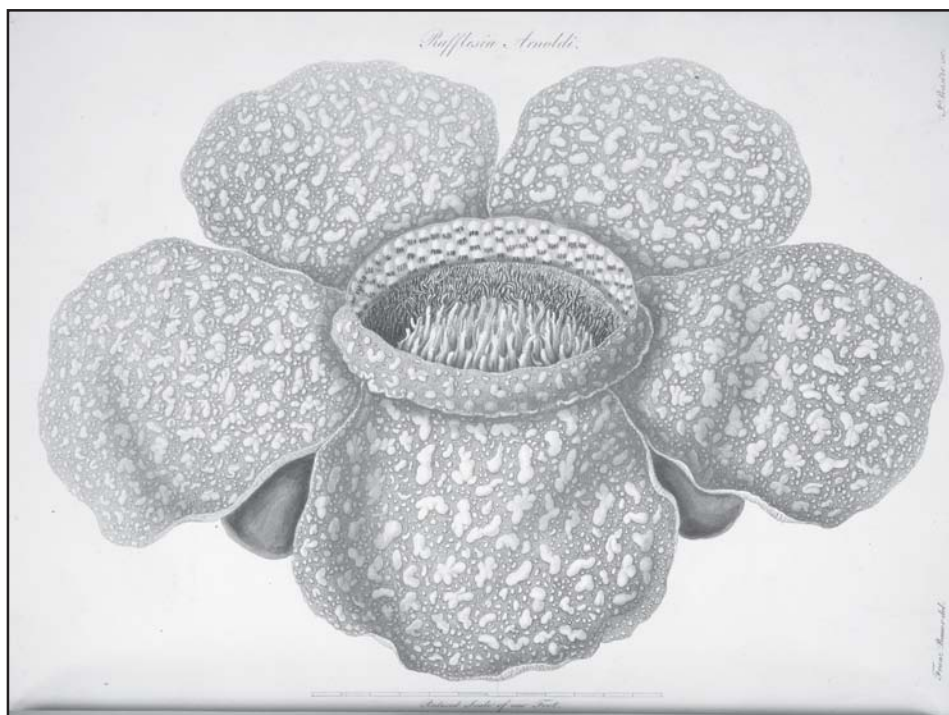
scheduled to open in May 2008. It is hoped that the paintings of these endangered plants will help bring awareness to the public of the need to preserve these rare species.

How Did the World's Largest Flowers Evolve?

Species of *Rafflesiaceae* possess the world's largest flowers (up to 1-meter in diameter in *Rafflesia arnoldii*), yet their precise evolutionary relationships have been elusive as the plants are holoparasites and highly modified for this life history. These Southeast Asian plants are embedded inside their hosts, *Tetrastigma* species (vines in the grape family, Vitaceae), and rarely put forth their massive bizarre flowers that stink of rotting flesh to attract pollinating flies. Phylogenetic placement of these parasites has proven difficult because of the highly modified morphology and anomalous molecular evolution, including increased rates of change and the loss of the chloroplast genes usually used for constructing plant phylogenies.

A recent cover story in *Science*, "Floral gigantism in *Rafflesiaceae*" by **Kenneth Wurdack** and a team led by Charles Davis of Harvard University, has presented the precise phylogenetic placement of *Rafflesiaceae*. They analyzed 8 genes and ca. 11,500 base-pairs of DNA sequence data and surprisingly found *Rafflesiaceae* grouped with *Euphorbiaceae*, Wurdack's specialty family.

Since most euphorbs have tiny flowers (sometimes reduced to a single stamen as in the spurges, *Euphorbia*), the authors were then able to estimate floral size increases. Their estimates indicated a ca. 73-fold increase in flower diameter had to occur on the stem lineage of *Rafflesiaceae*. This floral gigantism is one of the "most dramatic cases of size evolution reported for eukaryotes." This study is an extension of previous work Davis and Wurdack published in *Science* (305: 569, 30 July 2004; and see the *Plant Press* 7(4), Oct-Dec 2004) which showed that *Rafflesiaceae* have obtained genes from their hosts by horizontal gene transfer. As Wurdack noted, "These are bizarre plants where anything is possible, but I never expected them to land at my feet. This



