Department of Botany & the U.S. National Herbarium

The Plant Press

Smithsonian
National Museum of Natural History

New Series - Vol. 16 - No. 3 July-September 2013

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Botany Profile

Decisions, Traditions, and New Paradigms in Conservation

By Gary A. Krupnick

The National Museum of Natural History (NMNH) and the United States Botanic Garden (USBG) jointly hosted the 2013 Smithsonian Botanical Symposium in Washington, DC, this past spring, featuring the theme "Avoiding Extinction: Contemporary Approaches to Conservation Science." With presentations from seven invited speakers, a poster session, and an award for excellence in tropical botany, the attendees were presented with history, practices, and lessons in modern conservation biology.

The Symposium kicked off on April 19 with a poster session and opening reception at the U.S. Botanic Garden. Fourteen posters presented by professors, students, horticulturists, land managers, and citizen scientists graced the Conservatory at the Garden. The posters featured a wide-range of botanical and conservation topics, such as the history of a federally-listed species, the propagation and restoration of rare plants, best practices for classroom education, and lessons in interpretative displays of endangered species.

On April 20, Warren Wagner, Chair of the Department of Botany, welcomed the symposium participants to Baird Auditorium in the Smithsonian's National Museum of Natural History. Noting the 40th anniversary of the U.S. Endangered Species Act, Wagner remarked that this symposium would present a cross-section of topics exploring new approaches to the crisis of biodiversity loss.

The José Cuatrecasas Medal for Excellence in Tropical Botany was presented by Laurence Dorr to Ana Maria Giulietti Harley of Universidade Estadual de Feira de Santana, Bahia, Brazil (see related article, page 10). Giulietti was recognized for her expertise in her research of the flora of Brazil. She remarked that she was "happy and proud to be chosen among so many other botanists that contribute to tropical botany." She accepted the award "in the name of the taxonomists and students of Brazil."

Smithsonian Botanical Symposium

Symposium moderator, Gary Krupnick, head of the Plant Conservation Unit in the Department of Botany introduced the first speaker. Scott Wing, Curator of Fossil Plants in the Department of Paleobiology, NMNH, gave a talk entitled "What Does Past Global Warming Tell Us about Future Plant Conservation?" Wing explained that the most comparable past event to today's current global warming occurrence is the Paleocene-Eocene Thermal Maximum (PETM), an extreme spike of warmth 55.8 million years ago at the beginning of the Eocene epoch. During the PETM, an enormous sudden release of carbon resulted in the rising of global temperatures 4 to 8°C over a period of 10,000 years and lasted 200,000 years. Possible causes for the carbon increase are methane release, burning of peat, volcanic activity, and permafrost thawing. During his presentation he showed examples of the effect of the PETM on terrestrial ecosystems by looking at the fossil record from the Bighorn Basin in northwestern Wyoming. He explained that leaf margin analysis on fossilized plants shows that the proportion of species with smooth margins to toothed margins increased with temperature. Leaf area also increased with increasing precipitation.

The PETM floristic change included four distinct groups: (1) plant species that went extinct at the beginning of the PETM; (2) plants that were present only during the PETM interval; (3) plants that appeared right after the PETM event; and (4) plants that were common before and after the PETM, but not during the event. At the onset of the PETM, there were local and regional extirpations of temperate deciduous plants (e.g., dawn redwood, birch, sycamore, katsura), and immigration of Fabaceae and other dry tropical plants. At the PETM recovery, there were local and regional extirpations of Fabaceae and other families (i.e., return of the "natives"), and intercontinental immigration of temperate plants. What was surprising, according to Wing, is that there is little evidence of massive extinction. Wing concluded his talk with a few lessons from the PETM story as it relates to the current events of today: Global warming is happening and will

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Travel

Pedro Acevedo traveled to Salinas, Puerto Rico (4/21 – 4/28; 5/7 – 5/31) to conduct a floristic inventory of Camp Santiago in southern Puerto Rico.

Walter Adey traveled to Labrador, Canada (6/5 – 9/13) to collect an ecological array of the coralline alga *Clathromorphum compactum* form the northern Labrador Coast and the Quebec shore of the Gulf of St. Lawrence.

David Erickson traveled to San Jose, Costa Rica (6/23 – 6/27) to lead a symposium at the annual meeting of the Association for Tropical Biology and Conservation.

Robin Everly traveled to East Lansing, Michigan (5/7 – 5/11) to present a talk at the 45th annual meeting of the Council on Botanical and Horticultural Libraries at Michigan State University.

Vicki Funk traveled to Kailua Kona, Hawaii (4/21 – 4/25) to collect *Melanthera* and *Bidens* (Compositae) for ongoing research; and to Durham, North Carolina (5/12 – 5/15) to attend a meeting at NESCent (The National Evolutionary Synthesis Center) where she serves on the board.

Carlos García-Robledo traveled to San Jose, Costa Rica (6/17 – 8/2) to coordinate the annual meeting of the Association for Tropical Biology and Conservation as a member of the organizing committee and the program co-chair, to teach a graduate field course for the Organization for Tropical Studies, and to continue field work throughout Costa Rica.

W. John Kress traveled to St. Paul, Minnesota (4/21 – 4/22) to deliver the keynote lecture at a 3M Corporation Earth Day event.

Gary Krupnick traveled to San Jose, Costa Rica (6/22 – 6/27) to attend and participate at the annual meeting of the Association for Tropical Biology and Conservation.

Sylvia Orli and **Ingrid Lin** traveled to Bronx, New York (5/19 – 5/20) to consult with the staff on the New York Botanical Garden on collection data management and digital storage of collection records.

Ida Lopez traveled to San Jose, Costa Rica (6/23 – 6/28) to present a poster at the annual meeting of the Association for Tropical Biology and Conservation.

Rusty Russell traveled to Rapid City, South Dakota (6/16 – 6/22) to moderate a paper session at the annual meeting of the Society for the Preservation of Natural History Collections.

Rob Soreng traveled to Turkey (6/8 – 6/30) to collect grasses, especially *Poa*, for the first season of a 3-year collaborative project, with Evren Cabi (Namık Kemal Üniversitesi) and Musa Doğan (Middle East Technical University), to revise *Poa* in Turkey.

Meghann Toner traveled to Rapid City, South Dakota (6/16 – 6/22) to give a presentation at the annual meeting of the Society for the Preservation of Natural History Collections.

Alice Tangerini traveled to Riverside, California (4/23 – 4/28) to participate in a program of lectures and workshops at the Riverside Metropolitan Museum, to teach courses at the University of California at Riverside and the Riverside Unified School District, and to meet with botanical artists in Newport Beach.

Alain Touwaide traveled to Brussels, Belgium (5/2 – 7/2) with **Emanuela Appetiti** to conduct research on the history of botany and ancient Greek medicine at the Bibliotheque Royale in Brussels; at the Katholieke Universiteit in Leuven, Belgium; at the Staatsbibliothek in Berlin, Germany; at the Herbarium and Archives of the Botanic Gardens in Meise, Belgium; and to present a keynote lecture at the Belgian Academy of Sciences; to London, England (6/3 – 6/4) to deliver a paper and attend a workshop on scientific translations in the Byzantine world at King's College; and to Barcelona, Spain (6/27 – 6/29) where they both were invited speakers at a symposium organized by the Institute of Medieval Studies of the Universidad Autonoma de Barcelona.

Warren Wagner traveled to Kauai, Hawaii (4/4 – 4/16) to attend a board meeting of the National Tropical Botanical Garden and to conduct research on the Marquesas Islands flora.

Jun Wen traveled to Chicago, Illinois (4/19 – 4/20) to present a talk as an invited speaker at the 2013 Chicago Plant Science Symposium at the Field Museum.

Kenneth Wurdack traveled throughout Peru (6/9 – 7/17) to conduct field work on Euphorbiaceae and their endophytes.

Elizabeth Zimmer traveled to Snowbird, Utah (6/21 – 6/26) to present a poster at the Evolution 2013 meeting.

Visitors

Janelle Burke, New York Botanical Garden; Tropical Polygonaceae and Plumbaginaceae (8/1/12-12/31/14).

Jianqiang Zhang, Peking University, China; *Rhodiola* (Crassulaceae) (10/8/12-10/7/13).

Genevieve Croft, Washington University; *Byrsonima crassifolia* (Malpighiaceae) (10/16/12-10/16/13).

Alyssia Phanethay, Western Carolina University; Plant conservation internship (1/2-4/5).

Leah Birdwell, University of Maryland, College Park; *Silene* (Caryophyllaceae) (1/7-7/21).

