



The Plant Press



Smithsonian
National Museum of Natural History

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April-June 2005

Botany Profile

North to Alaska: Grass Collecting in America

By Jeff M. Saarela

The grasses (Poaceae) are the fourth largest family of flowering plants, with some 11,000 species. Grasses are worldwide in distribution, and they are components of most ecosystems. Grasses include many of the world's crop species, such as wheat, rice, oats, corn, millet, barley, rye, and sugarcane, and have an increasing horticultural role. Given their ecological and economic prominence, grasses have a long history of scientific study. Agrostologists have made substantial progress identifying, describing, classifying, and elucidating phylogenetic relationships among the world's grass species, but scientific exploration of the grasses is nowhere near complete. New species and genera are continually discovered and described, and genetic information is providing fresh insight into the genomic structure and evolutionary history of the family. Continued exploration in the field and laboratory will be necessary to further characterize grass biodiversity.

In July 2004, I participated in a month-long expedition to collect grasses in northwestern Canada. We were led by Paul Peterson, curator of grasses, who has been studying the taxonomy and systematics of grasses for over 20 years. The second member of our team was Stephen Smith, museum specialist. I am a Ph.D. student in Sean Graham's plant molecular systematics laboratory at the University of British Columbia, where I conduct taxonomic and phylogenetic research on grasses, their close relatives, and other monocots.

It was our goal to collect samples of

all of the grass species that we encountered, specifically targeting *Bromus* (the brome grasses; ~160 species) and *Calamagrostis* (the reed grasses; ~250 species). These large genera are distributed widely in temperate regions around the world, and each includes several species that are important components of many ecosystems in northern Canada. Differing taxonomic opinions among florists in the treatments of *Calamagrostis* and *Bromus* in northwestern Canada identify several species complexes that need to be studied in detail in the field and lab to properly characterize species boundaries. One goal was to collect as much material of these species as possible to support future studies of these taxonomic problems.

We collected from Manitoba to Alaska, which allowed us to pass through the varied habitats of the prairies, mountains, and arctic, to maximize the diversity of species that we encountered. We generally stopped to collect when we observed a prospective species or habitat from the road, and we often hiked along trails in search of novel species. Every time we stopped, we collected all the grass species that we encountered locally, took photographs, and attempted to identify all other flowering-plant species at the site. We recorded as much detailed information on the site as possible, placed samples of leaf tissue from each species into silica gel to rapidly dry and preserve DNA for molecular analyses, and pickled additional leaf tissue from some species for anatomical studies. We typically spent a

few hours each day getting our collections in order, and putting them into the expanding plant press by the roadside, at our campsites, in front of motels, or wherever we happened to be.

We planned our trip for July, at the peak of grass flowering in northern Canada. We made our first collections in south-central Manitoba in an uncultivated area, with several hectares of short-grass prairie, forest, and four square kilometers of open sand dunes. Here we watched a northern prairie skink (*Eumeces septentrionalis*) skitter across the sandy slopes, and collected needle and thread (*Hesperostipa comata*), a native grass that is widespread in western North America. In a small prairie remnant, we collected Hooker's oat grass (*Helictotrichon hookeri*) and June grass (*Koeleria macrantha*), native species that are widely distributed across the Great Plains. The nearby mixed deciduous-coniferous forest provides habitat for rough-leaved rice grass (*Oryzopsis asperifolia*), a species that is a common understory element of boreal and parkland regions in Canada.

We made our next collections in the Cypress Hills, which straddle the Alberta/Saskatchewan border in southern Canada. Rising 600 m above the surrounding prairie, the hills are a rugged mosaic of forests, prairie, wetlands, lakes and streams, with over 700 plant species. Many of these species are not found in the neighboring prairies, but are common in the Rocky Mountains several hundred kilometers to the

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Travel

Mark and Diane Littler traveled to Fort Pierce, Florida (12/15-2/10) to continue ongoing research in the Indian River Lagoon and to speak at the Martin County Library Systems Eleventh Annual "Book Mania" (1/22-1/23); and to Carrie Bow Cay, Belize (3/9 - 3/23) with **Barrett Brooks** to continue ongoing research on the Belizean Barrier Reef.

Robert Faden traveled to London, England (1/17-2/10) to conduct research on African Commelinaceae at the Royal Botanic Gardens, Kew.

Vicki Funk traveled to Australia (1/17-2/4) to present a seminar and conduct research at the Australia National Herbarium in Canberra and at the University of Queensland, Brisbane; and to Bronx, New York (2/24-2/25) to attend the editorial meeting for LINNE and to conduct research at the New York Botanical Garden.

Rusty Russell traveled to Chania, Crete (1/17-1/24) to attend the conference "From Ink to Electrons: Challenges and Solutions in Digitising Herbaria," sponsored by the European Network for Biodiversity Information (ENBI) and the Global Biological Information Facility (GBIF).

W. John Kress traveled to Oahu, Hawaii (1/5-1/11) to visit Lyon Arbore-

tum with Qing-Jun Li from China; to London, England (2/5-2/8) to present a talk at the First International Barcoding of Life Conference at the Natural History Museum in London and to visit the Eden Project with Sir Ghillean Prance; and to Dominica (3/30-4/4) to conduct research on *Heliconia* and hummingbirds with graduate student Vinita Gowda.

Laurence Skog and John Boggan traveled to Sarasota, Florida (1/23-2/1) to attend the American Gloxinia and Gesneriad Society Board of Directors meeting at Marie Selby Botanic Gardens.

Robert Soreng traveled to Brno, Czech Republic (2/7-2/11) to give a lecture on "Biogeography, Molecular Systematics, and Breeding Systems in Poaceae," and served as an external reviewer to the dissertation defense by Sierra Dawn Stoneberg Holt at Masaryk University.

Dan Nicolson traveled to London, England (2/10-2/23) to work on the last supplement(s) to Stafleu & Cowan's "Taxonomic Literature" (TL-2) at the Royal Botanic Gardens, Kew.