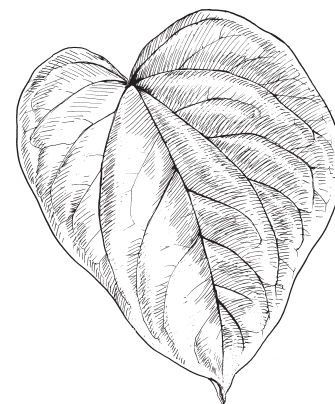
Rafflesia, one of the three genera of *Rafflesiaceae*, was named by Robert Brown for Sir Thomas Stamford Raffles (1781-1826), a British colonial administrator in Sumatra and later founder of Singapore. The type species *Rafflesia arnoldii* commemorates physician and naturalist Joseph Arnold (1782-1818) who died of malaria on the 1818 collecting trip with Raffles during which time the plant was discovered in Bengkulu, Sumatra. The taxon was published in "An account of a new genus of plants, named *Rafflesia*" read on 30 June 1820 and published in the *Transactions of the Linnean Society* in 1821. The original description was copiously illustrated with drawings by famed botanical artist Franz Bauer, in part based on unfinished life drawings done by Arnold. The hand colored plate 15, etched by James Basire, is shown here. This plate is part of the extensive rare book collection in the NMNH Cullman Library that also incorporates the rare books formerly held in the Department of Botany. (Courtesy of Smithsonian Institution Libraries, Washington, DC)

will open new doors to thinking about the evolution of both *Rafflesiaceae*, as well as, my own group the *Euphorbiaceae*."

New Ethnobotany Exhibit at NMNH

In February, with guests from the Cultural Institute of Mexico and the Smithsonian Institution Latino Center in attendance, **Cristián Samper** unveiled the new North Lobby Research Case in the National Museum of Natural History. Entitled "Ethnobotany of the Southwest United States and Mexico," this new exhibit results from three years of work by **Rusty Russell**, Bill Merrill and **Jamie Whitacre** to organize and prepare the data from more than 30,000 Botany and Anthropology specimens, personal journals, and archives materials. Using

these collections, the bi-lingual exhibit tells six stories that describe the manner in which local cultures used specific plants more than 100 years ago. It also chronicles the work of Edward Palmer, whose collections of both plants and cultural objects have contributed significantly to the study of ethnobotany in North America.



History of Botany and Ethnobotany of the Ancient Mediterranean World

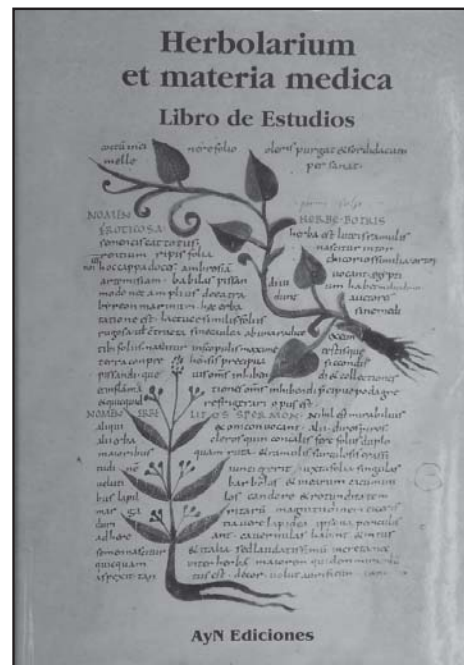
In 2002, Alain Touwaide and Emanuela Appetiti joined the Department as Research Associate and Scientific Collaborator, respectively, to launch a research program dealing with the history of botany, ethnobotany and ethnopharmacology of the ancient Mediterranean world. The main focus of the program consisted of preparing a *Flora of Classical Antiquity* for which they have been collecting material for more than 30 years. One aspect of their research—the therapeutic uses of plants—was funded in 2002 by the National Center for Complementary and Alternative Medicine of the National Institutes of Health. The *Medicinal Plants of Antiquity* program aims at making the ancient documentation—duly translated into English and analyzed—available to botanists, pharmacologists and historians through Web site presentations.

However rich they might be, ancient texts need to be complemented by other sources as they are not as explicit as

contemporary researchers would wish. To compensate for this limitation, a complementary program was launched on Renaissance herbals. Supported by the Earthwatch Institute, research was conducted from 2003 to 2006 at the National Library of Rome and in 2006 at the Library of Padua, in the most ancient Renaissance botanic garden. The research consisted of making a census of the herbals and of their content, reproducing plant representations in a digital form, and analyzing all of the material from a historical and a botanical viewpoint. All gathered material will be searchable on a Smithsonian Institution Libraries Web site, which is currently in development.

In spite of their apparent diversity, all of these programs have the same objective: bringing light to the documentation of botanical knowledge of the Old World from Antiquity to the Renaissance, and adding new data to the knowledge of plants and their uses before the development of modern botany, particularly from Linnaeus on. The research program complements current botanical research by explaining its origin, including Latin terminology. Furthermore, by analyzing the history of botany in the different cultures that flourished around the Mediterranean, the research program follows the continuous transmission of knowledge from the most remote antiquity to the birth of modern science.