The Plant Press

New Series - Vol. 16 - No. 3

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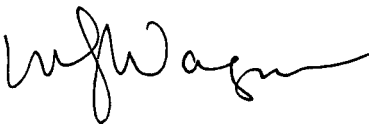
A Growing Department

In the October 2011 issue of *The Plant Press* I wrote in this column honoring 204 years of service by six staff who were retiring. Over the next several months the Department of Botany developed a staffing plan to fill the most critical positions in the department left by these retirements and other gaps resulting from earlier retirements or new approaches to our work. In the October 2012 issue we reported the staff changes and hires for the department's information technology group (Sylvia Orli as head and Ingrid Pol-Yin Lin in a new multi-media position). In the January 2013 issue we reported on the new collections staff that had been hired (Melinda Peters and Meghann Toner). I am delighted to report here the recent recruitment of two research scientists and curators to the department.

Dr. Ashley N. Egan (Assistant Professor and Herbarium Curator; East Carolina University) will join the National Museum of Natural History's Department of Botany as Curator of Legumes in August 2013. Egan received her doctoral degree from Brigham Young University in 2006 under the direction of Keith Crandall, and had her postdoctoral training at Cornell University in Jeff Doyle's lab. Egan is a systematic biologist with strong expertise in phylogenomics and bioinformatics. Her research integrates field work, phylogenetic theory, genomics and bioinformatics in tackling various complex systematic and polyploidy problems in legume plants, one of the largest plant families of flowering plants, and one in which the US National Herbarium has strong holdings. Her publication record is excellent with publications in a wide variety of journals including the high impact *Proceedings of the National Academy of Sciences*, *Systematic Biology*, *BMC Biology*, and *New Phytologist*. She is a collection-based researcher who has described new species and a new genus, and contributed treatments for the Flora of North America project. She has already established herself as an expert of next-generation sequencing approaches in plant evolutionary biology.

Dr. Eric Schuettpelz (Assistant Professor, University of North Carolina Wilmington) will join the NMNH Department of Botany as Curator of Ferns in August 2013. Schuettpelz is an evolutionary biologist well-known for his work on fern systematics and diversifications. He received is doctoral degree at Duke University under the direction of Kathleen Pryer in 2007. He had his postdoctoral training at Duke University and the National Evolutionary Synthesis Center. The US National Herbarium has the best collection of fern specimens in the world, so Schuettpelz's program will be a great fit to our collections' strengths. His publication record is excellent with publications in a wide variety of high impact journals: *Nature*, *Proceedings of the National Academy of Science*, *Systematic Biology*, and *Evolution*. His research has been collection-based and he has made valuable and important contributions to the field of systematics and evolutionary biology of ferns. Moreover he has contributed to the new family-level classification of ferns, and published new combinations and clarified species delimitations.

When the National Museum of Natural History opened its doors in 1910, the botany staff had four curators. With the forthcoming addition of two new research scientists, the number of curators in the Department of Botany will be at 13, a bit smaller than the peak of 20 curators in the early 1990s. The addition of Egan and Schuettpelz to the staff will allow the Botany Department to remain a strong a vibrant unit within NMNH, will add research programs for major taxonomic groups worldwide, and will provide expertise and curation for some of our strongest collections.



Chair With A View — Warren L. Wagner

Ning Zhang, Pennsylvania State University; Vitaceae (1/7/13-6/30/15).

Koray Durak, Bogazici University, Turkey; Byzantine medicine (2/26-5/15).

Carolina Guerriero, Instituto Darwinion, Argentina; South American Bambusoideae (Poaceae) (3/8-4/6).

Fabio Avila, Universidad Nacional de Colombia; Cuatrecasas project (4/1-8/3).

Gloria Batista de Vega, Smithsonian Tropical Research Institute; *Eucheuma* and *Kappaphycus* (Solieriaceae) (4/12-4/20).

Kerry Barringer, Brooklyn Botanic Garden; Scrophulariaceae (4/16-4/17).

Ana Maria Giulietti, Universidade Estadual de Feira de Santana, Brazil; Eriocaulaceae (4/17-4/25).

Raymond Harley, Royal Botanic Garden, United Kingdom; Lamiaceae (4/17-4/25).

Alina Freire-Fierro, Academy of Natural Sciences; Colombian *Monnina* (Polygalaceae) (4/19).

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Staff Research & Activities

On 5 April, **Lesley Parilla** (National Museum of Natural History's Field Book Project) and Pam Henson, Courtney Belizzi, and Kira Cherrix (Smithsonian Institution Archives) presented a panel session "Panamania: Connecting Collections and Reaching New Audiences" at the annual mid-Atlantic conference for the Society for History in the Federal Government, in College Park, Maryland. The event provided an opportunity to highlight Smithsonian's current efforts to catalog, digitize, and make archival materials like the Institution's field books available online to the public. The presentations were framed through a discussion of the century's worth of field documentation gathered in Panama. The panel talked about materials resulting from field work conducted over the last century by both Smithsonian and USDA personnel, beginning with the Biological Survey of Panama 1910 – 1912. The discussion provided an exciting chance to show the range of relationships across the Institution and diversity of material formats with which staff work. Projects like the Field Book Project, a joint effort of NMNH and the Smithsonian Institution Archive, demonstrate how units within the institution can work together in meaningful ways to make resources more accessible. Panel members discussed how these materials can be utilized through online exhibits and tools, like geotagging, by using examples of how the Smithsonian has used a wide variety of digital media to make the history of this work accessible to researchers, scientists and the general public.

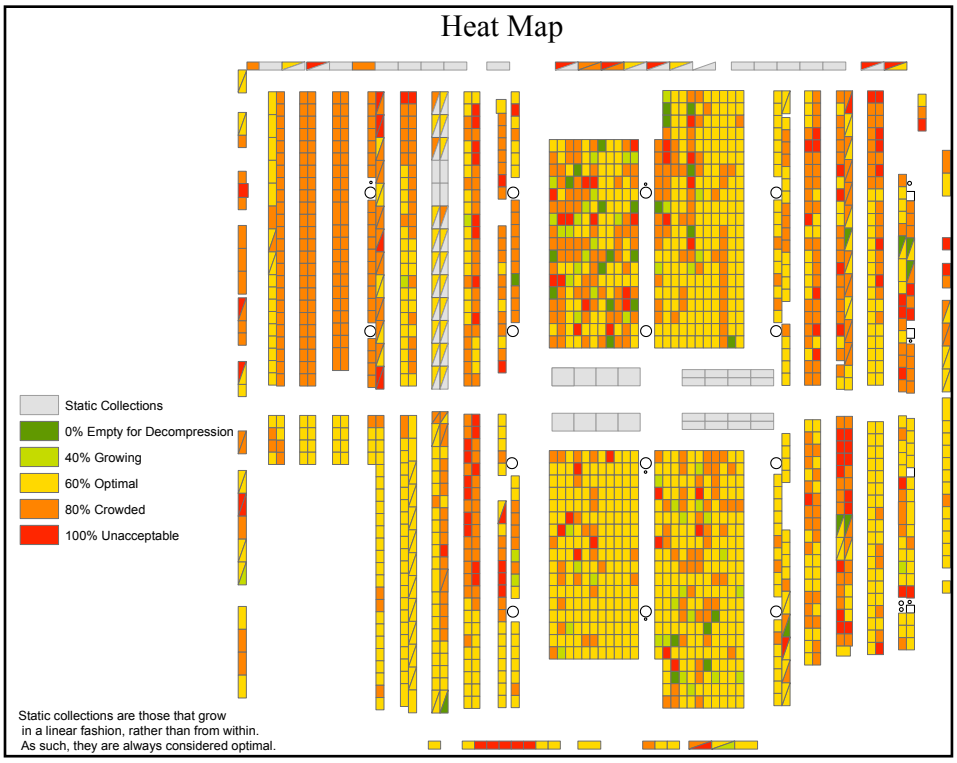
Melinda D. Peters has recently finished her thesis titled, "Cross Pollination: An Examination of Technology to Promote Learning in Botanic Gardens and Arboreta." This thesis completes her work for a degree of Master of Liberal Arts in Extension Studies, in the field of Museum Studies from the Harvard University Extension School. Peters is very excited to have completed the program and felt that it was a great experience. Overall, the coursework helped better equip her for her responsibilities at the U.S. National Herbarium, and her thesis work provided a new perspective on what living collections are up against. Prior to her work at Harvard, Peters received a Master of Science in Botany from North Carolina State University.

Rusty Russell and **Meghann Toner** attended the 28th annual meeting of the Society for the Preservation of Natural History Collections (SPNHC) in Rapid City, South Dakota, 17-21 June 2013. Russell moderated a session of herbarium-related presentations. Toner and Amanda Millhouse (Department of Paleobiology) jointly delivered back-to-back presentations. The first of these presentations detailed the uses of geographical information systems (GIS) as a way to address fundamental collections management issues by recording data on an individual storage case level. These data are then visually displayed in map form (below) and can be compared against multiple layers of related data. The second presentation covered the development of a museum-wide data standard for assembling collection assessment data. This would permit all museum collections units to assemble assessment data in a manner that would provide utility to both the museum's director's office as well as each supporting collections unit. The incorporation of GIS into natural history collections management is a unique initiative being led by the collection staffs of the Departments of Botany and Paleobiology and its initial tools are still under development.