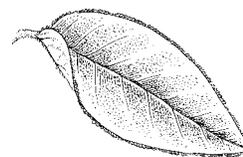
Alice Tangerini traveled to Kalaheo, Hawaii (2/17-3/2) to prepare illustrations of herbarium specimens and living plants for the Flora of the Marquesas Islands project under the direction of Warren Wagner.

Alain Touwaide traveled to Boston, Massachusetts (2/22-2/23) to make a

presentation at the Earthwatch Institute; to Dearborn, Michigan (2/25-2/27) to meet with Dan Moermann at the University of Michigan, Dearborn; to Berkeley, California (3/9-3/14) to collaborate with Chris Meacham and to present "Medicinal Plants of Antiquity: A Computerized Database" and "Ancient Botanical Illustrations" at the University of California, Berkeley; to Palo Alto, California (3/17-3/18) to present "Paleo-ethnopharmacology. Ancient Medicines for Modern Times" and "Phthisis, Consumption and Other Respiratory Affections of Antiquity: Pathology and Treatment" at Stanford University; and to Miami, Florida (3/31-4/2) to present a paper at the annual meeting of the Medieval Academy of America, co-organized by Florida International University.

Pedro Acevedo traveled to Bronx, New York (2/23-2/24) to conduct research at the New York Botanical Garden.

Warren Wagner traveled to Kauai, Hawaii (3/12-4/25) to work with collaborators on the Flora of the Marquesas at the National Tropical Botanical Garden.



Visitors

Naomi Delventhal, University of Wisconsin; *Lepechinia* (Lamiaceae) (1/5-1/6).

David Dick, West Virginia Department of Agriculture; West Virginian invasive species (1/6).

Jose Hernandez, Systematic Botany and Mycology Lab, USDA; Hosts of rust fungi (1/6).

Patrick McMillan, Clemson University; Southeastern U.S. *Rhynchospora* (Cyperaceae) (1/21).

Stephen Talbot, U.S. Fish & Wildlife Service; Vegetation ecology and floristics (1/28).

Bonnie Gisel, Sierra Club LeConte Memorial Lodge; John Muir collections

(1898 southern U.S. expedition) and Harriman Expedition collections (1899) (2/16-2/18).

Raymund Chan, Independent researcher; Arctoteae and Vernonieae (Asteraceae) (2/17-3/17).

Hidehisa Koba, Kanagawa Prefectural Museum of Natural History, Japan; *Leymus* (Poaceae) (2/17-2/18).

Benjamin Torke, University of Missouri St. Louis; *Swartzia* (Fabaceae) (2/17-2/28).

Hilary Gustave, Independent researcher; volunteer interview (2/18).

Mary Chor, United States Botanic Garden; Herbarium tour (2/19).

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Chair of Botany

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To Barcode or not to Barcode? That is no Question

If the last few decades are any indication, we are headed for a major revolution in the way we conduct taxonomic research in the near future. The quantum leap in our ability to understand evolutionary relationships among taxa that resulted from the acceptance of Willi Hennig's method of phylogenetic systematics, or cladistics, started the ball rolling in the 1960s. Our capacity to provide well-supported phylogenies has amplified the impact of the field of systematics on other disciplines, both scientific and applied. In one case the impact of phylogenetic thinking has been taken to an extreme. A few among our ranks, who have been called "phylogenetic fundamentalists" by some, have advocated (wrongly in my view) an entirely new system of nomenclature that abandons traditional binomials and the hierarchical Linnaean classification in favor of names based solely on phylogeny. This newly proposed system has not received much support among botanists, but it is an indication of the type of new thinking that is unfolding in the taxonomic community. Another event that radically changed the perception of taxonomy, biodiversity, and the value we place on nature was the 1992 Earth Summit in Rio de Janeiro that led to the Convention on Biological Diversity now ratified by over 180 countries. As a result of this international treaty plant inventory and collecting outside (and even inside) of one's country has become a quagmire of rules and regulations governing the way we document and understand plant diversity. In addition to these theoretical and political developments a smorgasbord of new technologies is ready to overturn our traditional methods of managing and analyzing taxonomic data. Rightly or wrongly, the process of discovering, describing, naming, and classifying new taxa is changing.

One of the newest innovations that has taken the world of taxonomy by storm is DNA barcoding. The use of short DNA sequences for biological identifications was first proposed by Paul Herbert and colleagues with the ultimate goal of quick and reliable species-level identifications across all domains of life. These ideas have been applied most successfully in animals, although the usefulness and practicality of such approaches have been long accepted for microorganisms for which morphological data is limiting or difficult to obtain. Until recently plants have been notably absent in the early stages of barcoding even though a Consortium for the Barcode of Life (see <http://www.barcoding.si.edu/>) has been established to stimulate the creation of a database of documented and vouchered reference sequences to serve as a universal barcode library.

As with the introduction of any new method of analyses in science some controversy and concern has arisen about the feasibility and utility of DNA

barcoding in taxonomy. A number of taxonomists appear to be particularly concerned that new technologies might be substituted for the taxonomic specialist working directly with specimens. Others believe that these new techniques will be misused and give faulty results. These misconceptions arise for a number of reasons, such as associating DNA barcoding with DNA taxonomy (which it is not), equating "service identifications" through barcoding with the entire field of taxonomy (when identification is only one aspect of what we do as taxonomists), misusing DNA barcodes to reconstruct phylogenies (when their primary purpose is for quick identification), and, finally, believing that any new tool, such as DNA barcoding, will replace the need for taxonomic specialists or siphon off all of our funds. These misguided conceptions are simply not true. DNA barcoding will undoubtedly become one of the many important tools on the modern taxonomist's work bench.