The research program has already reached several significant conclusions. Among others, *Datura stramonium*, supposedly introduced into the Old World from the New World, seems to be described in a chapter of the most important manual on medicinal plants of Antiquity, *De materia medica* by Dioscorides, from the first century A.D. Similarly, archaeological explorations have led to the discovery of a mosaic with a representation of a basket full of fruits, one of which looks like a pineapple. A scientist from a Pompeii archeological site recently identified pineapple fiber in a fabric from the city buried under the ashes of Vesuvius in 79 A.D. It is generally agreed that pineapple was introduced into the Old World after the 1492 discovery of the New World. Such findings will impose the



Touwaide's research of manuscript 296 of the State Library of Lucca, Italy, which was recently published, shows how ancient texts about the uses of plants were transmitted. (Photo by Emanuela Appetiti).

revision of historical plant introductions.

No less interesting are the statistics on the plants used therapeutically in Antiquity. The number of different plant names appearing in the 62 treatises ascribed to Hippocrates (5th - 4th century B.C.), the so-called *Father of Medicine*, reaches 380 units. It would be wrong, however, to conclude that ancient Greek physicians used all these plants in the same way. Half of the ca. 3,500 formulas for the preparation of medicines in this series of writings are made of only 44 plants. Furthermore, none of these 44 different species are rare or particularly difficult to find. They include, among others, hellebore, leek, linseed, garlic and, to quote but a few, pomegranate, beet or cabbage. This means that the medicinal resources of ancient physicians were the plants at hand, growing in the backyard of their patients.

A final example comes from the study of a Latin book on medicinal plants handwritten in the 10th century probably in Southern Italy and now preserved at the State Library of Lucca in Italy. The



***Datura*, from "Trattato della historia, natura, et virtu delle Droghe Medicinali, & altri Semplici rarissimi, che vengono portati dalle Indie Orientali in Europa ..." by Cristóbal Acosta. In Venetia, Presso à Francesco Ziletti, 1585. (Courtesy of Smithsonian Institution Libraries, Washington, DC)**



Alain Touwaide and Emanuela Appetiti (front) with George Washington University students (L to R): John Cotton, Jeff Leon, Sam Raker, and Bryan Randolph. (Photo by Marjorie Knowles)

Touwaides show that the book was in a chain of information that transmitted ancient botanical knowledge from Antiquity (Greece and Rome) to the West. Contrary to a widely diffused opinion, the book was not written by monks who deteriorated the texts contained in it, but probably by physicians who updated the information from a medical viewpoint and made it compatible with the culture and society of that time.

The Touwaides do not limit their investigations to ancient material, but also work with specimens in the US National Herbarium. They have located and digitized plant specimens from the Mediterranean to compare ancient plant representations to actual plants. Such activity is not only theoretical, but has a practical value: it complements the knowledge of plant species by means of pre-Linnaean data, and it provides useful information for new therapeutic applications.

Such multifaceted research relies on a wide variety of sources, from ancient texts and books to archeological material. Thus it requires a cross-disciplinary association with scholars from ancient history to high-tech pharmacology. The Touwaides have created and continue to develop a net of research centers and laboratories throughout the world,

including the National Library of Rome, the Service of Antiquities of Pompeii, the Herbarium of Istanbul University, the Goulandris Museum of Natural History in Athens, the Istituto Filosofico per gli Studi Filosofici of Naples, Italy, and the Department of Natural and Complementary Medicine at the Southern Cross University in Australia.

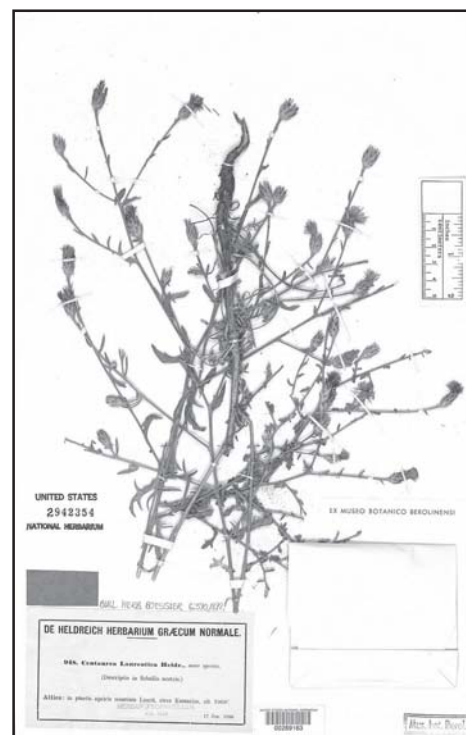
Research progress has been possible thanks to the collaboration of a large number of individuals and institutions. Earthwatch Volunteers and Smithsonian Institution Behind-the-scenes Program volunteers have helped process and digitize the materials. Many volunteers are now familiar with ancient botanical knowledge and are currently performing a wide range of tasks contributing to the final goals of the program. These tasks include locating specimens in the U.S. National Herbarium, developing computer applications necessary to process the sheer quantity of data and studying the pharmacological applications of plants.