Awards & Grants

The National Museum of Natural History's Office of the Associate Director for Science announced the following 2013 NMNH Grant Award recipients:

- **Laurence Dorr**: Malvaceae, Flora of the Guianas.
- **W. John Kress**: Using DNA barcodes to model tropical plant extinctions and co-extinction cascades of associated insect herbivores under projected climate change.
- **Vicki Funk**: Resolving the basal grade of the Compositae: Mutisioideae.
- **Paul Peterson**: Grasses of north central China.
- **Jun Wen**: Biogeographic diversification of the grape family Vitaceae in the Malesian region.



The collection management staff is using geographical information systems software (ArcGIS) to map the usage of storage cases across the herbarium and to assess future needs. This map shows case usage on the 4th floor (West Wing) of the National Museum of Natural History.

- **Kenneth Wurdack**: Evolution of biosynthetic novelty in the castor bean clade of Euphorbiaceae.

Alain Touwaide was awarded a 2-month residential research fellowship by the Institute for Advanced Study of the Belgian Academy of Sciences (May 2 - July 2), in Brussels, Belgium, to conduct research on the history of botany and ancient Greek medicine.

Elizabeth Zimmer, as co-principal investigator, was awarded an ADVANCE grant from the University of Maryland for her study, "What Darwin could not do: Estimation of the role of pollinator mediated selection on hermaphroditic floral design through male paternity utilizing microsatellite markers," with University of Maryland principal investigator Michele Dudash and co-PIs Charlie Fenster and Jian-Jian Ren.

Bob Faden, and his Smithsonian behind-the-scenes volunteer wife, Audrey Faden, were awarded the Linc and Timmy Foster Millstream Garden Award by the North American Rock Garden Society on 4 May 2013 at the annual meeting in Ashville, North Carolina. The award was for "creating a superior and Unique Garden 'The Expanding Garden' which [sic] reflects the standards of the Millstream Garden and the North American Rock Garden Society." The Fadens live in Alexandria, Virginia, and the major part of their gardening area is open to the public.

The most developed and best maintained beds are in Eugene Simpson Stadium Park which Audrey designed. The oldest of these beds, the water-wise garden, is 20 years old this year. Other beds include flagstone, butterfly, fragrance, tufa and gravel gardens. Interpretive information in the form of handouts in on-site boxes provides the public with names of the numbered plants in the water-wise garden and the types of flagstone that may be locally purchased. There are also handouts about the butterfly and fragrance gardens and the major trees and shrubs in the Simpson Park gardens area.

On the adjacent YMCA grounds which, although technically private, are also completely open to the public, a great diversity of woody plants is grown in the beds. These include two 10-meter high *Cercidophyllum japonicum* (Katsura) trees that were collected as seedlings in the National Museum of Natural History parking lot 20 years ago, and two crepe myrtles that were grown from cuttings collected in 1998 from a bulldozed tree in front of the IRS building, across from the Museum's entrance. Overall, the Fadens grow about 200 genera of woody plants. Peak blooming in the gardens is in May.

Visitors

Continued from page 3

Robert Ousterhout, University of Pennsylvania; *Historia Plantarum* collection (4/19).

Katelyn Hernandez and **Marilyn Holbeck**, Holbeck Chiropractic, Virginia, and **Claudia Thompson-Deahl**, Reston Association; History of medicine and botany (4/22).

Asmaa Muneer, University of Maryland; Plant DNA barcode project (4/22-12/31).

Gerry Moore, US Department of Agriculture; Collection tour (4/24).

Petros Bouras-Vallianatos, King's College, United Kingdom; *Historia Plantarum* collection (4/25).

James Macklin, Agriculture and Agri-Food Canada (DAO); Collections research (5/1).

Karoline Oldham, George Mason University; *Melampyrum lineare* (Orobanchaceae) (5/6).

João Bringel, Universidade de Brasilia; *Riencourtia* (Asteraceae) (5/9-5/11).

Genise Freire, Rural Federal University of Rio de Janeiro, Brazil; *Paullinia* (Sapindaceae) (5/10-6/22).

Thais Almeida, Universidade Federal de Minais Gerais, Brazil; *Microgramma* (Polypodiaceae) (5/20-5/22).

Leandro Giacomin, Universidade Federal de Minais Gerais, Brazil; *Solanum* (subgenus *Brevantherum*, Solanaceae) (5/20-5/22).

Katherine Dymek, Smith College; Plant DNA barcode project (5/20-7/26).

Hay Kendra, University of Wisconsin; U.S. Exploring Expedition (5/28-6/26).

Leah Aronowsky, Harvard University; U.S. Exploring Expedition (6/3-8/2).

Elena Clark, George Washington University, and **Rachel Livengood**, Bloomsburg University of Pennsylvania; Plant conservation internship (6/3-8/9).

Amanda Treher, NatureServe; *Caltha* and *Ranunculus* (Ranunculaceae) (6/4).

Karoline Oldham, George Mason University; *Melampyrum lineare* (Orobanchaceae) (6/5).

Murra Zabel, AMZA Film Production, Switzerland; Henri Pittieri research for film (6/10-6/11).

Rubens Coelho, State University of Campinas, Brazil; *Allophylus* (Sapindaceae) (6/10-8/8).

Christopher Hardy, Millersville University; Neotropical *Geogenanthus* (Commelinaceae) (6/13-6/14).

Kenneth Bauters, Ghent University, Belguim; *Scleria* (Cyperaceae) (6/14-7/5).

Carrie Kiel, Rancho Santa Ana Botanic Garden; *Justicia* (Acanthaceae) (6/17-6/21).

Alexander Krings, North Carolina State University; Collections research (6/20).

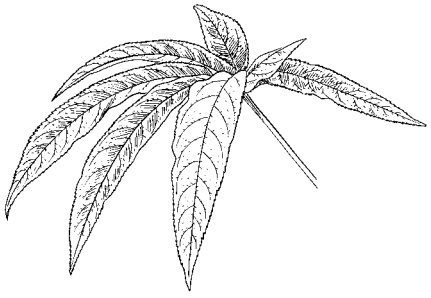
Norihisa Tanaka and **Wataru Ohnishi**, Kanagawa Prefectural Museum of Natural History, Japan; *Carex* (Cyperaceae) and specimen collected by Furuse Miyoshi (6/2-6/21).

Katya Medrano and **Samerawit Sebesibe**, Washington, DC; *Heliconia* project (6/24-8/2).

Alexander Dudley, University of Colorado; Liberian collections (6/24-8/16).

Clara Finkelstein, Kensington, Maryland, and **Nicole Choi**, University of Maryland, College Park; Historical expeditions project (6/26-7/19).

Wesley Knapp, Maryland Natural Heritage Program and Delaware State University; *Juncus* (Juncaceae) and *Rhynchospora* (Cyperaceae) (6/27).



The Ornaments of Life

The average kilometer of tropical rainforest is teeming with life; it contains thousands of species of plants and animals. As 'The Ornaments of Life: Coevolution and Conservation in the Tropics' (Fleming and Kress 2013) reveals, many of the most colorful and eye-catching rainforest inhabitants—toucans, monkeys, leaf-nosed bats, and hummingbirds to name a few—are an important component of the infrastructure that supports life in the forest. These fruit-and-nectar eating birds and mammals pollinate the flowers and disperse the seeds of hundreds of tropical plants, and unlike temperate communities, much of this greenery relies exclusively on animals for reproduction.

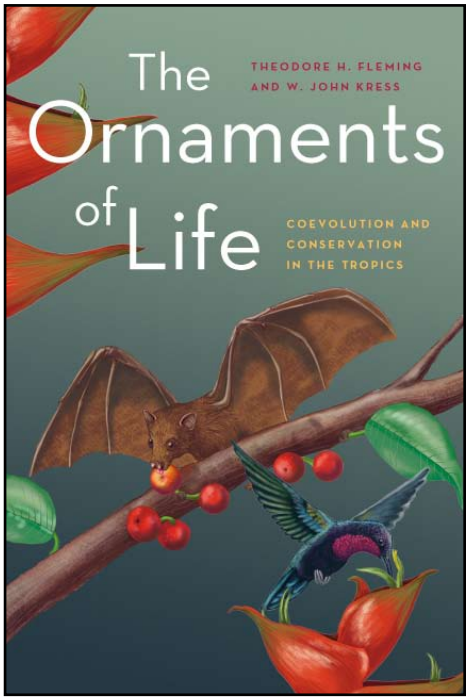
Synthesizing recent research by ecologists and evolutionary biologists, Theodore H. Fleming and **W. John Kress** demonstrate the tremendous functional and evolutionary importance of these tropical pollinators and frugivores. They shed light on how these mutually symbiotic relationships evolved and lay out the current conservation status of these essential species. In order to illustrate the striking beauty of these "ornaments" of the rainforest, the authors have included a series of breathtaking color plates and full-color graphs and diagrams.

