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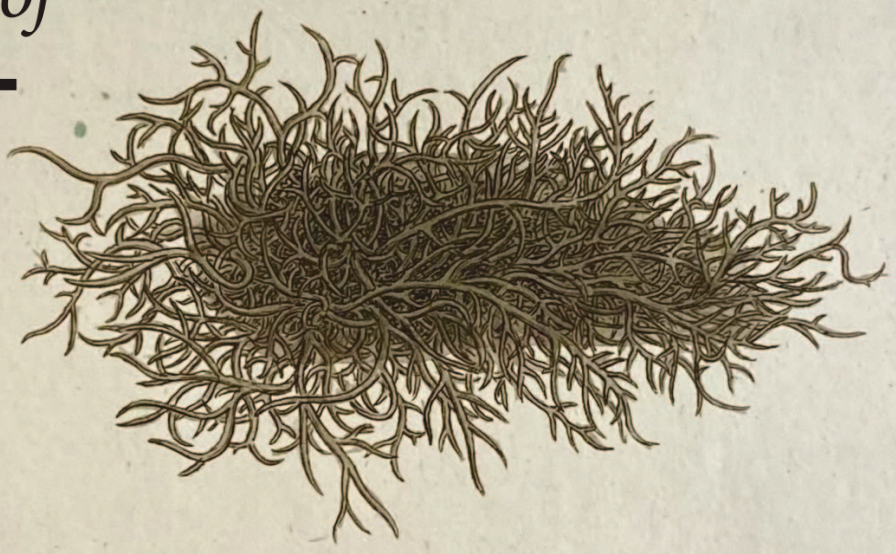
THE PLANT PRESS



Department of Botany & the U.S. National Herbarium

New Series - Vol. 24 - No. 4 October-December 2021

A Sowerby surprise

Specimen digitization project finds original hand-painted engravings

By Julia Beros

They were found within the herbarium case of lichen specimens, following name and geographic order and next to cases of other lichen specimens. Then in a single cubby above and below other cubbies filled neatly by folders with CLADONIA marked on them, were a stack of lichen reference material filed right where it -could likely- belong. As digitizing the vast holdings of the U.S. National Herbarium makes its rounds of the collection, accruing over 3.5 million images, the conveyor project's circumstantial overhaul of the Herbarium's vast holdings has unearthed some one-of-a-kind objects.

Sometimes you discover a stray specimen or two and maybe some out-of-place photo slides or glass plates are apt to get misplaced in the herbarium. Museum Specialist Carol Kelloff recalls the time when Emeritus Curator Harold Robinson accidentally refiled a stack of specimens with his unfinished manuscript at the bottom of the pile—and after finding it much later, he published it, post haste! So it is not unlikely, although still surprising, when a stack of beautifully hand-painted original engravings are found amongst packets of aging lichens. Nearing the final cases of imaging and cuing up the Bryophytes and Algae, the digitization project has just imaged the lichen collection, transcribing the label data for inclusion in the database and to be more easily accessible. Including all parts of the herbarium in this project not only rounds out the database, it gives a clearer picture of our holdings, prioritizing needs amongst the collections, and renewing focus in underutilized parts of the collections. In the lichen cabinets, pages delicately torn from original publications of James Sowerby's engravings are stapled tidily to specimen sheets and annotated with new or confirmed names at the bottom.

The artist James Sowerby (1757–1822), an innate natural-

Continued on page 2

The conveyor belt project is digitizing the U.S. National Herbarium's holdings and has unearthed some one-of-a-kind objects.

A collection of prints, displaying the variety of textures, forms, growth patterns, and colors among Sowerby's lichen representations. The prints were recently found in folders in the lichen cabinets during the digitization process of lichen specimens.

Sowerby

Continued from page 1

ist, studied at the Royal Academy in London and in combining these two passions "decided to be a painter of flowers." He worked first with botanist William Curtis, who helped Sowerby develop a scientific eye which laid the foundation of his career as a scientific illustrator. His first published engravings that he hand-painted were plates in Curtis' *Flora Londinensis*. A prolific illustrator, his work was published in many floras, mineralogy, and zoology books, and his sons, learning the trade from childhood, continued the Sowerby legacy of scientific illustration.

The newly found lichen plates are no exception to Sowerby's talent at capturing the necessary facets and personality of a specimen. Each image delicately outlining the lichen crusts and following the intricate details of these composite organisms often unnoticed as they adorn trees and stones. With an array of growth forms and a color palette that concentrates an entire forest scene, lichens have an enchantment unique to their symbiotic existence. On each page preserved in this collection the embossed rim of the engraving plate is tangible on the paper, lending a beveled frame for each lichen still life, their print series number lightly inscribed in the upper right. The illustrations themselves buoyantly hovering in the center of the page, expertly colored and shadowed, their forms obscured from the forest and showing off their sinuous curves, edges, bumps and ripples, tubes and fruticose straggles of "hair" and folding leaflike waves. While the descriptions and names of these lichens (some publications dating to the late 18th century) have certainly changed and may be obsolete, the illustrations remain illuminating, as their annotations are penciled in a whisper at the bottom corner of the page.