The notion that barcoding will make the work of taxonomists and taxonomy obsolete could not be further from the truth. Barcoding, when successfully applied to plants, will provide the user with rapid species-level identifications. Yet the species name is not an end in itself. The name alone is a simple two-word identifier that gives the typical user little information about the species. However, stick that name into Google or any biodiversity database and an explosion of information about that species will tumble out. We taxonomists are the ones that have provided, are currently providing, and will always provide that biodiversity information. The public as well as our fellow scientists will continually want more of this information that will remain largely unavailable without rapid access to the name of the species. Barcoding provides that rapid access.

The easier it is for end-users to access good taxonomic data through modern methods and tools, such as DNA barcoding, the more the field of taxonomy and taxonomists will be appreciated for their skills and knowledge. The interest of non-professionals in nature, biodiversity, and the environment is soaring and the demand by the public for effective field guides that provide correct and easy identification of species is at an all time high (just search Amazon.com for "field guides"). The more taxonomic information that is available to the non-specialist to use for species identifications, the more appreciation and respect will be accorded to the taxonomists who have supplied that information from the start. And in the long run, respect for nature and its conservation will proportionally increase as well. Barcoding is not an option; it is a done deed.

Chair

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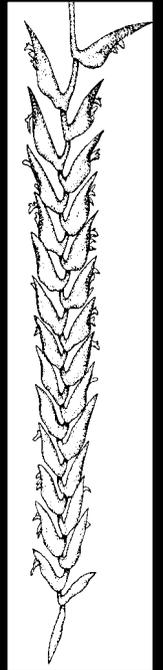
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**John
Kress**



Staff Research & Activities

Robert Faden spent a month at the Royal Botanic Gardens, Kew, 17 January to 10 February, to conduct research on African Commelinaceae, particularly for the Flora of Tropical East Africa. He studied some of the blue-flowered species of *Commelina* that are poorly understood and an orange-flowered *Commelina* species that occurs throughout the savanna region surrounding the Congo rainforest. The latter "species" turned out to be a species complex with multiple names all described from syntypes belonging to more than one taxon. Taxonomic limits in this group still need to be finalized. He also studied the type of a species of *Murdannia* that is endemic to Thailand but is not correctly identified in any herbarium in Thailand. Faden spent one day at the Natural History Museum (BM) studying the same species as at Kew. On 16 March, Faden gave an invited illustrated talk, "The Royal Botanic Gardens, Kew: Reflections from a Frequent Visitor," to the Four Seasons Gardens Club at a private home in Arlington, Virginia.

From 17 January until 4 February, **Vicki Funk** was in Australia. She visited the Australia National Herbarium in Canberra where she worked with Randy Bayer on the Compositae Supertree and presented a seminar. She then visited the University of Queensland, Brisbane, for two weeks where she worked on biodiversity questions with Karen Richardson of the Rainforest CRC. Currently they are investigating species turnover rates across space using data from the Smithsonian's Biological Diversity of the Guiana Shield Program. She also presented a seminar at the Queensland Herbarium. On the 4th of February she left Australia for the South Island of New Zealand where she gave a seminar at Land Care Systems in Christchurch.

Mark and Diane Littler traveled to Smithsonian Marine Station, Fort Pierce, Florida, 15 December to 10 February to continue ongoing research in the Indian River Lagoon with colleagues from

Harbor Branch Oceanographic Institution. They collected and identified over 150 species from the Indian River Lagoon (the two summer hurricanes that did much destruction in the area cleaned the Lagoon of harmful sediments and many of the species collected were new records for the Indian River). Over 3,000 digital photographs were taken (both macroscopic and microscopic) in support of their ongoing project, "Marine Plants of the Indian River Lagoon," in collaboration with M. Dennis Hanisak (HBOI). They also worked extensively with Brian E. Lapointe (HBOI) and Peter J. Barile (HBOI) on several papers concerning the shifts in nutrient stoichiometry of Caribbean reef macroalgae: specifically green macroalgal blooms in southeast Florida generally thought to be generated by anthropogenic nutrients. Along with Brian E. Lapointe the team began organizing a new project in the Bahamas to produce a floristic guide to the marine plants of Green Turtle Cay, Abacos Islands. The Littler's were also featured speakers at the Martin County Library Systems Eleventh Annual "Book Mania" (22-23 Jan), a fund raising social weekend with proceeds going to The Library Foundation of Martin County. Their presentation "Waterways & Byways of the Indian River Lagoon" was followed by a book signing.

The Littlers, along with and **Barrett Brooks**, traveled to the Smithsonian Research Station at Carrie Bow Cay, Belize, 9-24 March, to continue ongoing research in on the Belizean Barrier Reef with colleagues from the Smithsonian Marine Station, Fort Pierce, Florida. They collected over 150 specimens from the reef wall to a depth of 190 feet. Over 1,000 digital photographs were taken in support of one of their long term projects: *Caribbean Reef Plants: First Revision*. They initiated a new long term project to experimentally answer the ongoing debate/problem in marine paleobiology which might be termed the "paradox of the coralline algae." The paradox stems from the fact that although coralline algae are nearly always abundant (often dominant) in terms of cover on coral-reef systems worldwide, they only show up abundantly within fossil coral-reef deposits in relatively few isolated formations. The hypothesis that this disappearance during fossilization is due

to differential taphonomic processes is being experimentally analyzed. Also, due to the growing problems associated with eutrophication and overfishing along tropical and subtropical shorelines, the ecological responses of coral reefs and macroalgae to nutrient enrichment and release from predation have been repeatedly cited as priority areas in need of further research. The team's ongoing long-term research, which begun in 2003, is directly addressing this need and will provide new insights into the nutrient and herbivore status of Caribbean coral reefs. This experimental setup was thoroughly documented with dramatic new results and will successfully improve our understanding of the ecology and sustainable management of coral-reef ecosystems.