New World or Madagascan nectarivores are featured in 'The Ornaments of Life', including a hummingbird (*Eulampis jugularis* with *Heliconia caribaea*), phyllostomid bat (*Choeronycteris mexicana* with *Chelonanthus alatus*), and a Madagascan lemur (*Varecia variegata* with *Ravenala madagascariensis*).

'The Ornaments of Life' represents a collaboration between Fleming, now an emeritus professor of biology at the University of Miami, and three members of the Department of Botany, National Museum of Natural History – Kress, **Ida Lopez**, and **Alice Tangerini**. Fleming's research on the importance of fruit-eating bats as dispersers of tropical seeds began in Costa Rica in 1970. By 1977 he was thinking about writing a book dealing with the ecology and evolution of fruits and frugivores. It wasn't until 2000, however, after he had studied bats as pollinators of giant columnar cacti in Mexico for a decade, that he began to seriously pursue this idea, this time including vertebrate pollinators and as well as frugivores in the synthesis.

At the Association for Tropical Biology and Conservation's (ATBC) annual meeting in Bangalore, India, in 2001, Fleming asked his long-time friend Kress to be a co-author. He reasoned that this duo would be an excellent team in which he would cover ecological topics and Kress would cover evolutionary and phylogenetic topics. In 2002, they sent a detailed book prospectus to the University of Chicago Press and received a contract from them in early 2003. Fleming began to write ecological sections of the book in the summer of 2003, asking Kress to contribute specific sections along the way. By 2007, they were ready to tackle two chapters dealing with the evolutionary consequences and phylogenetic history of these mutualisms from both the animal and plant sides. In fall 2007, Fleming spent 10 weeks in the Department of Botany working with Kress on these chapters. Four more chapters, including one dealing with conservation issues with Kress as the lead author, followed, and a clean first draft was sent to the Press for outside review in August 2011. The final revised draft was returned to the Press in April 2012.

A critical aspect of this book, which is the most extensive synthesis of tropical plant-animal interactions ever published, was the artwork. Because the book contains many phylogenetic trees, Fleming and Kress convinced the Press that all of the artwork, including a series of plates



illustrating these plant and animal 'ornaments,' needed to be published in color. Lopez, Kress' research assistant, helped produce many of these trees, plates, and other figures. Tangerini, the Department's botanical illustrator, contributed the beautiful cover art as well as a classic figure containing examples of convergent evolution in New and Old World vertebrate pollinators and seed dispersers. Funding for all of the color work was generously provided by the Department of Botany, NMNH; the College of Arts and Sciences, University of Miami; and Bat Conservation International.

The book is scheduled to be released in hardback and paper editions on October 9, 2013.

Tangerini Artwork on Display at "Smithsonian Week in Riverside"

The Riverside Metropolitan Museum (RMM) in Riverside, California, hosted a week-long series of programs featuring the work of Smithsonian staff as it relates to current exhibits on plant biodiversity and conservation. "Smithsonian Week in Riverside," co-sponsored by the Smithsonian Associates took place April 23 -25, 2013. Botanical illustrator **Alice Tangerini** traveled to Riverside to participate in the program with a series of lectures and

workshops at the museum and local public schools. In addition, James Bryant, Curator of Natural History at RMM, arranged for Tangerini's original artwork to be displayed from April through August in conjunction with the "John Muir and the Personal Experience of Nature" exhibit at RMM. The framed Tangerini originals displayed included *Fulcaldea stuessyi*, *Platycarpha glomerata*, *Sampera coriacea*, *Dryopteris macropholis*, *Hitchenia glauca*, and *Globba sherwoodiana*, with screened images of *Oenothera*, *Hymenoxys*, and *Mortoniodendron*.

During the week, Tangerini presented talks to a plant taxonomy class at the University of California at Riverside and to Riverside Unified School District's STEM magnet program which included 400 students from grades 5 through 8. In her presentations, she explained the techniques of illustration from pen and ink through digital color on her Wacom Cintiq. She also gave a lecture at Riverside Metropolitan Museum on the changing world of botanical illustration followed by public demonstrations with her drawing the well-known city sycamore, *Platanus racemosa*, in both ink and graphite techniques. After the Riverside events, Tangerini spent time with the Botanical Art Group of Southern California (BAGSC) in Newport Beach.

Alice Tangerini presents illustration techniques at a Smithsonian Associates workshop in Riverside, California.

Notes from the Plant Mounting Room

By Melinda Peters

The Plant Mounting Program continues to flourish as we enter the summer months. With some volunteers away for summer fun, we are still meeting the needs of the Botany Department with regards to newly acquired material and material from the backlog. During this quarter, staff, volunteers and contractors have mounted some **3,500** specimens for the permanent collection.

Left to right: Specimen US 3487444 is a bromeliad collected by botanical artist Margaret Mee. Specimen US 3654291 is an orchid collected by American naturalist Roger Tory Peterson and ornithologist Philip S. Humphrey.

We have recently hosted **Terrie Chan**, a volunteer in Paleobotany, who is working on preparing *Ginkgo* specimens for Conrad Labandeira and Jorge Santiago-Blay for their study of herbivory on *Ginkgo* through time. She has enjoyed the project so much that she will be joining our Plant Mounting Program as a new volunteer. We are also helping to train some volunteers who will be charged with working on botanical specimens for the museum's education center, entitled Q?RIUS, slated to open later this year.

We have had many new acquisitions so far this year. We have received approximately **3,000** specimens as exchange, **1,240** as gifts, and **280** as gifts for identification.

A couple of noteworthy newly mounted specimens include:

- Specimen US 3487444 is a specimen of *Ananas nanus* (L.B. Sm.) L.B. Sm. (Bromeliaceae) collected in Brazil by Margaret Mee. This was an exciting find in the backlog because Margaret Mee, botanical illustrator, contributed many Bromeliaceae drawings to Lyman B. Smith's publication, "The Bromeliads" in 1969. A great description from the introduction of this publication describes Mee as "not satisfied to drag a dying plant back to the comfort of her studio nor to reconstruct from a dead one. Instead, she met them where they lived and painted them there, evolving a highly successful technique through trial and error and undergoing some hair-raising experiences in the process." Even though this specimen was not used as a drawing model, it represents the rich historical specimen data found here at the U.S. National Herbarium.

- Specimen US 3654291 is a specimen of *Codonorchis lessonii* (Brongn.) Lindl. (Orchidaceae) collected by Roger Tory Peterson and Philip S. Humphrey in Tierra del Fuego, the southernmost tip of South America, during their expedition in 1960 to collect birds. The goal was to collect and document bird species, but they also collected plant specimens as a record of potential food sources. The specimens were sent to the U.S. National Herbarium from Yale University in 1962 where Humphrey was on the staff. Peterson is known as being an American naturalist and for writing many field guides. Humphrey was a Curator of Birds at the Peabody Museum at Yale University when this expedition took place; he later became the Director of the Museum of Natural History at the University of Kansas until he retired.

Wait, is that the Original?

By Adriana Marroquin and Robin Everly
Smithsonian Libraries

Recently, the librarians at the Smithsonian Libraries' Botany-Horticulture Library uncovered a "mini-mystery" involving one of our titles. It started when **Alice Tangerini**, botanical illustrator in the Smithsonian's Department of Botany, got a call from a colleague asking why a work on the Biodiversity Heritage Library (BHL) website (http://www.biodiversitylibrary.org/) was appearing with black and white illustrations rather than the beautiful color originals. James Bryant, Curator of Natural History at the Riverside Metropolitan Museum and manager of the Clark Herbarium, was curating an exhibit on botanical illustration, where several of the original paintings by Mary Eaton are on display. He wondered if the Eaton paintings had been reproduced in color for the publication, instead of the black and white illustrations he found online.