This research program is also devoted to the formation of the next generation of scientists. An agreement has recently been signed with the Department of Classics at The George Washington University, making it possible for students to study the history of ancient botany. Undergraduate students will

conduct personal research that will lead to the writing of an end-of-term paper. A similar agreement will make it possible for visiting students from the University of Victoria in Canada to receive an intensive training in the history of botany, ethnobotany and ethnopharmacology of the ancient Mediterranean world.

University scholars from all over the world come to complete their education and to conduct research. Niki Papavramidou from Greece recently spent two months in the Department. Two scientists from China will soon visit to study the influence of Greek medicine on Chinese medicine and to compare the uses of plants in ancient Greek medicine to contemporary traditional Chinese medicine.

Scholars may also come to consult the many resources gathered in the *Historia Plantarum Collection* (more than 12,000 books devoted to the subject). Interns joining the program in the summer will conduct personal research and will be trained in the methods of the history of botany, ethnobotany and ethnopharmacology developed by the Touwaides over the past years.



A Greek specimen of *Centaurea laureotica* from the US National Herbarium, collected in 1886 in the region surrounding Athens by Georg Heldreich, a German botanist who specialized in the study of Greek ethnobotany.

Ethnobotany: A Declaration from Kaua'i

Warren Wagner joined a group of 43 people from ethnobotany and associated disciplines in an Ethnobotanical Summit at the National Tropical Botanical Garden in Kaua'i on 27-30 January 2007. Considering the grave environmental crisis facing the world today, the loss of biodiversity and the loss of culture, the group decided to issue a statement to stress the importance of ethnobotany for providing some of the solutions towards more sustainable living.

The initial draft of the resulting 'Kaua'i Declaration' is being shared here to bring it to a wider audience. The final declaration text, along with a white paper, will be submitted for publication soon.

The Kaua'i Declaration

Ethnobotany is the study of the interactions and relationships between plants and people over time and space. This includes the uses, knowledge, beliefs, management systems, classification systems and language that both modern and traditional cultures have for plants and their associated terrestrial and aquatic ecosystems. If plants did not exist, human life would not be possible. All members of the human family depend on plants for their survival in myriad different ways. Today we also depend on them for many of our opportunities to improve the quality of human life in the future. Plants are fundamental to the functioning of all human societies and to the operation of all ecosystems. Along with the photosynthetic bacteria and algae, plants are responsible for the formation of almost all of the energy that we consume. In terms of the energy from biomass that we are so actively seeking to develop now, they also provide the hope for energy supplies in the future. Yet despite their central importance, plants are often poorly appreciated.

Ethnobotany, along with the related disciplines of ethnobiology and ethnoecology are of central importance for understanding and improving the sustainability of our relationships with the living world. The greatest resource that people have is their ability to innovate, and that ability is shared with all groups of humans who live or have lived on the Earth. We also stress here that we consider the survival of individual human cultures

important in and of itself, since we have so much more to learn from these cultures as living societies rather than from descriptions and images of those societies that might be left behind once they have disappeared forever. Further, we believe that cultures have a right to exist and that we should respect and facilitate that right to the extent that it is feasible. This capacity to innovate has been expressed in creative ways by different groups of people faced with varied environmental and social challenges; we must attempt to understand those ways for our individual and common benefit. Combining concepts derived from the disciplines of anthropology, linguistics, agriculture, archaeology, biochemistry, genetics, horticulture, ecology, conservation biology, and botany, the field of ethnobotany holds extraordinary promise for helping us build a better future.

Sustainability is defined as the use of resources at a rate slower than that at which they are being created. Building sustainability depends not only on our use of the environment, but also on cultural, political, and economic considerations.

Our collective management of the world's resources is unsustainable at present. Rapidly rising population levels, the runaway growth of individual consumption, the continued use of inappropriate technologies and the erosion of traditional knowledge are progressively limiting the options for the future, and the kind of world that our descendants will inhabit. The application of ethnobotany is a possible way of breaking free of our passive approach to the world and dealing with this seemingly overwhelming set of challenges in a positive way.