Dan Nicolson was in London, 10-22 February, to work on the last supplement(s) to Stafleu & Cowan's "Taxonomic Literature" (TL-2), bringing vol. 1 (A-G) up to the standards of H-Z. At the Royal Botanic Gardens, Kew, Nicolson finished entering information from Kew's reprint holdings and checked the original publications in periodicals, starting with Asa Gray (where he left off during his last visit). Nicolson tracked down incomplete information previously collected. Nicolson was given permission to work in the Kew Library on Saturday where he exploited their new 2004 edition (61 volumes) of the DNB, TL-2's code for Oxford's "Dictionary of National Biography". He spent his second week was at the Botany Library at the British Museum (Natural History) to see what could be accumulated there.

Nicolson presented a post-show lecture on 16 March, at the Environmental Film Festival showing of "Banks' Florilegium: A Flowering of the Pacific" at the National Arboretum. The film traces the first voyages of botanist Joseph Banks, who accompanied Captain James Cook on his first journey of circumnavigation and collected over 700 unknown species of plants, which were recorded in drawings by Sydney Parkinson. Nicolson explained how collections of drawings and paintings assist the botanical world.

On January 17-24, **Rusty Russell** participated as a working group leader at the meeting "From Ink to Electrons: Challenges and Solutions in Digitising

Herbaria," which was sponsored by the European Network for Biodiversity Information (ENBI) and the Global Biological Information Facility (GBIF), in Chania, Crete.

On February 17, Russell conducted a videoconference with Coastal Carolina University on "The Botany of Lewis & Clark" and tied it to the theme of their three day conference "Memory, Place, Identity."

On 21-22, February, Russel participated in a meeting at the museum and at the Heinz Center in Washington, DC, sponsored by the Smithsonian Institution, DiscoverLife, and the National Biological Information Infrastructure. The meeting was to brainstorm a better strategy to study and monitor life on Earth. In attendance were Peter Raven and E.O. Wilson.

Russell presented a lecture at the U.S. Botanic Garden on 8 April, on "The Plants of the U.S. Exploring Expedition," in which he gave special attention to the flora of Australia and New Zealand.

Stanwyn Shetler chaired the annual workshop of the Virginia Native Plant Society at the University of Richmond, in Richmond, Virginia, on the topic "Biodiversity: The Wise Stewardship of Virginia's Native Flora," on February 26.

Awards & Grants

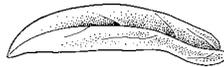
Pedro Acevedo received a grant from the U.S. Department of Agriculture which will assist him with the publication of the first volume of "Monocots of Puerto Rico and the Virgin Islands," and facilitate the completion of the manuscript of the second volume.

Vicki Funk has been selected as the President Elect of the International Biogeography Society. She will serve 2005-2007 as President Elect and 2007-2009 as President.

Alain Touwaide's Earthwatch grant has been renewed for the 2004/2005 year. "Medicinal Plants of Antiquity" is a study of Renaissance herbals. With the help of Earthwatch volunteers, Touwaide is preparing a Web site in collaboration with Smithsonian Libraries that will be launched in August this year.

Future of Floras

W. John Kress recently published an invited book review of *Flowering Plants of the Neotropics* in the *American Journal of Botany* (91: 2124-2127; 2004). This extended review addresses the "Future of Paper Floras" and outlines new technologies, including electronic field guides and DNA barcoding, which have the potential to radically change how we understand, identify, and classify biodiversity. This same theme, "The Future of Floras," will be the core topic in the 2005 Smithsonian Botanical Symposium hosted by the Department of Botany in April. Seven speakers, including **Vicki Funk**, and a keynote address by Rita Colwell, are lined up to discuss and debate the new technologies that further the inventory and classification of life on April 15-16, 2005, in Baird Auditorium at the National Museum of Natural History. The United States Botanic Garden and the International Association for Plant Taxonomy are cosponsoring the event.



Contributions on the Web

The Contributions from the United States National Herbarium is now accessible at <http://www.nmnh.si.edu/botany/pubs/CUSNH/>. The *Contributions* series has featured externally peer-reviewed articles of scientific botanical research since 1890 (see *Plant Press*, vol. 7, no. 4; 2004). These articles include taxonomic papers, checklists, floras, and monographs produced by the staff and associates at the U.S. National Herbarium. PDF files of the most recent issues (vol. 49-present) of the journal are available, as well as an illustrated list of all previous issues (vol. 39-present). The Web site was created through the work of **Paul Peterson** and **Susan Pennington**.

Visitors

Continued from page 2

Ihsan Al-Shehbaz, Missouri Botanical Garden; *Flora North America, Arabis* (Brassicaceae) (2/22-2/25).

Gail Carter, Independent researcher; volunteer interview (3/3).

Catherine Furlong, Independent researcher; volunteer interview (3/8).

Heather Loring, University of Florida; Brazilian *Heliconia*, Biological Dynamics of Forest Fragments Project (BDFFP) (3/9-3/14).

Hugh Iltis, University of Wisconsin; Capparaceae (3/14-3/15).

Sharyn Wisniewski, University of Wisconsin; Capparaceae (3/14-3/15).

Susan Grose, University of Washington; Compositae (3/16-3/17).

Michael Rawson, Corcoran Gallery, Washington, DC; Herbarium tour (3/18).

Yaowu Yuan, University of Washington; *Verbena* and *Glandularia* (Verbenaceae) (3/19-3/24).

Jamie Whitacre, Independent researcher; volunteer interview (3/21).

Acosta Castellanos, Escuela Nacional Politecnico de Mexico; Mexican Acanthaceae (3/22).

Steve Manchester, Florida Museum of Natural History; Cornales fossils (3/23-3/26).

Absara Rogosch, Independent researcher; volunteer interview (3/23).

Jenny Xiang, North Carolina State University; Cornales fossils (3/23-3/26).

Maggie Moore, Independent researcher; volunteer interview (3/24).

Rob Naczi, Delaware State University; Cyperaceae (3/24).