At the very least it was a pleasant surprise to find such lovely engravings, but it also stoked curiosity. Some of the sheets are stamped with "Missouri Botanical Garden" and some have the stamp crossed out, while others are blank. Some are accompanied by the adjoining lichen description page from its original book, others are bare on the sheet. With no outstanding loans from Missouri, it is unlikely that this is part of a forgotten return. Museum Specialist Meghann Toner also points out that at some point the entire Missouri lichen collection was transferred here (the history of which has never quite been elucidated, but probably has something to do with Mason Hale's work). It could have been reference material collected at Missouri that were kept with the specimens and found a new home here. Botany Illustrator Alice Tangerini was also unsure about the story of this particular stack of plates. With a quick search she found many prints from books of Sowerby's lichen engravings being sold (with varying price tags) on art websites, and even potential Sowerby florals at Washington D.C.'s Eastern Market.

Whether for aesthetic or scientific use, Sowerby's illustrations seem to crop up everywhere, as their history and botanical

accuracy make them significant collections. This folio of plates in the herbarium cabinet is invaluable for research and the collections. This past January, Botanical Research Institute of Texas researcher and previous Smithsonian postdoctoral fellow Manuela Dal Forno, with colleagues Robert Lücking, Laurel Kaminsky, Gary B. Perlmutter, and James D. Lawrey published a paper describing a novel (and potentially extinct) species, *Cora timucua*, from historical collections supported by digitization of various herbaria (*The Bryologist* 123: 657-673; 2020). With the recent digitization of the lichen holdings here at the U.S. National Herbarium, hopefully more cross-institutional and historical research can be supported.

Etching of a lichen by James Sowerby, with a species name annotated as "prunastri" and print series number "859" in upper corner, published 1801. The etching was recently found in a folder in the lichen cabinets during the digitization process of lichen specimens.

A find like this is a reminder of how valuable and inspiring our collections are, particularly when collections staff, volunteers, and contractors get bogged down by the many rote tasks necessary to keep an herbarium well-functioning and in safe order. Within each corner of the herbarium the smallest specimen has much to recall from its own history and much to inspire in the line of questioning for researchers. This is far from the only collection of engravings lying in wait. Tangerini tells me she has recently pulled out some plates of *Quercus macrocarpa* illustrated and subsequently translated into stipple engravings by Pierre J. Redouté and Pancrace Bessa, "but there should be many others scattered in the herbarium." Many others ready for rediscovery.

The author thanks Carol Kelloff, Alice Tangerini, and Meghann Toner for their collections sleuthing.

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On the cover: Etching of a lichen by James Sowerby, with a species name annotated as "lanatus" and print series number "846" in the upper corner, published 1801.

Tropical forests in Africa's mountains store more carbon than previously thought – but are disappearing fast

-Adapted from University of York

Scientists studying tropical forests in Africa's mountains were surprised to uncover how much carbon they store, and how fast some of these forests are being cleared. The international study reported in *Nature* (596: 536-542; 2021), found that intact tropical montane forests in Africa store around 150 tons of carbon per hectare. This means that keeping a hectare of forest standing saves CO_2 emissions equivalent to powering 100 homes with electricity for one year.

The study found that African mountain forests store more carbon per unit area than the Amazon rainforest and are similar in structure to lowland forests in Africa. Existing guidelines for African mountain forests – which assume 89 tons of carbon per hectare – greatly underestimate their role in global climate regulation.

The international team, including Smithsonian botanist **David Kenfack**, also investigated how much tropical mountain forest had been lost from the African continent in the past 20 years. They found that 0.8 million hectares have been lost, mostly in the Democratic Republic of the Congo, Uganda, and Ethiopia, emitting over 450 million tons of CO_2 into the atmosphere. If current deforestation rates continue, a further 0.5 million hectares of these forests would be lost by 2030.

Lead author Aida Cuni-Sanchez (University of York) said: "The results are surprising because the climate in mountains would be expected to lead to low carbon forests. The lower temperatures of mountains and the long periods they are covered by clouds should slow tree growth, while strong winds and steep unstable slopes might limit how big trees can get before they fall over and die. But unlike other continents, in Africa we found the same carbon store per unit area in lowland and mountain forests. Contrary to what we expected, large trees remain abundant in mountain forests, and these large trees (defined as having diameters over 70 cm) store a lot of carbon."

Scientists measured 72,000 trees in 44 mountain sites in 12 African countries, from Guinea to Ethiopia, and south to Mozambique. ForestGEO's Ngel Nyaki, Nigeria FDP contributed to the dataset. In each mountain site they established plots where they recorded the diameter, height, and species of every tree.

Researchers said that better knowledge about how much carbon mountain forests store is especially important for the ten African nations where the only tropical forests they have are those found on mountains.

"While we know what makes African forests special, we don't yet know *why* they are different. It is possible that in Africa, the presence of large herbivores such as

Behind-the-scenes video takes you inside the Botany Digitization Conveyor project

A behind-the-scenes video of the Botany Digitization Conveyor project is now available on YouTube at <https://youtu.be/qFpOWYOIb5w> where you can see the conveyor belt in action and hear about the workflows and processes that made the project such a success. After 6 years of digitizing the US National Herbarium, the digitization project is nearly complete. By January 2022, nearly 4 million catalog records of the herbarium's botanical specimens will have been digitized, each with a high-resolution image. All flowering plants and ferns, lichens, bryophytes, and algae will be represented online (see the online collection portal at https://collections.nmnh.si.edu/search/botany/).

The behind-the-scenes video was featured during the "Biodiversity Digitization: A Decade of Success" (Biodiversity Digitization 2021 | iDigBio) virtual conference. Co-sponsored by the National Museum of Natural History (NMNH), iDigBio, and GBiF, the two-day conference held on September 22 and 23 celebrated the collective successes of mobilization and efforts to digitize the world's biodiversity data in the US and abroad. Participation by NMNH staff in the conference included six speakers and four virtual tours of the museum's collections. Over 800 attendees preregistered for this event.