Such vital environmental resources as the air we breathe, the quality of the water we drink, the topsoil upon which our agriculture depends, the relatively stable global climate we have enjoyed until recently, and the global stock of biodiversity are all being degraded rapidly. Concurrently, the diversity of human cultures is being eroded rapidly everywhere. For example, hundreds of the approximately remaining 7,000 languages are being lost each decade and it is likely that over 50% will be lost in the next 50 years. Yet each of these represents a distinct philosophi-



Randy Thaman, an expert in Pacific Island biogeography and ethnobotany, from the University of the South Pacific in Fiji, presents the results of one of the conference breakout-groups on Indigenous Pacific island perspectives on priorities for ethnobotany. The other break-out groups (not shown) included global ethnobotanical hotspots and the role that botanical gardens and universities should play in ethnobotany. (Photo by Janet Leopold)



Local Hawaiian cultural practitioner Sabra Kauka speaks to summit participants about the importance of wauke (*Broussonetia papyrifera*) as a source of fibers to Pacific Islanders. (Photo by Janet Leopold)

cal and pragmatic approach to the organization of our lives which means we are losing our cultural heritage at a rate that will seriously diminish our opportunities to achieve sustainability in the future.

To reverse these trends, we need to respect the wisdom of the diverse approaches to nature that exist in every society. This knowledge is central to the preservation of the integrity of the cultures that possess it, and important for us all to understand, record, and, when appropriate and helpful, apply in other situations. The capacity to innovate and to share lessons learned is a quintessential human characteristic, and one that we have a special need to exercise well in the challenging times that face us now.

The strong links between biological and cultural diversity uniquely position ethnobotany to help us craft effective local solutions to many of the global issues that confront us as a species. Some of the most challenging of these issues are food security, deforestation, pollution, the maintenance of human health, the quality of human life, and resource depletion of all kinds. The concepts and practices of ethnobotany accord well with the "land ethic" of the great conservationist Aldo Leopold, which he describes as changing "the role of *Homo sapiens* from conqueror of the land-community to plain

member and citizen of it."

Ethnobotany can strengthen our links to the natural world. It is of central importance for understanding the collective experience of humankind in a series of exceedingly diverse environments and using those experiences to meet the challenges that we face. It makes it possible for us to learn from the past and from the diverse approaches to plants represented by the different human cultures that exist today. Ethnobotany is at once a vital key to preserving the diversity of plants as well as to understanding and interpreting the knowledge by which we are, and will be, enabled to deal with them effectively and sustainably throughout the world. **Thus ethnobotany is the science of survival.**

Participants in the workshop who endorsed the declaration: Kamaui Aiona, Michael J. Balick, Bradley C. Bennett, Kim Bridges, David A. Burney, Lida Pigott Burney, Robert A. Bye, Liloa Dunn, Eve Emshwiller, Mary Eubanks, Trish Flaster, David L. Lentz, Edelmira Linares, David H. Lorence, Will McClatchey, Heather McMillen, Mark Merlin, James S. Miller, Daniel E. Moerman, Ghilleen T. Prance, Anne E. Prance, Diane Ragone, John H. Rashford, Pat Raven, Peter H. Raven, J. R. Stepp, Namulau'ulu G. Tavana, Randy Thaman, Michael B. Thomas,

Tamara Ticktin, Thomas Urban, Peter Van Dyke, Warren Wagner, W. Arthur Whistler, Charles R. Wichman Jr., Hau'oli Wichman, Kawika Winter, James Wiseman, Michael Wysong, Brian Yamamoto.

DNA Exhibit Opens at U.S. Botanic Garden

A new exhibit, *DNA Identification of Plants—Reading the Hidden Barcode*, has opened at the U.S. Botanic Garden exploring how DNA from plants can be used to develop a rapid and accurate method of species identification. Co-sponsored by the NMNH Department of Botany, *Nature's Barcodes* is on display at the USBG Conservatory through June 10.

In devising a natural barcode, scientists study an organism's unique DNA sequences, which can be easily extracted from tissue samples and then analyzed. Conceivably, this could be done for every species on the planet. The new exhibit tracks the progress of an ongoing joint project to develop such genetic "barcodes" for plants, as well as barcode "readers." The project uses medicinal plants as a pilot study, also co-sponsored by the Botanic Garden and NMNH.

Botanical Partners Lecture Series

Jane Smart, Head of the Species Programme at IUCN, continued the Botanical Partners Lecture Series by presenting "Plants in Danger: What Do We Know" on 18 January at the United States Botanic Garden (USBG) Conservatory. The Botanical Partners Lecture Series is a collaboration between the Department and USBG, designed to bring together the Washington scientific community interested in botanical studies. Invited speakers have been chosen to attract participants from a broad spectrum of the local community who are interested in the botanical sciences. Informal receptions after the talks were hosted to promote discussion and exchange of ideas. If you have suggestions for future speakers, please contact Gary Krupnick at krupnickg@si.edu.