Arthur Tucker, Delaware State University; Lamiaceae (3/24).

Steve Feiner, Columbia University; NSF electronic field guide project (3/25).

David Jacobs, University of Maryland; NSF electronic field guide project (3/25).

Roland Dute, Auburn University; Alabamian lichens (3/28-4/1).

Curtis Hansen, Auburn University; Alabamian lichens (3/28-4/1).

Wesley Knapp, Maryland Natural Heritage Program; *Juncus longii* (Juncaceae) (3/31-04/5).

Japanese Artists Visit the Museum

Alice Tangerini was host to a group of 21 visiting members of the Japanese Association of Botanical Illustrators (JAPI) on 4 March. Tangerini was contacted by artist Mieko Ishikawa, whom Tangerini had met on a previous visit in 2003 when Ishikawa had exhibited her cherry blossom paintings at the Japanese Cultural Institute in Washington, DC. Ishikawa, along with JAPI president, Hidenari Kobayashi, organized the recent group visit to coincide with the exhibit of “Botanical Illustration of Japan’s Endangered Plants” at the National Arboretum. Tangerini arranged for the group to have a tour of the herbarium, graciously guided by **Gregory McKee**. Tangerini also escorted the group to the Cullman Library where Leslie Overstreet presented a display and a lecture on rare botanical books. **Mary Ann Apicelli** and **Bernadette Gibbons** provided a tour of the Chairman’s office, which features a display of botanical paintings from the Department’s collection. Finally, the group received a tour of Tangerini’s office in Botany and illustrator Vichai Malikul’s office in Entomology.



Alice Tangerini (second from left) provides a tour of the museum for 21 visiting artists from Japan, including Mieko Ishikawa (standing to the right of Tangerini). This photo was taken in the Entomology office of Vichai Malikul (center).

Identifying DNA Barcodes in Plants

A new technology that uses short gene sequence bar codes to distinguish one species from another could revolutionize the world of taxonomy and biological collections. Scientists are developing a portable device that will provide a rapid method for non-taxonomists to identify unknown specimens and then link the information to a massive biological database.

In February, the Consortium for the Barcode of Life (CBOL), which is hosted by the National Museum of Natural History (NMNH), convened The First International Barcoding of Life Conference at the Natural History Museum in London. DNA barcoding, effective on most of the animal groups so far tested, including insects, fish, birds, and mammals, has not worked yet in plants. At the meeting, botanists unveiled the first concrete proposal to add a feasible system for plants. **W. John Kress** along with Lee Weigt, Director of the Laboratories of Analytical Biology, **Ken Wurdack**, Botany Research Associate, and Dan Janzen, tropical ecologist at the

University of Pennsylvania, attended the meeting and presented their results on identifying a workable barcode for plants. They proposed a dual system that would combine a short nuclear region called ITS with a short, hypervariable intergenic spacer region of the chloroplast genome that worked in the over 100 species in their trials. The next step is to test this system on the 8,000 species of plants in the Central American country of Costa Rica. This project will be initiated in collaboration with botanists from Costa Rica and the Royal Botanic Gardens at Kew. Funding is still being sought for this project.

CBOL wants to tag every organism on Earth—starting with the 1.7 million species that have already been identified and continuing with the estimated 10–20 million that have not. CBOL members anticipate myriad applications of the information the new technology will yield, from enforcing food laws, to protecting wildlife and developing biodefense systems. A review of the barcoding conference in London appears

in a recent issue of *Science* magazine (307: 1037).

The Expanding Lichen Collection

The US National Herbarium recently received a gift from the National Herbarium of Canada, lichenology section, consisting of 1,599 lichens collected by Stephen Sharnoff and Sylvia Duran Sharnoff (Accession No. 2035962). These collections represent more than a decade of collecting by the Sharnoffs in support of their seminal work, *Lichens of North America*, co-authored by Irwin Brodo, a wonderfully illustrated reference published in 2001 by Yale University Press. These important collections supported the extensive research involved in the production of this excellent work and informed the accounts of most of the lichen species. The gift is significant contribution to the country’s largest and most important lichen herbarium here at the Smithsonian Institution.



Chinese Visitors View Dinoflagellate Collection

Maria Faust hosted two visitors from China, Guo Hao and Du Fei, on 27 January. Both researchers are from the National Marine Environmental Monitoring Center, Dalian, People's Republic of China. Their visit was organized through the Office of International Relations, National Oceanic & Atmospheric Administration in Silver Spring, Maryland. The visitors received a tour of the United States National Dinoflagellate Collections. They were especially interested in ongoing research activities on the red tide and toxins producing marine harmful dinoflagellates. Harmful dinoflagellates often cause toxic out breaks in aquaculture facilities that result in unoxia in Chinese coastal waters, resulting in significant economical loss.



Protecting Crop Biodiversity

On March 1, the National Museum of Natural History played host to an informative evening event, "Start with a Seed...At the Intersection of Gastronomy, Good Health, and Global Food Security," co-sponsored by the American Institute of Wine & Food and the Global Crop Diversity Trust. Museum Director Cristián Samper welcomed the event's guests to a panel discussion moderated by **W. John Kress** and featuring Peter Raven, director of the Missouri Botanical Garden, as the keynote speaker with panelists Nora Pouillon, chef/proprietor of Restaurant Nora, America's first certified organic restaurant; Geoffrey Hawtin, Executive Secretary of the Global Crop Diversity Trust; and Rayna Green, Curator of "Julia Child's Kitchen" at the National Museum of American History. The panel discussions focused on the global origins of our foods, the factors

threatening agricultural diversity, and the means necessary to protect and continue cultivating our essential food staples. After the discussion in Baird Auditorium, guests adjourned to the Rotunda to sample dishes from a diverse menu of culinary food crops prepared by sixteen of Washington's leading chefs.