The virtual conference provided both detailed looks at specific work being done in digitization, as well as a broad outlook on the meaning and significance of digitized collections. The themes for the two-day conference were innovations, community, grand challenges, what's next, and looking to the future of digitization.

Other behind-the-scenes tours featured at the conference include those of the Entomology Collection, Molluscs Collection, and Cultural Objects. Each video is part of NMNH's "Natural History for Scientists" YouTube channel.

A behind-the-scenes video of the Botany Digitization Conveyor project features Sylvia Orli and Victor Shields (Picturae) with an introduction by Eric Schuettpelz.

elephants plays an important role in mountain forest ecology, as these large animals disperse seeds and nutrients, and eat small trees creating space for others to grow larger, but this requires further investigation," Cuni-Sanchez added.

Co-author Phil Platts (University of York and the IUCN's Climate Change Specialist Group) said: "About five percent of Africa's tropical mountain forests have been cleared since 2000, and in some countries the rate exceeds 20 percent. Besides their importance for climate regulation, these forests are habitats for many rare and endangered species, and they provide very important water services to millions of people downstream".

Montane forest in Rwanda. (photo by Johan Wingborg)

However, said co-author Smithsonian botanist **David Kenfack**, "with appropriate protection measures in place and with the support of the local communities, montane forest can quickly recover. For example, in Ngel Nyaki, one of the ForestGEO research site in Nigeria, patches of fenced grassland adjacent to the forest showed a significant increase in woody species only after a few years".

Most African nations have committed large amounts of land to forest restoration under the Bonn Challenge. Although forest restoration is important to mitigate climate change, avoiding deforestation is a greater priority.

Co-author Martin Sullivan (Manchester Metropolitan University) added: "Previous carbon estimates for tropical mountain forests in Africa were much lower than the values we report in our study. We hope that these new data will encourage carbon finance mechanisms towards avoided deforestation in tropical mountains. As outlined in the Paris Agreement, reducing tropical deforestation in both lowland and mountain forests must be a priority."

A view of the Ngel Nyaki Forest, a ForestGEO research site in Nigeria. (photo by David Kenfack)

Co-author Gerard Imani (Université Oficielle de Bukavu in DR Congo) added: "Carbon finance mechanisms could help improve conservation interventions on the ground – even within protected areas, deforestation, forest degradation and defaunation remain a challenge."

Biogeography of *Tetrastigma* fleshes out Asia-Australian floristic exchange history

- Adapted from Chinese Academy of Sciences

How did biotic exchange between Asia and Australia occur across the geologically and topographically complex Malesian region in space and time? A new case study published in *Cladistics* has shed light on this question.

Chen Zhiduan's group from the Institute of Botany of the Chinese Academy of Sciences (IBCAS) and international collaborators, including **Jun Wen** from the Smithsonian's National Museum of Natural History, carried out comprehensive biogeographic analyses with intensive taxon sampling of *Tetrastigma* (in the grape family Vitaceae) to illustrate the long attractive pattern of Asia-Australian biotic exchange across the Wallacean region.

As dominant climbers in rainforests and subtropical forests from Asia to Australia, the genus represents an ideal model to address the Asia-Australian floristic exchange pattern.

Previous studies suggested that the convergence of the Sunda and Sahul shelves promoted biotic exchange between Asia and Australia. The geological activity raised substantial islands in between and might act as stepping-stones for dispersal events.

In *Tetrastigma*, the researchers inferred the genus has originated in continental Asia and split from the newly segregated genus *Pseudocayratia* in the early Eocene. Dispersal events might have started in the late Eocene but mainly proceeded in the late Miocene. The timing shows a consistent process of floristic exchange with the terrestrial connections between Asia and Australia.

In addition, this study provides new evidence for asymmetrical floristic exchange between the two regions, a southward-dominated dispersal in *Tetrastigma*. Continental Asia is inferred as the most important source area while the Sunda region serves as the biggest sink. This trend is in line with the previous hypothesis: organisms tend to migrate from a larger species pool to a smaller one.

Following the expansion of wet tropical forests across Wallace's Line and beyond, these findings also suggest that successful colonization is not only determined by dispersal ability but also by habitat preference.

This study provides new clues of floristic exchange between Asia and Australia. With more and more case studies completed, researchers can arrive at a general pattern of the Asia-Australian biotic exchange, and further elucidate the evolutionary and biogeographic processes of biodiversity formation.

The landscape shows specific habits of *Tetrastigma* with most species as dominant climbers in rainforests and subtropical forests from Asia to Australia, as pictured by the larger image of a well-conserved rainforest in Balikpapan, Indonesia. The three smaller images illustrate the colorful and fleshy fruits of *Tetrastigma*, which can attract birds to facilitate their dispersal between Asia and Australia via the Malesian island chains. (image by IBCAS)

STAFF ACTIVITIES

On March 16, **Alice Tangerini** gave a presentation on "Botanical illustration at the National Museum of Natural History" to the Baltimore City Master Gardeners for their first meeting of 2021. The initial request was from Master Gardener and beekeeper, Chris Turett. An audience of 40 plus gardeners attended the virtual Zoom meeting. Tangerini's 40-minute presentation included scenes from the Botany Department and the drawing process including field collection, mounting plants, and curating the collections. The program was well received, and Turett sent Tangerini two jars of his very own harvested honey.