Discovery of Rare Hawaiian Species

A recent discovery of an extremely rare new plant species in Hawaii was made in the context of a collaborative effort between the Department and the National Tropical Botanical Garden (NTBG) to discover, describe, and understand plant diversity of the Pacific Islands. This effort is critical at this time to conserving the diversity of island ecosystems. Known from only four individuals, the plant species, *Labordia lorenciana*, is among ca. 120 other extremely rare Hawaiian species that are limited to less than 50 individuals. It is currently being cultivated for conservation at NTBG.

Labordia lorenciana is described and illustrated from the Hawaiian Island of Kaua'i. This new species, named for David H. Lorence, Director of Science at NTBG, who has made many valuable contributions to Pacific botany and to the study of the large tropical family Rubiaceae (coffee family), most closely resembles the O'ahu endemic species, *Labordia kaalae*. The new species is described in a paper published in *Systematic Botany* by **Warren Wagner** and two colleagues.

Labordia (Loganiaceae: Gentianales) is one of 31 currently recognized vascular plant genera completely restricted to the Hawaiian Islands. It is closely related to the Pacific genus *Geniostoma*. *Labordia* comprises 16 species, with 11 species being single-island endemics and the remaining five species occurring on several islands. Three species and two varieties are currently listed as Federally Endangered under the Endangered Species Act. Recent field research by Ken Wood of NTBG within the northwestern canyon region of Kaua'i (i.e., Kawai'iki Valley), has documented another new species known from only a few remaining individuals and critically in need of protection.

Future Female Scientists Program

The National Museum of Natural History's Office of Guest Services sponsored the first *Smithsonian Future Female Scientists Program*, a two-day

program for 23 local high school girls that took place 8-9 March. The goal of the program was to highlight the many backgrounds, academic paths, and roles of females in science at the National Museum of Natural History, for students interested in pursuing science in college and as a career. The program was coordinated by Mollie Oremland and Amy Bolton of Guest Services and funded primarily through a Smithsonian's Women's Committee grant, with additional support for food provided by Coca-Cola.

Cristián Samper welcomed the students to the program and provided an overview of the Museum and his scientific background. Students then spent two days behind-the-scenes of the Museum learning about the work done here. Small groups of 2-3 students were matched with scientist "sponsors" to learn about their work, based on student interests. Students also participated in hands-on activities, demonstrations, and tours at NMNH and at Smithsonian's Museum Support Center (MSC) with additional female staff members. Several staff members participated in a panel discussion about the many pathways to a career in science, introduced by Associate Director for External Affairs and Public Programs, Elizabeth Duggal. At the conclusion of the first day of the program, a reception was held in the theater lobby for student participants,

their parents, teachers, and Smithsonian Women's Committee members. Nancy Newkirk of the Smithsonian Women's Committee, and Carole Baldwin of Fishes, then introduced the film *Galápagos 3D* to the attendees, and Baldwin took questions afterward.

Over 40 female staff from Research and Collections were involved in the event. **Maria Faust, Vicki Funk, Carol Kelloff, Ida Lopez and Alice Tangerini** represented Botany. **Elizabeth Zimmer** represented the Laboratories of Analytical Biology (L.A.B.)

Profile

Continued from page 1

time is spent walking, paddling a canoe, cutting trail, dragging supplies in and out of boats and setting up camp in the rain and heat or rain and cold—all of this in order to collect and preserve biological specimens so that we can understand and conserve diversity.

From the start of the BDG, all collections were databased and geo-referenced. This decision has been central to the program and is true for all types of organisms collected. Furthermore, beginning in the early 1990s, the BDG began to database specimens held by the National Museum of Natural History and most this work has been completed. The result is a great legacy of data that we



Paloue sp. nov. from the Pakaraima Mountains. (Photo by Karen Redden)

have only recently begun to analyze.

In addition to collecting and research, the BDG Program has helped build the infrastructure necessary for housing Guyana's own natural history collections via the construction and enlargement of the "Centre for the Study of Biological Diversity" located on the campus of the University of Guyana; funded by the Royal Bank of Canada and USAID. BDG has also helped in the training of students and scientists both in the US and Guyana, assisting them in their research, and establishing or maintaining their collections. The Centre has organized training classes for Amerindian guides, provided lectures to the public, taught short intense taxonomy classes on various groups, helped organize the first international scientific meeting held in Guyana in recent memory, and started its own journal.