Collecting Plants in Guyana

Tom Hollowell, Vicki A. Funk, and Carol Kelloff, along with colleagues Tim McDowell (Eastern Tennessee State University) and Doorjooan Gopaul (University of Guyana), have published "Smithsonian Plant Collections, Guyana: 1990 - 1991, Tim McDowell" (*Contributions from the United States National Herbarium* 50: 1-150; 2004). This publication details the Guyana plant collections of Tim McDowell, who was the fourth Resident Plant Collector to participate in the Biological Diversity of the Guiana Shield (BDG) Program. Over a nearly 18 month period, McDowell collected 3,242 plant numbers; the specimens were first processed at the University of Guyana and then at the U.S. National Herbarium at the Smithsonian Institution. This publication is a comprehensive reference for herbaria holding collections made by the collector and an aid to taxonomists interested in particular plant groups.

The paper is divided into five parts, in which Part I provides the collector's notes and narratives on the expeditions in chronological order. Part II lists collection localities, with collection number ranges, habitat descriptions, geographic coordinates, and assisting collectors. Part III consists of maps of Guyana illustrating the collecting localities. Part IV lists collections in numerical order with identifications. Part V lists all collections ordered by determined name. The volume also contains a listing of collections of particular interest. Illustrations or photos of all of McDowell's type collections are

also included. This is the third in a series on the Smithsonian's BDG Program's collectors, the others being on the collections of John J. Pipoly and Lynn J. Gillespie, which are both available at <<http://www.mnh.si.edu/biodiversity/bdg/collector.html>>.

A New Classification of Gingers

W. John Kress and research colleagues from China and Scotland have published a recent article in the *American Journal of Botany* on the classification of the gingers (92: 137-178; 2005). The study focuses on the genus *Alpinia*, which includes the largest group of species in the ginger family (Zingiberaceae). Species of *Alpinia* often predominate in the understory of forests, while others are important ornamentals and medicinals. *Alpinia* as currently defined includes six polyphyletic clades in the tribe Alpinieae. This paper provides the phylogenetic basis for erecting a new classification and generic boundaries of the subfamily Apinoideae, an equally important evolutionary framework for tracing the pathways of plant-pollinator interactions.



American Journal of Botany cover illustration: At the Cai Yung Hu Reserve in Yunnan, China, the single anther of a flower of *Alpinia blepharocalyx* (Zingiberaceae) deposits pollen on the back of a *Bombus* pollinator as it enters the flower to take nectar. (Photo by W. John Kress)

Putting Botany on the Map

By Heijia L. Wheeler

If you watch a group of very young kids, you can almost predict the ones who will develop a love affair with maps. Before they know it, these same people have an attic full of National Geographic Magazines and just cannot understand why the local library is not thrilled to get a donation from them as they tidy up their lives at age 70 or 80. Maps are multifaceted. They are beautiful in their own right, and full of fascinating information. They are often carefully framed and displayed as valuable art objects. They tell stories from historic, political, and botanical points of view. All maps are ultimately useful. Most of us have a stack of utility maps to help guide us around unfamiliar places, and explorers of all variety have relied on maps to guide them in their various quests. Jim Harle, a Botany volunteer, is one of those kids who always loved maps.

The U.S. National Herbarium has between 8,000 to 10,000 maps of various varieties and vintages collected over time by Botany staff and others. They are scattered all over the department and throughout the museum. These are botanical maps of various ages and in many different languages. The problem was that the collection was not well organized, making it difficult to find a useful map. Outside of the central map collection, smaller assemblages of maps were located in various offices around Botany. Since there was no index to these maps, it was often a time consuming treasure hunt to find a specific map. They needed to be cataloged and made more easily accessible to researchers.

Harle was excited about volunteering on the map project in response to a call from Rusty Russell. Since there was no system in place, Harle volunteered to create one while he organized the collection. First, he had to design the data base to enter the information about these maps. Some of these maps are very old and have no coordinates, some are drawn with interesting scales, and many are in foreign languages. The Western European languages were easy enough for Harle to decipher, but for the ones in Russian he needed help. Margarita Gospodinova, a



Jim Harle creates a database of maps. (Photo by Deborah Bell)

volunteer in Botany from Bulgaria, was pressed into service and translated the legends of a dozen or so maps while Harle carefully took notes.

Harle first created a data base management program to enter the pertinent information about each map. He worked in concert with the Smithsonian information technology group and with the Smithsonian librarians who were delighted to know about this project. What Harle enjoys most about this project is that it requires his creative talents and problem solving acumen. So far he has relabeled and inventoried maps of Brazil, Ecuador, Peru, Uruguay, Bolivia, Argentina, Chile, Puerto Rico, the West Indies, Europe, North Africa, Australia, and New Zealand.

Harle was a computer specialist who retired from the US Naval Academy in Annapolis, Maryland, in January 2004, but he has loved maps for many years. He worked in nearly all areas of computer science from hardware manipulation to software design to management for nearly 40 years. In addition to the usual information technology functions, he helped design the first online course registration system. That was over 30 years ago and the first of such systems that are now ubiquitous and indispensable to nearly all colleges and universities.

Harle loves to travel and his love of maps has resulted in a perfect fit. Many of

his trips have been with Earthwatch, an organization that invites people to come and do work for them on various projects all over the world. Volunteers have to pay for that privilege, but they gain a feeling of accomplishment in making a valuable contribution to basic research. He has another Earthwatch trip planned, in which he is heading off to Russia in a few weeks.

The map database, currently a work in progress with over 1,700 maps cataloged, is accessible to Botany staff and there are plans to make these map data available publicly. While much needs to be done to both the details of the database and the number of maps included, Harle posts a copy of the database on the shared internal museum directory at the end of each day.



Schiedea Explored

A book-length monograph by **Warren L. Wagner**, Stephen G. Weller, and Ann K. Sakai was published in March 2005 in *Systematic Botany Monographs* (vol. 72). The monograph is the result of more than a decade of collaboration between the authors with support from grants from the National Science Foundation, the National Geographic Society, and three

sources from the Smithsonian Institution (Scholarly Studies Program, Andrew W. Mellon Smithsonian Fellowships to Weller and Sakai, and the Smithsonian Walcott Botanical fund).