Kazoo Magazine, a subscription magazine, published an article, "Drawing Upon Nature", featuring **Alice Tangerini** and her work as a botanical illustrator at the National Museum of Natural History in its Fall 2021 issue. The magazine, aimed at pre-teen girls, has themed issues; this issue was "The Wild Issue" with nature-oriented topics. The magazine printed Tangerini's illustrations including a color *Globba*, a *Sampera* in graphite, and a sample of inked leaf shapes for a drawing project. The story on her work was based on an interview by the editor, Erin Bried.

One in three tree species face extinction, study finds

Thirty percent of the world's trees are threatened with extinction, according to the new *State of the World's Trees* report at <https://www.bgci.org/our-work/projects-and-case-studies/global-tree-assessment/>. The report, compiling work led by the Global Tree Assessment (GTA) and launched by Botanic Gardens Conservation International (BGCI), is one of the first assessments of the world's threatened trees and is the culmination of five years of research to identify major gaps in tree conservation efforts.

Examining the globe's 60,000 tree species, it reveals that 30% (17,500) of tree species are currently at risk of extinction. That means there are twice the number of threatened tree species globally than threatened mammals, birds, amphibians, and reptiles combined.

The report reveals that globally over 440 tree species are right on the brink of extinction, meaning they have fewer than 50 individuals remaining in the wild. These species are found all over the world, from the Mulanje cedar in Malawi, with only a few remaining individuals on one mountain, to a species of alani (*Melicope balloui*) found only in Hawai'i that has not recently been sighted in the wild.

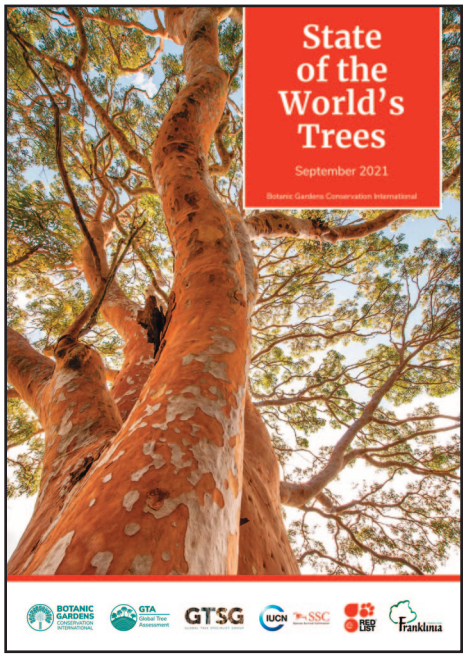
The report finds hope for the future, however, as conservation efforts led by the botanical community worldwide are growing. Identifying which trees are at risk and ensuring these are protected is the most effective way to prevent extinction and restore endangered species. The report reveals that at least 64% of all tree species can be found in at least one protected area, and about 30% can be found in botanic gardens, seed banks, or other *ex situ* collections, but further action is needed.

The *State of the World's Trees* report brings together research from over 60 institutional partners, including botanic gardens, museums, forestry institutions, and universities worldwide, as well as more than 500 experts who have contributed to tree assessments in the last five years. The Department of Botany at Smithsonian's National Museum of Natural History is one institutional partner, and several staff members from the department have served as experts on species assessment reports.

The greatest threats facing trees include habitat loss from agriculture and grazing, followed by over-exploitation from logging and harvesting. Climate change and extreme weather are emerging threats to tree species globally. As the temperature and weather of the world changes, many trees risk losing areas of suitable habitat, in both temperate and tropical regions.

At least 180 tree species are directly threatened by sea level rise and severe weather events. This threat is most severe to island species, including magnolias in the Caribbean. An increased occurrence of fire is a major threat to trees in Madagascar and has also been identified as a risk to US species of oak and *Nothofagus* trees in Australia and South America. Globally, land use change to agriculture alongside increasing global temperatures compounds the risk of fire to many tree species.

Tree species are the backbone of the natural ecosystem. They store 50% of the world's terrestrial carbon and provide a buffer from extreme weather, such hurricanes and tsunamis.



Many threatened tree species provide the habitat and food for millions of other species of birds, mammals, amphibians, reptiles, insects, and microorganisms. The extinction of a single tree species could cause a domino effect, catalysing the loss of many other species.

Despite this, it has often been animals that have received most attention as requiring urgent protection. With a third of tree species on the verge of extinction, the *State of the World's Trees* report hopes to raise awareness of the trees that are equally at risk and require action to prevent extinction.

The report indicates hope for the future if conservation efforts continue and further action is taken. BGCI has launched a new GlobalTree Portal, an online database tracking conservation efforts for trees at a species, country, and global level.