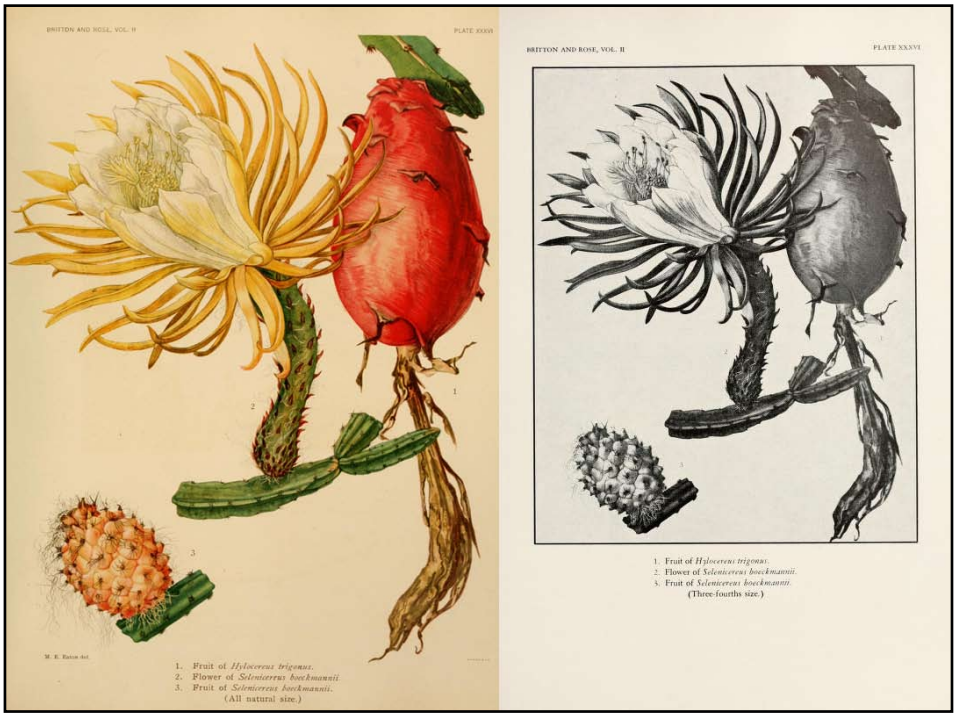
The work in question is Britton and Rose's ***The Cactaceae, Descriptions and Illustrations of Plants of the Cactus Family (The Cactaceae)*** (http://biodiversitylibrary.org/bibliography/46288#/summary). The four volume set is an early definitive taxonomic work on the family Cactaceae.

***Opuntia atrispina*, *Opuntia phaeacantha*, and *Opuntia engelmannii*, from *The Cactaceae*, Vol. 1. Color image (left) from the Biodiveristy Heritage Library website. Black and White image (right) from Internet Archive website.**

When the first volume was published in 1919 it sold for $18, the equivalent of $242.19 today. Noted by a contemporary reviewer as "the most sumptuous botanical publication since Dykes' 'The Genus Iris,'" ***The Cactaceae*** was an ambitious project funded by the Carnegie Foundation. The final work was a result of the combined effort of botanists across North and South America, and the Caribbean islands. One of the reasons the work is so important is that it reexamined type specimens and original descriptions. As noted in the introduction to volume one, it was a necessary task due to many species having been incorrectly identified, descriptions incorrectly interpreted, and common names attributed to the incorrect species.

After further investigation on the BHL website, it was discovered that the New York Botanical Garden's LuEsther T. Mertz Library had provided its copy of *The Cactaceae* for scanning. These botanical illustrations are now available in all their technicolor glory.

However, why did BHL have a copy with black and white illustrations in its database? As it turns out, that black and white copy of *The Cactaceae* had been ingested into BHL from the Internet Archive (http://archive.org/index.php) through a scan done at North Carolina State University Libraries (see Volume 1 here). For BHL to capture as much digitized biodiversity material as possible, it accepts scans of books and journals already present within the Internet Archive corpus that meets a set of subject heading and call number criteria in line with its collection development policy. This was the case with the NCSU Libraries' copy of *The Cactaceae*, which is a reprinted version of the original 1919 publication. The publisher had reissued it with black and white illustrations. For more informa-



***Hylocereus trigonus* and *Selenicereus boeckmannii*, from Vol. 2. Color image (left) from BHL. Black and White image (right) from Internet Archive.**

tion about our ingest of non-BHL member materials from the Internet Archive see the post "Ingest Criteria Revised**"** (http://blog.biodiversitylibrary.org/2010/07/in-november-2009-bhl-started-ingesting.html).

Using BHL's Feedback link, the librarians requested that the black and white version's URL be redirected to the color version of ***The Cactaceae***. All images are available in Flickr (http://www.flickr.com/photos/biodivlibrary/sets/).

Genome: Unlocking Life's Code

What makes you….you? Your genome, of course. Within every nucleus of every cell is a collection of chromosomes that contain life's code - an instruction manual that makes you an individual. DNA sequencing technology is propelling the science of genomics by leaps and bounds, allowing us to take great strides in advancing our knowledge about ourselves, our families, and our world. It is at the forefront of Smithsonian science and is playing a prominent role in National Museum of Natural History research through the Global Genome Initiative and the Laboratories of Analytical Biology.

Genome: Unlocking Life's Code is a new traveling exhibition that gives you the keys to learn more about genomics and how this science might affect you. With 4,400 square feet of dynamic media interactives, the latest sequencing technology, fun mechanical interactives, and exciting models, the exhibit shows you what a genome is and how genomic science effects human health, disease, ancestry, and the natural world. The Genome Zone has a number of hands-on activities to encounter along with some stunning photography.

A multi-year collaboration between NMNH and the National Human Genome Research Institute of the National Institutes of Health, the exhibition commemorates the anniversaries of two landmark scientific events: the completion of the Human Genome Project in 2003, which produced the first complete human genome sequence as a blueprint of the human body; and James D. Watson and Francis Crick's discovery in 1953 of DNA's double helix structure. That revolutionary discovery laid the foundation for understanding how DNA encodes and copies genetic information to pass on to the next generation.

Department of Botany's **Liz Zimmer** was an early participant in discussions and committee meetings in the design of the exhibition. *Genome: Unlocking Life's Code* is located on the second floor off the Rotunda and it opened to the public on June 14. The exhibition will be on view for 14 months and then travels throughout North America.

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Giulietti Receives 11th Cuatrecasas Medal

The Department of Botany and the United States National Herbarium present this award to a botanist and scholar of international stature who has contributed significantly to advancing the field of tropical botany. The José Cuatrecasas Medal for Excellence in Tropical Botany is named in honor of Dr. José Cuatrecasas, a pioneering botanist and taxonomist, who spent nearly a half-century working in the Smithsonian Institution's Department of Botany. Dr. Cuatrecasas devoted his career to plant exploration in tropical South America, and this award serves to keep vibrant the accomplishments and memory of this outstanding scientist.

The winner of this prestigious award is selected by a committee made up of three botanists on staff in the Botany Department in consultation with other plant scientists outside of the Smithsonian. Nominations for the Medal are accepted from all scientists in the Botany Department. The award consists of a bronze medal bearing an image of José Cuatrecasas on the front with the recipient's name and date of presentation on the back. Highlights from past presentations to the recipients are available on the Symposium Archives at http://botany.si.edu/events/sbsarchives/.

Ana Maria Giulietti Harley is the 11th recipient of the José Cuatrecasas Medal for Excellence in Tropical Botany. Giulietti, a Professor of Botany at the Universidade Estadual de Feira de Santana, Bahia, Brazil, was selected for this honor as she has made many important contributions to tropical Botany through her research, field work, and teaching. She received her bachelor's degree (1967) from the Universidade Federal Rural de Pernambuco in Recife, and her master's (1970) and doctoral (1978) degrees from the Universidade de São Paulo. Her doctoral dissertation was on the genera *Eriocaulon* and *Leiothrix* (Eriocaulaceae) in the Serra do Cipo, Minas Gerais state, and she has continued to study and publish on the Eriocaulaceae throughout her career. Giulietti taught botany courses at the Universidade de São Paulo from 1975 to 1996, including undergraduate courses in plant systematics, morphology, anatomy, economic botany, and biodiversity, and graduate courses in flowering plant systematics. In 1996, she moved to the Universidade Estadual de Feira de Santana where she has continued to teach and also served as coordinator of Graduate programs in Botany.

Giulietti has long been involved in floristic exploration in Brazil dating back to her undergraduate days and involvement in the *Flora de Pernambuco*. She has undertaken field work in the Distrito Federal, Mato Grosso, Minas Gerais, Goiás, and Bahía, and has contributed to the Serra do Cipo (Minas Gerais) and the Chapada Diamantina (Bahía) flora projects. Giulietti has held a number of professional society offices, and since 2005 has been a member of the Brazilian Academy of Sciences.