With a few exceptions, such as cities along the Río Orinoco (Venezuela), the Rupununi savanna (Guyana), and the coastal areas of the Guianas, the Guiana Shield has benefited from its isolation and low population density, and much of the vegetation is still relatively undisturbed by human activities. Unfortunately, the pace of disturbance has accelerated because of logging by Asian and local companies, gold and diamond mining by Canadian and local outfits, oil drilling, bauxite mining, dams for hydroelectric power, wildlife trade, burning, grazing, and agriculture. If these trends continue, the Guiana Shield will lose its place as part of one of the three remaining "tropical wilderness" areas in the world (Conservation International).

Efforts to conserve this unique region vary according to country: Venezuela has set up seven national parks, 29 natural monuments, and two biosphere reserves covering 142,280 km² which comprises almost 31% of the Shield that lies in Venezuela and about 15% of the country. Guyana has only one major national park, the expanded Kaieteur National Park (627 km² or about 3% of the country). Surinam has 12 conservation areas encompassing 20,000 km²; 12% of the country. French Guiana has no designated protected areas but there are 18 proposed sites that total 6,710 km² and make up 7.5%. However, an indication on the map of a park or reserve does not mean that the area will actually be protected. As with many countries, areas in the Guiana Shield that



Kaieteur Falls, Guyana, in the Guiana Shield. (Photo by Carol Kelloff)

are designated as parks are often only "paper" parks, and lack the infrastructure and financial backing necessary for effective protection. Each of the five countries of the Guiana Shield has a different administrative structure and official language(s), and there are a number of border disputes. The borders are generally porous to drug, gold, and wildlife trafficking, and there are serious political and environmental issues in regards to the native peoples of the region. All of these problems will have to be dealt with in order to design and maintain a viable reserve system for the Guiana Shield.

The efforts of the BDG program are important as a major part of the process of gaining an understanding of the flora and fauna so that informed decisions can be made on critical areas with a high priority for conservation, and so data can be collected from areas that may ultimately be degraded. Also, because this region was long neglected by biologists, it is often an area of "missing information" for many biological analyses. The BDG program is designed to provide specimens and data to address biodiversity questions across many groups. The assembled information is being used to produce checklists, vegetation maps, floristic and faunistic studies as well as to address the more theoretical aspects of spatial biodiversity models.

By far the most important activity was building and expanding of the Centre for

the Study of Biological Diversity (CSBD), at the University of Guyana (paid for by the Royal Bank of Canada and a USAID grant). The herbarium was moved into the new addition and is now fully functional. The zoology collections have been re-organized and are waiting additional shelving to finish their expansion. The biggest remaining problems are that the library needs to be moved into the new space and the small hut next to the Centre needs to be renovated into a drying room for plants. The Centre currently houses 45,000 collections of plants, ca. 10,000 animals, and ca. 22,000 insects.

The symposium "The Biodiversity of Guyana: A Global Perspective for the Future" was held in Georgetown, Guyana from 7 – 10 October 2001. It was co-hosted by BDG and the University of Guyana (UG). For many years, institutions and research organizations in Guyana and around the world, including the Smithsonian Institution, have been working in Guyana collecting plant and animal data, discussing conservation strategies, and evaluating areas for preservation. In 1999 the CSBD and its collaborators decided that the time had arrived to evaluate the level of our knowledge of the biodiversity of Guyana and to use those data to address question such as "What do we know about the diversity of various groups of organisms in Guyana?", "How does the diversity

Continued on page 14

Profile

Continued from page 13

compare regionally and globally?”, “How can it be conserved?”, and “How might conservation efforts affect the people of Guyana?”

In 2002 the CSBD decided to publish its own peer reviewed journal that would focus on biodiversity issues of the Guiana Shield and provide a forum for selected senior theses to be published. The BDG program has been actively involved in both the editing and reviewing process and in 2003 the first volume was issued. The *Contribution to the Study of Biological Diversity* journal is currently distributed to the major institutions worldwide that have had an interest in this region of South America. Two volumes have been published and a third one is nearly finished.

The *Checklist of the Terrestrial Vertebrates of the Guiana Shield* was published in 2005. It contains all known terrestrial vertebrates (and their distribution on the Shield) and so has chapters on birds, mammals, herps, and reptiles. Edited by Hollowell and Reynolds, the chapter authors are from Canada, Venezuela, Brazil, and the USA and the Director of NMNH, Cristián Samper, wrote the forward. The only missing part of the vertebrates is the fishes and a project is underway to synthesize the *Checklist of the Freshwater Fishes of South and Central America*. BDG now has a list of 3,507 fishes from the Guiana Shield. This checklist should be finished during 2007 and at that point all known vertebrates

from the Guiana Shield will be listed.