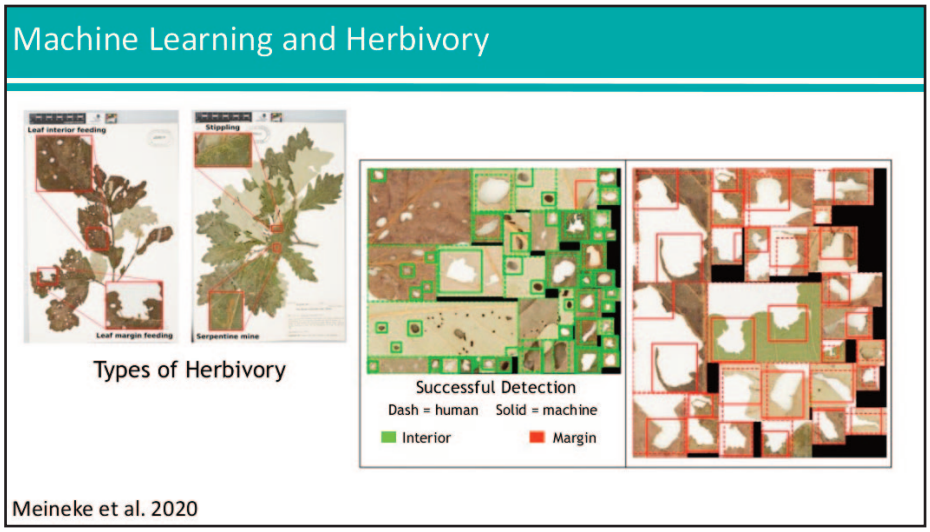
Both the report and portal show for the first time which trees need the most protection, where action is needed most urgently, and most importantly, where the gaps in conservation effort are. Recommended actions include extending protection of habitat for threatened tree species; ensuring threatened tree species, where possible, are conserved in botanic garden and seed bank collections; and expanding native and threatened tree planting programs, amongst others.

Reflections on the Botany 2021 Virtual Meeting

The Botany 2021 meeting (July 19-23) was held virtually for the second year in a row. The virtual meeting was once again a great success as the virtual platform enabled nearly 2,000 participants from 63 countries to attend the meeting. The 2020 virtual Botany meeting ran smoothly, and the 2021 conference built off of last year's success by lowering costs, increasing accessibility, and making available more content on-demand for participants. The low registration fees were great for facilitating access to the conference for undergraduate students and researchers from developing countries, many of whom may not have been able to attend the meeting if it was held on-site. This year, half of the attendees to the conference were students and 10 percent were post-doctoral fellows; the student prices were lowered from last year to optimize accessibility. Botany conference organizers and the participating societies are working together to decide how to include positive aspects of the virtual conference format into future in-person meetings.

Several members of the Botany Department (**Richie Hodel**, **Gabe Johnson**, **Eric Schuettpelz**, **Laurence Skog**, **Alice Tangerini**, **Warren Wagner**, **Jun Wen**, **Ken Wurdack**, and **Liz Zimmer**) participated in the meetings. Additionally, other people associated with the National Museum of Natural History or other Smithsonian research centers participated (Eleinis Avila-Lovera, Rebecca Dikow, Bill DiMichele, Simone Evans, Dalila Lara, Melissa McCormick, Isabella Schrader, Andy Simpson, William Taylor, Mike Trizna, and Eranga Wettewa).

Richie Hodel organized a workshop, "Using deep learning with digitized herbarium specimen image data," with Rebecca Dikow and Mike Trizna (Smithsonian's Office of the Chief Information Officer), Pam Soltis (Florida Museum of Natural History), and Erica Krimmel (iDigBio). The workshop took place on Sunday, July 18 before the main conference program began. The workshop helped participants—ranging from undergraduate students to tenured faculty—get over some of the initial hurdles to executing deep learning analyses using digitized herbarium specimen data in their own research. The workshop ran from 9am-5pm EDT and approximately 50 botanists from around the world participated. Some researchers in Asia joined at 9pm their local time and stayed late into the night, and participants in Hawaii rose early to join at 3am local time. The workshop was conducted using Zoom, Slack, GitHub, and Google Colab. In a post-workshop survey, the majority of participants found the virtual format of the workshop to be very effective or extremely effective.



At a Botany 2021 workshop, Richie Hodel shared a slide showing an example of using deep learning with digitized herbarium specimens. Hodel demonstrated the range of possibilities of machine learning applications. In this example, Meineke et al. (2020; DOI: 10.1002/aps3.11369) trained an insect damage detector model to automate the extraction of herbivory data from herbarium specimens.

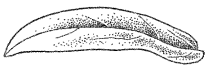
Next year, the Botany 2022 conference will be held in Anchorage, Alaska from July 24-27. Until then, recorded talks from Botany 2021 will be available to watch on-demand for registered participants in the conference.

A virtual summer experience for natural history interns

Natural History Research Experiences (NHRE) was a Research Experience for Undergraduates site at the National Museum of Natural History sponsored by the National Science Foundation (NSF). Each summer (2010-2021) NHRE welcomed approximately15-18 exceptional undergraduate students from around the United States to the museum for a 10-week-long research project guided by an NMNH scientist. NMNH curators Liz Cottrell (Mineral Sciences) and Gene Hunt (Paleobiology) co-Directed NHRE.

This year, NHRE intern **Isabella Schrader** worked with Rebecca Dikow, Mike Trizna, and **Alex White** (Smithsonian's Office of the Chief Information Officer), Paul Frandsen and Ashlyn Powell (Brigham Young University), as well as Botany's **Eric Schuettpelz**, on a project called, "Using machine learning tools to quantify mercuric chloride staining across digitized herbarium specimens." The goal of the project was to update a machine learning model that identifies mercuric chloride staining on digitized herbarium sheets and apply it to all digitized species housed at the U.S. National Herbarium.

Schrader presented her results at a NHRE virtual research symposium held for Smithsonian staff on August 5, 2021. All 14 NHRE interns presented their e-posters using the Gather.Town app, a platform that allows participants to move and interact freely within a virtual space using an avatar. The symposium was well-attended by NMNH staff, associates, and volunteers.