The past recipients of the Cuatrecasas Medal are Rogers McVaugh of the University of North Carolina at Chapel Hill (2001); P. Barry Tomlinson of Harvard University (2002); John Beaman of the Royal Botanic Gardens, Kew (2003); David Mabberley of the University of Leiden, The Netherlands, and the Royal Botanic Gardens, Sydney (2004); Jerzy Rzedowski and Graciela Calderón de Rzedowski of Instituto de Ecología del Bajío, Michoacán, Mexico (2005); Sherwin Carlquist of Rancho Santa Ana Botanic Garden and Pomona College (2006); Mireya D. Correa A. of the University of Panama and Smithsonian Tropical Research Institute (2008); Norris H. Williams of the Florida Museum of Natural History and the University of Florida, Gainesville (2009); Beryl B. Simpson of the University of Texas at Austin (2010); and Walter S. Judd of the University of Florida at Gainesville (2012).

Ana Maria Giulietti Harley, Professor of Botany at the Universidade Estadual de Feira de Santana, Bahia, Brazil, accepts the 2013 José Cuatrecasas Medal for Excellence in Tropical Botany from Laurence Dorr (Chair of the Cuatrecasas Medal selection committee). (Photo by Ken Wurdack)

Abstracts from the Speakers at the Smithsonian Botanical Symposium

The 11th Smithsonian Botanical Symposium, "Avoiding Extinction: Contemporary Approaches to Conservation Science," was held 19-20 April 2013. The invited speakers covered a wide range of organisms and topics to illuminate modern methods and approaches in the field of conservation biology. Below are the speakers' abstracts from the papers that were presented.

Symposium convener Gary Krupnick (left), Botany Chair Warren Wagner (third from left), and U.S. Botanic Garden Executive Director Holly Shimizu (third from right) join speakers Dennis Whigham, Scott Carroll, Andrea Kramer, Chris Thomas, Scott Wing, Stuart Pimm, and Stephen Weller during the opening reception of the 2013 Smithsonian Botanical Symposium at the U.S. Botanic Garden. (Photo by Elaine Haug)

Scott Wing
National Museum of Natural History

"What Does Past Global Warming Tell Us About Future Plant Conservation?"

One way we can better understand the effects of anthropogenic climate change on plants is to examine the fossil record of their response to past climate changes. The Paleocene-Eocene Thermal Maximum (PETM) is a particularly useful episode of global warming because it was analogous to business as usual scenarios for the future both in terms of the amount of carbon released (>4,000 Pg), and the amount of warming experienced (4-8°C). In this talk I will summarize basic information about the PETM, then describe what fossil leaves and pollen reveal about floristic change during the PETM. The best record of plant response to the PETM comes from the northern Rocky Mountains. There, floristic composition changed radically during the event because local or regional populations of mesophytic plants, especially conifers, were extirpated. Mesophytic plants were replaced in this area by invading thermophilic and dry-tolerant species, many in the Fabaceae. This floristic change largely reversed itself as the PETM ended, though some immigrant species persisted and some Paleocene species never returned. Despite geologically rapid extirpation, colonization, and recolonization, there was little plant extinction during the PETM, suggesting the rate of climate change did not exceed the capacity of plants to disperse. Extrapolating the response of plants from the PETM to future anthropogenic climate change likely underestimates risk, however, because rates of climate change during the PETM were probably an order of magnitude slower than current rates of change, and because the abundant, widespread species common as fossils are likely resistant to extinction.

Stephen Weller
University of California at Irvine

"Conservation on Oceanic Islands: Interactions between Introduced Ungulates and Invasive Plants"

Remote island ecosystems may be especially susceptible to invasion because island species have evolved in isolation and have little resistance to competitors, herbivores, and pathogens introduced from continental areas. Synergistic interactions between introduced ungulates and invasive plants may have profound effects in island ecosystems, leading to modifications of ecosystems that cannot easily be reversed. Removal of introduced ungulates may result in unexpected negative consequences, such as the increase in frequency of alien plant species that might have been suppressed by herbivory. Attempts at restoration may lead to alternative, undesirable states that are highly resilient to further change. These possibilities were investigated in lowland dry and mesic forests in Hawaii, which are among the most diverse communities in the archipelago, but now occur in only a small fraction of their former range. Low elevation dry and mesic forests are also well known for their very high numbers of endangered species. Our goal was to determine how ungulate removal from these forests influences the balance of native and alien plant species. Removal of ungulates had positive effects in both community types, including reduced mortality and greater recruitment of native species, but invasive plant species capable of altering habitats and limiting regeneration of native plant species were also favored. Active management of these remnant communities, including reintroduction of key native species, will be essential for conservation of biodiversity in low elevation communities in Hawaii.

Scott P. Carroll
University of California at Davis

"Conciliation Biology: The Eco-evolutionary Management of Permanently Invaded Biotic Systems"

Human influence on the biosphere has a profound and underappreciated evolutionary dimension. While many harmful

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Abstracts

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species adapt to human actions in damaging ways, many beneficial species are not adapting fast enough. Both outcomes threaten human welfare and are vitally important to the practice of environmental stewardship, sustainable agriculture and responsible medicine. The novel biotic systems created by introduced exotic species are a key case in point. Eradication efforts are routinely defeated by the rapid evolution of resistance to our control measures, for example, and 'invaders' also cause evolutionary and ecological changes that prove irreversible or indeed positive. Contexts that appear to call for control or eradication may thus instead require managed coexistence. Conciliatory approaches to non-native species address many practical needs, including cultivating replacement services and novel functions, slowing resistance evolution and managing native–nonnative coevolution. Rather than signaling defeat, conciliation biology utilizes the predictive power of evolutionary theory to suggest new ways for managing ecosystems of mixed biogeographic heritage.

Acknowledgements

The success of the Symposium was due to the significant time and efforts of the following people:

Organizers
- Gary Krupnick
- Laurence J. Dorr
- Vicki Funk
- Nancy Khan
- Sue Lutz
- Ari Novy
- Sylvia Orli
- Holly Shimizu
- Warren L. Wagner
- Jun Wen
- Kenneth Wurdack
- Elizabeth Zimmer

Support
- Mary Ann Apicelli
- Patricia Davis
- Bernadette Gibbons

Photographers
- Elaine Haug
- Kenneth Wurdack

And many others who had helped in a myriad number of ways.

Andrea Kramer
Botanic Gardens Conservation International

"Getting Plant Conservation Right: Successes, Challenges, and Opportunities for the Future"

Are we getting plant conservation right? While there is no formula for effective plant conservation, there are key ingredients that include basic information needs, including accurate and accessible species distribution and rarity data, as well as capacity for research, management, education and training to mitigate threats facing rare species. The formula also includes policy and funding to support information and capacity needs. Policymakers and the general public must understand and support the importance of plants and the need for their conservation. Finally, plant conservation efforts must be coordinated to ensure resources and expertise are strategically, efficiently and effectively. Arguably, we are not getting plant conservation 'right', as plants are becoming increasingly rare in the United States and around the world. However, there are some areas where we are doing better than others. Results of numerous nationwide assessments have helped identify strengths as well as opportunities to improve plant conservation in the United States and globally. This presentation will describe the most interesting and relevant results of the Botanical Capacity Assessment Project and the North American Collections Assessment, and will discuss successes and opportunities for improvement in research and conservation application as well as education and outreach.

Dennis Whigham
Smithsonian Environmental Research Center

"North American Orchid Conservation Center – A Continental Scale Public-Private Effort to Establish a Model to Assure the Survival of Native Orchids"

Many orchid species are rare and threatened with extinction and international efforts (e.g. CITES) have focused on the illegal trade of orchids and the conservation of threatened species. No organization in North America focuses on the conservation and restoration of native orchids and no single entity is devoted to educating the public about the evolutionary and ecological importance of orchids. In addition, organizations mandated to identify and protect threatened and endangered orchids rely almost completely on habitat conservation for management. While habitat management is important, ecological attributes of orchids (e.g., obligatory relationships between orchids and fungi) dictate that it alone will not result in successful conservation or restoration. Units within the Smithsonian, with funding from the SI Consortia, joined the U.S. Botanic Garden to launch the North American Orchid Conservation Center (NAOCC). Research, education and outreach will be key components of NAOCC and all elements will have a national focus that will include botanic gardens to serve as hubs for the conservation of orchid biodiversity. NOACC will include continental scale collections of seeds and orchid mycorrhizal fungi for use in research, education, conservation and restoration. This presentation will focus on the ecology of orchids and their fungal partners; with emphasis on the need for a large-scale and multidisciplinary effort if orchid conservation is to be successful. The Smithsonian is in a unique position to lead the NAOCC effort; which will further SI goals of increasing and diffusing knowledge to broader audiences in support of efforts to support biodiveristy conservation.

Stuart Pimm
Duke University

"Most Threatened Plants are in Fragmented Habitats, So What Can We do to Reconnect Them?"

To set priorities for plant conservation we must first ask where the greatest number of known small-ranged species live and then where the estimated 15-20% of species still missing from the taxonomic catalogue live. Using the taxonomically revised data available from Kew, I reassess the Myers' hotspots to quantify formally which areas contain the most endemic species. The results are close, but not identical. I then model the rates of species' descriptions to estimate how incomplete are these areas' species lists. Correcting for missing species, these revised hotspots contain an even larger fraction of threatened species than previously anticipated.