Schiedea (Caryophyllaceae, carnation family), is one of 31 genera of plants endemic to the Hawaiian Islands, and is one of the most critically endangered lineages in the Hawaiian flora. *Schiedea* is one of the best examples of adaptive radiation in the Hawaiian Islands, with some of the most conspicuous evolutionary shifts of any Hawaiian plant lineage. Among the most prominent evolutionary changes have been the remarkable changes in growth habit, which are particularly notable for a lineage within the carnation family, normally a family of herbaceous annuals and perennials. *Schiedea* species occur in an extraordinary range of habitats in the Hawaiian Islands, and include deciduous perennial species in coastal habitats, sprawling subshrubs in mesic forests, woody shrubs in dry, mesic, and wet forest, rainforest vines, and small subalpine shrubs. *Schiedea* also exhibits the greatest diversity in breeding systems of any native Hawaiian angiosperm genus, with species ranging from full cleistogamy and mixed mating systems, to gynodioecy, subdioecy, and dioecy.

Morphological and molecular phylogenetic analyses support the division of *Schiedea* into seven sections and 34 species. In a majority of the species each floral nectary is either terminated by a tubular, straight structure (a shaft) that extrudes a drop of nectar at the tip, or in three species a recurved shaft that deposits a pool of nectar on the adaxial face of each sepal. In four species (formerly treated as a separate genus, *Alsinidendron*) the nectary appendages are flap- or cup-like, and collect large quantities of black nectar. These hypodermic, flap- or cup-like extensions of the floral nectaries are unique within the family, and serve as a key feature to delineate *Schiedea* as a monophyletic group resulting from a single colonization of the Hawaiian Islands. Molecular information indicates that a clade of two small circumboreal-Alaskan genera is most closely related to *Schiedea*, suggesting that the ancestor of this subtropical genus colonized the Hawaiian Islands from a north temperate-boreal region. Species



Schiedea verticillata. (Photo by Warren Wagner)

are hermaphroditic and insect- or bird-pollinated or autogamous, or dimorphic (dioecious, subdioecious, and gynodioecious) and wind-pollinated. Nearly all hermaphroditic species occur in mesic or wet forests, whereas all dimorphic species are found in dry, often windy habitats. The morphological changes associated with the evolution of wind pollination, including a shift to smaller flower size, abundant pollen production and high pollen/ovule ratios, smaller pollen grains, and upright, highly condensed inflorescences, have had profound effects on the morphological diversity found within this lineage.

Two new species were published in the monograph (*S. laui*, *S. perlmanii*) and two others were published in papers leading up to the monograph (*S. attenuate*, *S. jacobii*). Several species presumed extinct were rediscovered during the course of intensive fieldwork for the project, but two species (*S. amplexicaulis*, *S. implexa*) were not relocated and are considered extinct. Most of the other species of *Schiedea* are greatly at risk of extinction. All species are illustrated and their ranges mapped. This monograph provides information critical for assessing biodiversity, and documents loss of biodiversity in *Schiedea* due to global change.

Profile

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west. One such disjunct species is Richardson's brome (*Bromus richardsonii*), which we found growing on a shallow, open slope after half a day of searching. A stretch of open prairie in the Cypress Hills provides habitat for several native grass species, including oat grass

(*Danthonia* sp.), fescue grass (*Festuca* sp.), and Hooker's oat grass (*Helictotrichon hookeri*), while a moist ravine is home to Virginia wild rye (*Elymus virginicus*), mountain brome (*Bromus marginatus*), and slender wedge grass (*Sphenopholis intermedia*).

After a night in Calgary, we collected in the prairies and parkland in western Alberta. A small creek running through a dry sedge meadow yielded several common wetland grasses, including water whorl-grass (*Catabrosa aquatica*), reed canary grass (*Phalaris arundinacea*), tufted hair grass (*Deschampsia caespitosa*), slough grass (*Beckmannia syzigachne*), short-awn foxtail (*Alopecurus aequalis*), reed manna grass (*Glyceria grandis*) and alkali grass (*Puccinellia* sp.). The dry ditches along the edge of the highway are dominated by several prairie grasses, including red fescue (*Festuca rubra*), a native species that is commonly planted to re-vegetate disturbed sites and prevent erosion along highway slopes, western wheat grass (*Agropyron smithii*), a widely distributed native species that is used for feed and erosion control, and smooth brome (*Bromus inermis*), a species introduced from Europe in the late 1800s and now widespread and common in disturbed habitats across North America.

Entering the Rocky Mountains, our focus shifted to western North American grass species. With official collecting permits in hand, our first few stops in Banff National Park yielded several species that we had not yet encountered, as well as park wardens who wondered why we were collecting plants in a protected area. We found bluebunch wheat grass (*Pseudoregneria spicata*) growing sporadically among the rocks on a steep, dry slope, several different fescue (*Festuca* spp.) species growing in open habitat among the aspen and douglas fir, and spike trisetum (*Trisetum spicatum*) growing in rocky soil. Driving north through the mountains, we ascended to the subalpine zone (~2000 m above sea level). Many of the species in the subalpine zones do not occur at lower elevations, and are adapted to the severe growing conditions, including shorter growing season, low air temperature, and high wind. Common high-elevation

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Grasses

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species that we collected included alpine blue grass (*Poa alpina*) and alpine timothy (*Phleum alpinum*), which have both evolved to be much smaller in stature compared to closely related lower-elevation species.