A summer of grape escapes: A field work photo journal

Jun Wen recently completed two 'Grape Escapes'—one collecting trip to the southeast United States (August 30 – September 10, 2021) with **Sue Lutz**, and the other collecting trip to Texas and western Louisiana (September 19-28, 2021) with her long-time collaborator Stefanie Ickert-Bond (University of Alaska, Fairbanks). Wen and her colleagues made important collections and observations throughout the southeast (especially South Carolina, Florida, Alabama, and Kentucky), as well as Texas and western Louisiana, targeting grapevines (*Vitis*, Vitaceae), hickories (*Carya*, Juglandaceae), and rattlebox (*Crotalaria*, Fabaceae).

While in Texas, Wen and Ickert-Bond visited the John Fairey Garden near Hempstead. Having a unique artistic design by its founder John Fairey, the Garden is a hidden treasure with extraordinary collections from Mexico. The collecting team enjoyed getting to know the Garden via an introduction from botanist Adam Black via FaceBook. The team was given a tour by Executive Director Randy Twaddle and horticultural botanist Wally Wilkins.

The two trips were among many recent grape escapes that Wen had led, setting a foundation to wrap up the taxonomic revision of North American grapes. The studies of *Carya* and *Crotalaria* are collaborative work with colleagues at the Food and Drug Administration (FDA) for DNA-based species identification assay development.

Jun Wen and Stefanie Ickert-Bond.

Wen and her colleagues found the field work hard but also fun and productive, doing what they love to do and to better document these economically important plant species. The targeted field work has led to the discovery of several key variations of the economically important plant lineages that are not preserved in herbarium collections. The summer collections have filled in many gaps of the current knowledge on grapes and hickories, demonstrating that the discovery phase of biodiversity science is far from over. Wen and her associates and collaborators will soon start to analyze the collections using genomic and morphological tools to try to better understand the evolutionary patterns and processes of the grape and hickory species. They will also integrate the evidence from herbarium work, field studies, and cutting-edge phylogenomic analyses to revise the taxonomy of both of these economically important plant groups.

Continued on page 10

Top left: In a private floodplain forest owned by Mr. Greg Grant, a citizen who strives to conserve very important forests, Grant helps collect black hickory, *Carya texana*. There were five species of hickories in this one forest in eastern Texas.

Middle left: Sue Lutz collecting *Carya floridana* in Central Florida.

Bottom left: Nutmeg hickory in eastern Texas.

Top right: Jun Wen collecting *Vitis aestivalis*.

Bottom right: Stefanie Ickert-Bond collecting *Vitis berlandieri*. Native grapes from this area played an important role in saving the French grape industry from phylloxera (an insect pest of commercial grapevines), thanks to the efforts by the great viticulturalist T.V. Munson.

(All photos by J. Wen and S. Ickert-Bond)

Top left: The easternmost population of *Vitis arizonica*, just north of Rocksprings, north of Del Rio, Texas.

Top right: Wen at work in her hotel room pressing, recording, and placing DNA samples into silica gel.

Right: Wen and Ickert-Bond tour and collect in the John Fairey Garden near Hempstead, Texas, with horticultural botanist Wally Wilkins. (photo by Randy Twaddle)

Bottom right: *Vitis berlandieri* in its full glory on Grape Creek Road in Grape Creek, Texas.

Bottom left: The collecting team dug up a few roots and saplings of grapevine species to grow at the Smithsonian Botany Research Greenhouses. They mailed them back to Washington, DC in FedEx boxes.

(*All photos by J. Wen and S. Ickert-Bond, unless otherwise noted.*)

Spotlight Interview: ForestGEO's David Kenfack

***David Kenfack** has been involved with the Forest Global Earth Observatory (ForestGEO) network since 1996 when he began as Field Manager for the Korup, Cameroon Forest Dynamics Plot (FDP). Since 2010 he has been coordinating the ForestGEO Africa Program, and he is currently a co-Principal Investigator of the Korup (Cameroon), Mpala (Kenya), and Ngel Nyaki (Nigeria) FDPs. In 2020 he was elected as a Fellow of the African Academy of Sciences. Kenfack's office is located in the Department of Botany of the Smithsonian's National Museum of Natural History in Washington, DC. When he's not discovering and describing new species, he enjoys playing drums and guitar, as well as promoting his traditional culture through Lemou Bafou USA.*

David Kenfack studying *Grewia* flowers at Mpala Forest Dynamics Plot.

When did you realize you wanted to be a scientist/work in forest ecology? How did you decide to go down this career path?

I grew up in Bafou, one of the most prosperous villages located in the highlands of the western region of Cameroon. As the son of hardworking farmers, I spent most of my childhood practicing mixed farming in coffee plantations, pruning trees that made live hedges on our properties, and extracting raffia palm wine from the stems of the swampy valley's monodominant *Raphia hookeri*. I was therefore very close to nature early in my life, and by the time that I completed high school and moved to the University of Yaoundé, I could easily name most of what remained of the plant and animal diversity in my village. With this background, I didn't hesitate to choose biology over other disciplines at the university. After my BSc in botany, I carried out a botanical inventory of a small hill in the vicinity of Yaoundé for my "Maitrise Ès Science" and later worked on the revision of the genus *Striga* for my "Doctorat 3ème Cycle." Pursuing a career in forest ecology and botany, therefore, became obvious for me, not only because it involved being close to nature, but also lots of travel, another one of my passions.

What led you down the path to your current job? What has been your biggest challenge in getting to this point in your career?

The short answer will be "luck". A few months after graduation from the University of Yaoundé, I got a position with the Wildlife Conservation Society (WCS) in Yaoundé to carry out botanical inventories in southeast Cameroon. Unfortunately, only two months later, the entire program closed because of a disagreement with the government of Cameroon, and I was jobless.