Such efforts provide a strategic overview of conservation priorities. Practical conservation requires downscaling to tactical solutions. I present solutions to two areas — the coastal forests of southeastern Brazil and the Western Andes of Colombia that have exceptional numbers of small-ranged species. For both, the habitats are massively fragmented and what protected areas exist are often isolated. Protected areas "work", in that they retain forest cover and prevent anthropogenic fires that clear forests. Creating reforested connections between protected fragments to create large protected areas is likely the most cost-effective solution for protecting all species. I will discuss two projects from SavingSpecies, www.savingspecies.org that effect such restoration of habitat connectivity.

Chris D. Thomas
University of York, U.K.

"The End of Trying to Re-create the Past"

Environmental changes are so rapid and extensive that it is no longer practical to return most ecosystems to some imagined pre-human past, or even to stop the clock at the present. Accepting that change is inevitable requires a major shift in philosophy within the conservation movement since we have been brought up on the idea that environmental change is, almost by definition, bad. This perspective is ingrained. Once the conceptual switch is made, however, substantial shifts in the relative frequencies of different practical conservation actions become feasible. And they are needed. I will illustrate some of these issues by considering the ecological impacts of climate change and strategies to translocate species outside of their historical geographic ranges to locations where the climate will be suitable for them in future.

Symposium

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continue for many millennia to come – the world will never be the way it was, even in the recent past. Local floristic changes will be severe. Many plant populations might survive a large temperature increase if the rate of dispersal is high relative to the rate of warming. Wing urged that more records of past climate and floristic change are needed with much finer time-resolution.

The next two speakers tackled the subject of invasive species, with very different conclusions. First was Stephen Weller, University of California at Irvine, whose talk was entitled, "Conservation on Oceanic Islands: Interactions between Introduced Ungulates and Invasive Plants." Weller began by explaining why island endemic species are highly susceptible to the threat of invasive species. Hypothesized reasons include that native species are highly susceptible to grazing, unlikely to withstand pathogens, and have an increased palatability. He then shared his experiences using two different conservation approaches: a focus on a particular species, and a study at the community level.

He presented his work with *Schiedea adamantis*, a species that occurs in a single population on Diamond Head Crater in the middle of Honolulu. His interest in this species stems from his work on the population biology and evolution of breeding systems in *Schiedea*—a diverse lineage endemic to the Hawaiian Islands. In the past 15 years he has seen the *S. adamantis* population decline from 267 flowering individuals in 1987 to four flowering plants and 19 smaller plants in 2012. After one unsuccessful restoration attempt, he tried again, transplanting seedlings grown in a greenhouse to a site with remnant native vegetation and a source of water for irrigation. The plants have done well. The next question is whether habitats into which these plants have been placed can sustain a dense enough population.

The first study system at the community level is the dry forest community in the Ka`upulehu Preserve on the island of Hawai`i, which has been invaded by the competitive and fire-promoting fountain grass, *Cenchrus setaceus*. Weller asked whether restored ecosystems are sustainable through natural successional processes and without continued human intervention. After a baseline survey of the preserve to measure change, Weller's team studied the effects of fountain grass removal. They found that the removal of key alien species may have beneficial effects for native species, but they also found the rapid expansion of additional alien species. Weller concluded that the dry forest ecosystem has been altered to the extent that an equilibrium is no longer possible, which will require ongoing preservation efforts. In the second study system, the removal of introduced ungulates in the mesic forest of Mahanaloa Gulch reduced the mortality of both native and alien species, but alien species increased in frequency relative to natives. Ungulate exclusion favored mat-forming alien species that impede germination of native plants. Weller's studies suggest that active restoration is necessary to conserve rare understory native species.

Speaker Stephen Weller describing his work on invasive species on oceanic islands. (Photo by Elaine Haug)

Scott Carroll, Director, Institute for Contemporary Evolution and an ecologist in the Department of Entomology at the University of California at Davis spoke afterwards. Carroll introduced the concept of "Conciliation Biology: The Eco-evolutionary Management of Permanently Invaded Biotic Systems." Conciliation biology is an integrated approach to the management of biological systems that incorporates invasive species by predicting

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Symposium

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and managing the outcomes of dynamic native-nonnative interactions. In this strategy, invasive species that provide benefits should not be eradicated, which contrasts with Weller's study of active restoration.

He began his case by explaining how rapid evolution should be a part of conservation planning, using as examples insects that have adapted to insecticides and plants that have developed resistance to herbicides. Carroll argued that many nonnative organisms are present throughout the world, that these nonnatives often provide services, that eradication of these nonnatives is not a simple fix, and that rapid evolution generated by the native-nonnative interaction offers solutions. He then discussed several case studies of complex consequences of eradication efforts, such as the attempted removal of European rabbits from Australia with the myxoma virus.

Then he described rapid evolutionary assessment programs by speaking about soapberry bugs, which are seed predators on the Neotropical balloon vine, *Cardiospermum grandiflorum* (Sapindaceae). In the past 30 years, the balloon vine has spread throughout eastern Australia, leading to the rapid evolution of beak lengths in soapberry bugs as a response to their exploitation of the introduced sapinds. Immediate eradication of the invasive vine would have diverse unintended consequences on the bugs, since they have adapted to the exotic species. Carroll therefore argues for a focus shift from acute to chronic effects and management, using proactive, experimental, and process-oriented approaches.

The afternoon session began with Andrea Kramer, Executive Director, Botanic Gardens Conservation International and conservation scientist at Chicago Botanic Garden. Her presentation, entitled "Getting Plant Conservation Right: Successes, Challenges, and Opportunities for the Future," provided a comparison of the national framework of the Plant Conservation Alliance (PCA) with the targets set by the Global Strategy for Plant Conservation (GSPC). PCA is an association of ten U.S. federal land-managing agencies and nearly 300 non-government organizations. GSPC is a program of the Convention on Biological Diversity aimed at halting the continuing loss of plant diversity. Both programs are not just about threatened species, she explained, but about building policy, funding, training, research, and infrastructure that will prevent a common species from also becoming rare.

Kramer organized her presentation around eight priorities: species inventory, species distribution data, conservation status of species, plant conservation research and policy (e.g., CITES, Endangered Species Act), in situ conservation, ex situ conservation, and education. With each priority, she presented various challenges and opportunities to overcome those challenges. For instance, limited funding is available to maintain and update the conservation status of plant species; however, an opportunity exists in citizen science and rare plant monitoring. In terms of conservation policy, plants listed under the Endangered Species Act are only protected on federal lands (not private lands), and even though they make up to 60 percent of the species listed, plants only receive 4 percent of federal funding. An opportunity does exist in which 32 states have some level of additional protection for listed plant species.

Kramer concluded her talk by acknowledging the great strides that the U.S. has made in describing the flora, assessing the flora's conservation status, banking seeds, and creating infrastructure for scientific research. She also highlighted the shrinking plant conservation capacity, plant blindness, and a lack of funding that compromises our ability to effectively conserve the country's botanical resources.

Shifting from a U.S. flora focus to that of a single plant family, the next speaker, Dennis Whigham, Senior Botanist at the Smithsonian Environmental Research Center, spoke about the "North American Orchid Conservation Center – A Continental Scale Public-Private Effort to Establish a Model to Assure the Survival of Native Orchids." North American terrestrial orchids pose a problem for conservation, Whigham explained, due to their complex life cycle involving fungi and animals, and their high sensitivity to environmental change. He provided a few examples from Australia of successful terrestrial orchid conservation programs, such as studies on *Caladenia huegelii* and *Drakaea glyptodon*. Yet in North America, very little is known on how to successfully conserve terrestrial native orchids.

Speaker Stuart Pimm discussing ways to reconnect fragmented habitats. (Photo by Elaine Haug)

The challenge is that mycorrhizal fungal partners are important at all life history stages of terrestrial orchids. A successful conservation program for these orchid species will require an understanding of the plant-fungi interaction; however, many fungi species that are necessary for orchid germination and dormancy have never been identified. Whigham argues for a continental-scale conservation effort that focuses on all aspects of orchid ecology to assure the survival of native terrestrial orchids. Using the small-whorled pogonia, *Isotria medeoloides*, as an example, Whigham explained the difficulty in understanding how to germinate the plant, and the threat of climate change leading to a changing distribution.