In central and northern British Columbia we collected several species of reed grass (*Calamagrostis*), each distinguished by subtle morphological characteristics and habitat differences. We collected pine grass (*C. rubescens*) in the understory of conifer-dominated forests, and two varieties of bluejoint reed grass (*C. canadensis*), the most common and widespread species of *Calamagrostis* in North America, in moist sites in the woods, meadows, and wetlands. We collected purple reed grass (*C. purpurascens*) in dry areas on slopes and in the open understory of conifer-dominated forests, and plains reed grass (*C. montanensis*) in dry sites at higher elevations. Through study of DNA sequence data from these and other *Calamagrostis* species from around the world, we aim to reconstruct the evolutionary history of this ecologically important genus of grasses.

We reached the Yukon Territory on the eighth day of our trip, greatly anticipating the prospect of exploring Canada's most northerly flora. Our first major stop in the Yukon was Whitehorse, where we picked up collecting permits. Next we met Connie LaRochelle, director of land claims for the White River First Nation, in Beaver Creek, 500 km west of Whitehorse at the Alaska/Yukon border. LaRochelle had requested our help to produce species lists of grasses in areas that have histories of traditional use around Beaver Creek. We spent a day exploring the boreal wetlands and forests surrounding Snag, an original village site of the Upper Tanana people that was abandoned after the construction of the Alaska Highway in 1942. The grass flora at Snag is typical of the Yukon, and includes quack grass (*Agropyron repens*), bent grass (*Agrostis scabra*), bluejoint reed grass (*Calamagrostis canadensis* var. *langsдорffii*), narrow small-reed (*Calamagrostis stricta*), spike trisetum (*Trisetum spicatum*), timothy (*Phleum pratense*), several blue grass species



Stephen Smith (L) and Paul Peterson collecting grasses in northwestern Canada. (Photo by Jeff Saarela)

(*Poa* spp.), mountain hair grass (*Vahloidea atropurpurea*), and tufted hair grass (*Deschampsia caespitosa*).

To access the more northerly roads in the Yukon, we took a shortcut through western Alaska, along a stretch of road cut out of a forest that had been devastated by fire only days earlier. After passing through the tiny community of Chicken (named because the gold prospectors in the early 1800s could not agree on how to spell ptarmigan, the game bird that they relied on for food), we ascended a gravel road high into the hills and re-entered the Yukon above the tree line at Canada's highest elevation border crossing. The tundra-like vegetation along the Top of the World Highway is dominated by several low-stature shrubs, and includes several familiar grasses and alpine sweet grass (*Anthoxanthum monticolum*), a species with a long history of traditional use in spiritual ceremonies. A few hours later, we approached the gold rush town of Dawson City, and collected the native species pumpelly brome (*Bromus pumPELLIANUS*) in the mud while waiting for the ferry to take us across the Yukon River.

Beyond Dawson City, we traveled north along the 25-year old Dempster Highway, an 800 km dirt road that connects Inuvik, the homeland of the

Inuvialuit and Gwich'in people, to the rest of Canada. Recently dubbed Canada's last great road trip, the Dempster Highway typically provides endless hours of breathtaking scenery through mountains and valleys, but much of our view was obscured by thick smoke generated by forest fires burning further south. Over five days, we crossed the Arctic Circle in the North West Territories and traveled to Inuvik and back, searching many habitats for grasses while battling thick clouds of mosquitoes. Most of the grasses we encountered were the same as those further south, although we found our first population of the low-arctic species pendant grass (*Arctophila fulva*) growing along the edge of a small pond, and many populations of the northern species polar grass (*Arctagrostis latifolia*). We kept an eye out for the arctic species Fisher's tundra grass (*Dupontia fisheri*) and circumpolar reed grass (*Calamagrostis deschampsoides*), but these are known previously only from the arctic coast, which is accessible only by plane.

After over twelve days exploring many regions of the Yukon, a bit of Alaska, and parts of the western North West Territories, we began the long journey south. Explorations in the eastern Yukon yielded a population of *Bromus richardsonii* at the northern tip of its western North

American range; our collections appear to be only the second record of this species for the territory. Leaving the Yukon, we traveled through northwestern British Columbia, where we hoped to find two distinctive species that occur only along the Pacific coast, Pacific reed grass (*Calamagrostis nutkaensis*) and Pacific brome (*Bromus pacificus*). After several days of searching, we found them each within a hundred meters of the coast, exactly where the floras indicated that we should look. We continued collecting through the southwestern portion of British Columbia, and returned to Vancouver after 26 days on the road.

By the end of our trip, we had traveled over 10,000 km and made more than 400 collections at over 70 localities in four provinces, two territories, and one state. Although we were looking for plants, we encountered 140 bird species and 29 mammal species, including pronghorn antelope, moose, coyotes, a wolf, black bears, Dall's sheep, caribou, a mink, and a red fox. Our plant collections are currently housed in the U.S. National Herbarium. After further study and identification, duplicates of our specimens will be deposited widely in herbaria in the USA and Canada. Ultimately, our collections will become part of the growing scientific record that documents the world's flora in space and time, and the material we collected for genetic analysis will be used in phylogenetic and taxonomic studies, increasing understanding of the biodiversity of the world's grasses. For me, the memories of the long days, massive size, and largely untouched wilderness of Canada's extreme northwest will last a lifetime.

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Calamagrostis nutkaensis. (Photo by Paul Peterson)

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Art by Alice Tangerini

Bromus sp. nov.

This new grass found in the Department of Ayacucho, Peru, was first collected by Paul M. Peterson and graduate student Nancy Refulio (Rancho Santa Ana Botanic Garden) in 2002 among large boulders and beneath thorny shrubs in the mountains east of Puquio. The new species is characterized by having laterally flattened spikelets, pilose ligules, 1-veined lower glumes, and 3-veined upper glumes. In a recent paper submitted to *Taxon*, graduate student Jeff Saarela (University of British Columbia), Peterson, and Refulio describe this new species, discuss its phylogenetic placement with other species of *Bromus* using DNA sequence data, and include a key to the 12 species of *Bromus* found in Peru.



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