In the process of closing the program, my boss advised me to accompany a consultant named Duncan W. Thomas (currently one of the PI's of the Korup plot) to carry out a biodiversity assessment of the Tchabal Mbabo in northern Cameroon. I accepted the offer and spent three weeks collecting and documenting the flora of this beautiful mountain. What I didn't know was that this was in fact an interview. Prior to our departure from Yaoundé, the consultant informed my (WCS) boss that he was looking into recruiting a young biologist for a long-term monitoring program in Korup National Park. When we returned to Yaoundé, Dr. Thomas told me about the 50-ha plot program, and a few months later, in August 1996, I was recruited as Field Manager of the Korup Forest Dynamics Plot.

After completion of the first census of the plot, I took on the positions of Herbarium Curator at the Limbe Botanical Garden, and then, later, Botanist at WWF-Cameroon, while still managing the KFDP field program and attending CTFS [Center for Tropical for Forest Science, now ForestGEO] workshops.

In 2002, I obtained a scholarship for my PhD at the University of Missouri – St. Louis, and later a postdoctoral fellowship at the University of Michigan. Throughout this time I continued to be involved with CTFS and the KFDP. In 2010, I officially joined the network as postdoctoral fellow and CTFS Africa Program Coordinator, based at the Harvard University. In 2012 I became a STRI Staff Scientist.

What is the most interesting or unique aspect of your site?

I'm currently co-PI in three of the five African plots: Korup, Mpala, and Ngel Nyaki. The Korup plot is the wettest plot of the network, as it receives over 5000 mm, is located in a refuge forest, and the flora is comprised of many endemics and sub-endemics. The Mpala plot, of course, is the largest plot of the network (120 ha) and is so far the only one in a woody savanna ecosystem, spanning three soil types with different vegetations. The Ngel Nyaki plot, with the Indian Cave and the Niobrara plots in Nebraska, are the only three plots of the network that investigate the dynamics along the forest-grassland boundary.

What questions are you currently addressing in your research/site?

The particulars of each site dictate unique questions that they are equipped to answer. For example, at Korup we examine

how trees interact with lianas, while at Ngel Nyaki we look at the edge dynamics between the core forest and the grassland, and at Mpala we study the ways in which large herbivores influence tree architecture and mortality. Of course, discovering and describing new plant species remains one of our main priorities.

What kind of capacity building opportunities does your site provide for students, early-career researchers, and the local community?

In all our sites, about 80% of the field crews are always recruited from local communities who, by far, are always the primary beneficiaries of the program. They are trained in ForestGEO standard census methods, but more importantly, in plant identification, skills that often allow them to pick up even better jobs between the censuses. Our censuses also involve a few high school graduates. Most of them end up studying biology in local universities, and the census provides them with good fieldwork experience even before their coursework begins. Our partnership with local universities has also allowed several graduate students to conduct their master's and PhD theses in our plots. Finally, we facilitate the use of the plot by international and other local independent researchers who desire to carryout research in our plots, providing them with field assistants and field training.

What is your favorite part about your work?

My job involves so many activities that I enjoy almost equally. However, there is nothing that provides me with more joy than being in the field, interacting with the field crews, and identifying trees. With my background in plant taxonomy, I love to be in hyper-diverse forests with challenging taxonomic groups because I know that at the end of the tunnel, I often end up discovering new species (e.g., *Rhaptopetalum rabiense* Kenfack & Nguema, detailed in *PhytoKeys* 128: 39-46).

What do you like to do when you're not studying forest dynamics?

Although I'm not particularly good with any instruments, I like playing guitar and drums. As vice president of Lemou Bafou USA, I spend lots of time promoting our culture and teaching our traditional dances to the Bafou community in the Washington, DC area.

NEW FACES


José Medina Vega


David Wickell

José Anibal Medina Vega is a postdoctoral fellow with ForestGEO and NGEE–Tropics working to develop a pantropical analysis of nutrient controls and their impact on tropical tree recruitment, growth, and mortality. He began his fellowship in August 2021. His office is located in the Department of Botany at the National Museum of Natural History. Medina Vega received his B.S. at Pan-American School of Agriculture, Zamorano in Honduras and his M.S. and Ph.D. in Forest and Nature Conservation at Wageningen University in the Netherlands. Prior to coming to ForestGEO, he had a postdoctoral fellowship in Stefan Schnitzer's lab at Marquette University in Wisconsin. Medina Vega collected the data for his doctoral dissertation using canopy cranes of the Smithsonian Tropical Research Institute (STRI) in Panama from 2015 to 2017.

His current fellowship is to develop a pantropical analysis of nutrient controls on lowland tropical forest structure and functional composition. This analysis will be synthesized into a suite of model testbed sites used to evaluate and benchmark model nutrient cycle representations. Medina Vega will use long-term ForestGEO data coupled with recent detailed soil surveys. For his future research, Medina Vega would like to advance the current knowledge of the mechanisms that regulate the dynamics of natural ecosystems, particularly in the tropical forest biome, by incorporating the study of largely ignored life forms, such as lianas and/or palms, to the already more advanced tree research. He aims to investigate their associations and interactions within each other and with the biome. His hope is that his work can provide a more complete understanding of the dynamics of tropical forest systems.