Then he presented the goals of the North American Orchid Conservation Center (NAOCC), a coalition of organizations dedicated to ensuring the survival of orchids native to the U.S. and Canada. The group's aim is to overcome many of the challenges to conserving terrestrial orchids: protecting natural orchid populations; restoring populations; developing and maintaining national collections of seeds and mychorrhizal fungi; and cultivating native orchids in botanic gardens and arboretums for restoration and education purposes. NAOCC serves as a model for a national and integrated approach to conserving biodiversity. If successful, NAOCC will be the first attempt to assure

the survival of an entire family of plants at a continental scale.

The next speaker, Stuart Pimm, the Doris Duke Chair of Conservation Ecology at the Nicholas School of the Environment at Duke University, spoke about threatened species in fragmented environments. His talk was entitled, "Most Threatened Plants are in Fragmented Habitats, So What Can We do to Reconnect Them?" He began his talk by discussing the big unanswered questions such as "how many plant species are there, where are they located, and what can we do to protect them?" Pimm explained that "missing" undescribed species tend to be rare. Are they in harm's way? Where are they—in the tropics, moist tropics, or hotspots? He explained that in Brazil the greatest numbers of still missing species are not in the Amazon rain forest, but in the heavily impacted coastal Atlantic forest.

If most undescribed species are rare and in places where destruction of tropical biomes are high, then what is the best method to prevent their extinction? Pimm argues for large landscape-scale actions. He showed how the Brazilian coastal forest is riddled with small isolated patches, which typically support fewer species than the larger forests. He then went into a case study about his non-profit organization called SavingSpecies. They purchased land in southeastern Brazil, removed the cattle from the land, and restored the habitat by planting native trees. The cattle pastures that separated the fragments have been restored to reconnect the patches. He concluded by discussing the evidence he found of ecological healing – golden lion tamarins and pumas have been seen moving between previously isolated fragments. The solution to reconnecting these fragments, Pimm urged, is by raising money to pay for reforestation.

The last lecture of the Symposium was delivered by Chris Thomas from the University of York, who spoke about "The End of Trying to Re-create the Past." Thomas began by saying that habitat changes are globally universal—from Europe, where all habitats have been modified, to the New World Tropics, which experienced pre-Columbian shifting cultivation. The traditional logic of conservation biology, explained Thomas, is to protect habitats, manage them traditionally, and recreate by restoring the habitats by referring to past biodiversity. The presence of climate change, however, may force a new strategy. Thomas provided data on the northern movement of British southern species, which have an average northward shift of their range margin of about 20 centimeters per hour (or about 5 meters per day). He showed an example of how the Greenland collared lemming has no overlap between its current distribution and the projected future distribution.

Climate change also complicates management decisions about invasive species. Thomas asked, "when is a species an invader?" He explained that *Rhododendron ponticum*, a species from the Iberian Peninsula, is considered an invasive species in the British Isles. Yet, the fossil record shows that the species occurred in the British Isles 200,000 years ago. If the Iberian subspecies is driven extinct within its current native distribution by climate change, should conservation biologists accept Britain as its future distribution? Thomas states that conservation biologists should change their philosophy from a situation where they want to stop the clock to a new paradigm where they should manage and adapt to the change. He concluded his talk by saying, "defining all change as negative dooms conservation to persistent failure."

After the formal lectures, participants enjoyed a reception and dinner. The reception included a private tour of the exhibit "Orchids of Latin America," featuring orchids from the Smithsonian Gardens Orchid Collection. This exhibit highlighted the importance of orchids in Latin American folklore and cultural traditions, explored how that region is a hotbed for scientific research on orchid biology and evolution, and examined conservation efforts to preserve them and their habitats for future generations. The reception was followed by dinner in the museum's rotunda.

Next year, the Smithsonian Botanical Symposium will explore the topic of biogeography, the study of species across geographic space and through geological time, with an emphasis on patterns, islands, evolution, phylogenetics, endemism, and climate change. The date is set for Thursday, April 24 and Friday, April 25, 2014. Differing from years past, the 2014 symposium will be free to attend, but registration will be required. All are invited to attend.

Opening reception and poster session of the 2013 Smithsonian Botanical Symposium at the United States Botanic Garden. (Photo by Ken Wurdack)

Supplementary Symposium Links on the Web

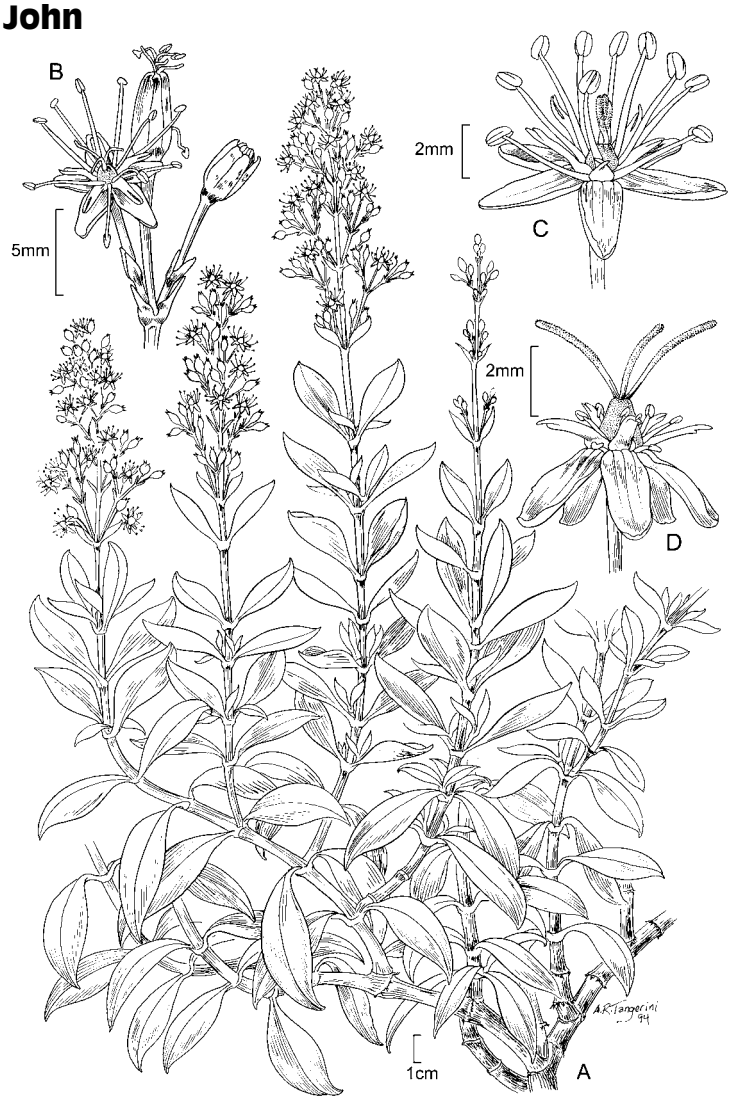
The website to the 11th Smithsonian Botanical Symposium <http://botany.si.edu/events/sbsarchives/sbs2013/> has many links and documents related to the conference. Included on the website is the full program, abstracts of the talks, links related to the speaker's presentations, and selected images from the various events. Additional items related to the Symposium can be added to the list of links and documents by sending an e-mail to sbs@si.edu.

The Symposium archive pages <http://botany.si.edu/events/sbsarchives/> also includes programs, abstracts and images from the past ten symposia: "Linnaean Taxonomy in the 21st Century" (2001); "The Convention on Biological Diversity" (2002); "Botanical Frontiers in Southeast Asia" (2003); "Botanical Progress, Horticultural Innovations, and Cultural Changes" (2004); "The Future of Floras: New Frameworks, New Technologies, New Uses" (2005); "Island Archipelagos: Cauldrons of Evolution" (2006); "Partners in Evolution: Interactions, Adaptations, and Speciation" (2008); "Genes, Genomics and Genome Evolution in Plants" (2009); "Food for Thought: 21st Century Perspectives on Ethnobotany" (2010); and "Transforming 21st Century Comparative Biology using Evolutionary Trees" (2012).

Art by Alice Tangerini

Schiedea adamantis H. St. John

In 1993 Alice Tangerini traveled to University of California at Irvine to illustrate species of *Schiedea* from living material for a monograph of the genus authored by Warren Wagner, Stephen Weller and Ann Sakai (*Systematic Botany Monographs* 72: 1-169; 2005). The Sakai/Weller lab is interested in the evolution of breeding systems in the Hawaiian endemic *Schiedea* (Caryophyllaceae), and they were growing several species in the UC Irvine research greenhouses. A few species were in stages of flowering during the month of September when Tangerini arrived. *Schiedea adamantis*, a critically endangered plant endemic to Diamond Head, Oahu, was one of the species that she drew. The trick was to capture the moment when the stamens had extended but not gone beyond anthesis. This could take place within an hour or less, so Weller monitored the blooming time and brought the potted plants from the greenhouses to Tangerini to draw in the lab. Her sketches from this trip resulted in 34 finished drawings of *Schiedea*.



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