Currently, the total number of plant records held by the BDG program is 125,387, which consist of 49,527 BDG collections, 71,136 plant specimens from the US National Herbarium, and 4,724 miscellaneous collections, all of which have been databased and most have been barcoded. Other databases include approximately 4,302 records of birds (plus 5,923 bird tissue samples), 9,000 spiders, 8,235 Lepidoptera, 75,000 ants, 23,000 aquatic insects, 450 termites, 3,388 amphibians and reptiles, and 1,300 mammals. The BDG could not function without the collaboration of over 300 scientists from around the world. These colleagues collect and identify specimens, send books and supplies to Guyana, prepare specimens to be returned to the host countries, and train students.

In 2000 we began publishing the *Smithsonian Plant Collections, Guyana* series starting with our first collector. The main purpose of this publication series is to make the results of the field work widely available to botanical and conservation communities. These publications describe and discuss the collecting trips and list all identified collections by number and by name. Three have been published so far (Pipoly, Gillespie, McDowell) and two are just about ready to send out for review (Clarke, Miscellaneous Collectors).

The BDG program has a website and a numbered publication series for papers supported by BDG funds, staff, and specimens. To date there are over 200 publications and the website lists them

and provides some copies <www.mnh.si.edu/biodiversity/bdg>. In addition, a number of synthetic papers have been published using the BDG data. Topics include, predicting plant and animal distributions, identifying survey gaps, and determining areas of species richness.

The *Checklist of the Plants of the Guiana Shield* is in press. It covers all vascular plants known to occur in the Guiana Shield region of northeastern South America. It was done in collaboration with the Missouri Botanical Garden. This checklist along with the Terrestrial Vertebrates and the Fishes publications represent a new research and conservation resource which highlights three critical facets of taxonomic work: research, collections, and expeditions.

Training has always been a big component of the BDG. The first intern from Guyana arrived at the Smithsonian in 1987 and over the years there have been 29 summer interns (12 from Guyana), 14 Guyanese visitors, eight masters students (six from Guyana), and 15 doctoral students (four from Guyana). Outside of the more formal education programs the program has sponsored several bird and plant workshops for students at the University, Amerindian training in classes and in the field, and hundreds of local participants in field trips.

In February 2007, NMNH Director Cristián Samper and the Associate Director for Research and Collections, Hans Sues, visited Guyana to learn more about the BDG. They spent a week visiting field sites, including a flight over some of the table top mountains of Guyana, and one day in Georgetown meeting with University officials and the US Ambassador to Guyana.

The University of Guyana has been the home base since the beginning of the program. Beginning with George Walcott and continuing down through a series of Vice Chancellors, Deans, and Head of Departments, to the current Dean, Philip DaSilva, and the Manager of the Centre, Calvin Barnard, the program has been fortunate to work with many kindred spirits. Currently the University is doing an excellent job fund raising and administering the Centre and the collections are in great shape.

As always, BDG thanks the Office of the Director at NMNH for continued funding (and of course to Congress for



The Centre for the Study of Biological Diversity, University of Guyana, Georgetown, Guyana. (Photo by Carol Kelloff)



Vicki Funk, Cristián Samper, and Hans Sues do their best jacana imitation while visiting Karanambu, Guyana, in February 2007. (Photo by Carol Kelloff)

the Global Change money many years ago). Also, the Program could not run without the help of Carol Kelloff, the Assistant Director of BDG. On the down side, Tom Hollowell, Data Manager for nine years, left in November 2005 and the program has not been able to replace him. His departure has slowed our ability to synthesize the data.

In 2005 BDG was reviewed by an external committee. The report was positive and was approved by the Office of the Director and the Associate Director for Science. There were several important recommendations including finishing the database, putting the data online, and finishing the synthetic work. They also recommended soon ending the BDG program and they suggested a competition so that the funds could be used to work in another area of the world or on another group in the same area. Further study of this topic is underway.

Finally, it is my belief that the BDG program fulfills the goals of the Smithsonian Institution by gathering new information and distributing it to those who use it to produce checklists, floras and faunas of a relatively unknown area, by supplying data for the identification and preservation of biologically diverse areas for conservation activities, by providing specimens that are used in systematic

studies both within the Institution and throughout the world, by building infrastructure in the host countries, and by providing training for university students and Amerindians. I think it is something we can all be proud of and I thank everyone who has helped along the way.

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Art by Alice Tangerini

***Graffenrieda irwinii* Wurdack**

Known only from Kaieteur Falls, Guyana, *Graffenrieda irwinii* is a white-flowered shrub with yellow stamens.

Graffenrieda has a species-density center in the Roraima-formation tepuis, with seven Guianan species confined to north-western Guyana. Alice

Tangerini illustrated *G. irwinii* for John Wurdack's treatment of Melastomataceae for the *Flora of the Guianas* (1993).



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