David Wickell is conducting a 10-week graduate student fellowship in the Department of Botany during the fall of 2021. He is working with **Liz Zimmer** using genomic methods to elucidate the evolutionary history of allopolyploid speciation in the genus *Isoetes*. During his time at the Smithsonian Wickell hopes to use *Isoetes* as a window into how polyploid lineages form and persist within the range of their well-established diploid parents. In addition to his research into polyploidy, Wickell studies the convergent evolution of CAM photosynthesis in *Isoetes* as part of his doctoral research in Fay-Wei Li's laboratory at Cornell University. Prior to starting his PhD, he studied asexual biogeography of apomictic ferns with James Beck at Wichita State University where he received his Master's degree in Biology. Wickell's current research interests include fern and lycophyte phylogenetics and niche evolution in nascent polyploids.

Botany grieves the loss of two cherished plant mounting volunteers

Rosalie "Roz" Elliott, age 76, a beloved plant mounting volunteer from New York, passed away on August 9, 2021. Elliott had been battling several health issues since 2018. She had to take a break from volunteering, and members of the Botany Department were hoping to see her back in the specimen preparation room when she regained her health. Tragically she was unable to recover from her complications. Botany is deeply saddened to lose such a wonderful, sweet, and cheery person who always had a warm smile and charming story to share. She lived every day to the fullest and she loved quilting and, most of all, her granddaughter and family. Elliott was always scouring the gift shop for her granddaughter and she loved showing off the treasures she had found. Elliott was a talented quilter; she was always eager to share her knowledge about sewing. One time Elliott took Melinda Peters, former Plant Mounter Supervisor, under her wing and offered one-on-one sewing instructions at her home. She was so generous with her time and knowledge. She will be deeply missed, and Botany will always cherish her sweet demeanor and kind spirit.

Kathleen "Kathy" Ann Kowalczyk, age 74, a beloved plant mounting volunteer from Chicago, passed away on August 3, 2021. The best way to describe Kowalczyk in one word would be a "firecracker"! Kowalczyk was a force to be reckoned with. She was boisterous, outspoken, and fierce. She was very passionate about her family, crafts, and politics. Kowalczyk loved to learn about everything under the sun, from history and art, to sports and science. She was a big fan of Carl Linnaeus; so much so, she made a special binder dedicated to interesting facts about him. Kowalczyk loved sports and she especially loved the sports teams from DC and Chicago. Kowalczyk was the life of the party, she always found a reason to celebrate no matter how large or small the achievement. She always remembered everyone's birthdays and during the holidays she would pass out little special handmade gifts. Kowalczyk was everyone's mom. She could be often overheard offering advice, usually unsolicited, but she would tell you exactly how she saw things—whether you liked what she had to say or not. She always stood firm on her positions and if you didn't agree with her, she would listen but never waver from her standpoint. The Botany Department will especially miss her spunky and fiery spirit, but we will continue to celebrate life's little achievements because that is what she would want us to do in her memory.

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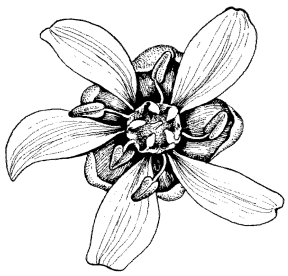
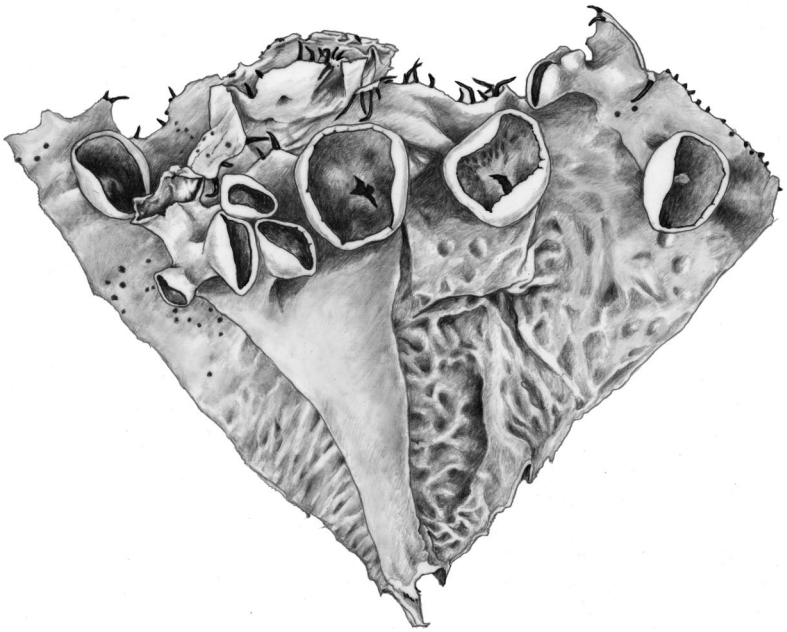


ART BY ALICE TANGERINI

Lecanora sp.



Alice Tangerini drew this graphite on film drawing of a lichen, *Lecanora* sp., for Mason Hale in November 1977. Her use of the polymer pencils started by following Jack Schroeder's drawings of lichens and Eupatoriae in the early 1970s. Most of Tangerini's original lichen drawings for Hale's *How to Know the Lichens*, a Pictured Key Nature Series (Wm. C. Brown Company Publishers, 1979) have been missing since publication. *Lecanora* sp. was supposed to have been described as a new species but was never published. Mason delivered the *Lecanora* specimen to Tangerini in a petri dish with no collection data provided. His instructions on drawing the lichen thallus were "to make it look exactly like the specimen" and "do not try to reconstruct it". The hope was that the drawing could be matched in the future with a digital image of the specimen. Wading through hundreds of undescribed digital images of lichens, however, might be a chore for another specialist.

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