

Botany News #3 - July 28, 2020

California Academy of Sciences



Ah! The Good Ole Days...Deb and Lindsay wearing matching shirts to work (and no masks!) -E. Magnaghi

Hello to our volunteers,

We have had some changes to the department over the past two months, but we are busy at home and in the field working on various botanical projects as you'll see in this newsletter. We sent our dedicated Collections Manager and the Director of Collections, Deb Trock, off with a virtual farewell for her retirement. We miss Susan Dalcamo as one of our Curatorial Assistants, but lucky for us she will be returning as a volunteer; right now she is having a great time enjoying the Sierra so probably doesn't miss work too much!

We hope you enjoy our third newsletter, and we hope you are all keeping well and busy.

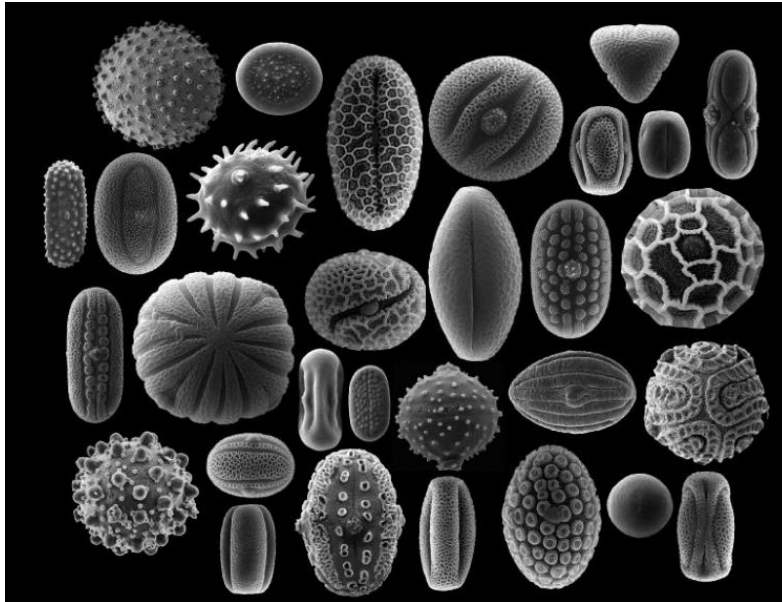
With our best wishes from the Botany Department

Shrimp Plants Have Cool Pollen!

Tom Daniel

The family of flowering plants that has been the focus of my research for the past 40 years is the large (> 4,000 species) and mostly tropical Acanthaceae or Shrimp Plant Family. In addition to its great diversity of growth forms, flower shapes and colors, and habitats, one of the most fascinating aspects of the family is its pollen. Although very small (varying from about the size of the point of a straight pin to a little larger than the head of that pin) pollen of Acanthaceae is more diverse than that of any other family. This diversity often correlates with taxonomic units within the family (e.g., subfamilies, tribes, genera, species), which makes observations of pollen important for all species studied. In some genera, all of the species have very similar pollen; in others, several different types of pollen are encountered. Pollen of most species and several genera of Acanthaceae have yet to be studied. That means that every time I remove some pollen from an herbarium specimen to look at it with the Academy's scanning electron microscope (SEM), I may see something entirely different from anything seen before. That has happened several times during my sessions in the SEM lab. In the photographic plate below,

the pollen grain at the upper right (with an almost figure-eight pattern of apertures) has a sculptural configuration I encountered that was not previously known in the family (or probably anywhere else among pollen of flowering plants). Based on subsequent molecular studies of this plant, it was determined to be a genus new to science, and the pollen is one of its more distinctive characteristics. In a [2019 publication](#), we described it as *Champluviera*, a new genus from Africa that we named for one of our colleagues who studies African Acanthaceae.



Sample of some of the diverse pollen types encountered in the plant family Acanthaceae. Images taken from pollen derived from herbarium specimens and observed/photographed in the Academy's scanning electron microscope laboratory.

An obvious question is: why does this tremendous diversity of pollen in a single family of plants exist? In spite of more than one Ph.D. dissertation that has attempted to address reasons for variation in pollen among plants, the answer is that we don't know. Among Acanthaceae, the different types of pollen do not correlate with known pollinators. For example, the large round grain below pollen of *Champluviera* in the plate characterizes virtually all ca. 250 species of the genus *Ruellia*, including species pollinated by flies, bees, hummingbirds, and bats. There is also no correlation of pollen types with floral form, geography, or habitats. For whatever reason, the shapes, number and types of apertures, and sculpturing patterns of the surface vary, and that variation largely corresponds with taxonomic units (at various levels of classification) in the Acanthaceae. If you have any ideas as to what might account for the diversity of pollen forms seen here, I would be interested to hear them.

Because virtually all species of Acanthaceae either self-pollinate or have animal-mediated transfer of pollen from one flower to another, acanthaceous pollen is neither airborne nor known to cause allergies. What it does have is an artistic beauty and scientific utility for those of us fortunate enough to observe it with scanning electron microscopy.

This beautiful plate of a very small sampling of variation among acanthaceous pollen was assembled by the Botany Department's former administrative assistant, Charlotte Pfeiffer. I gave her the individual images from my work in the SEM lab and asked her to try to make a nice collage. She exceeded my expectations!

The Importance of Mosses

Wen Zhang Ma

Greetings from Kunming, China, where we have just produced a [short video](#) as an introduction to mosses. You'll see beautiful landscapes of mossy regions in China, and explanations of how we collect and study mosses.

More Congratulations to Maia

Nathalie Nagalingum

Undergraduate Maia Jones was recently awarded the [Undergraduate Research Prize](#) from the American Society of Plant Taxonomists. She was given this award for her senior thesis on the conservation of an Endangered Australian cycad *Cycas candida* using genomic DNA data. The award will be given to her at a virtual dinner during the virtual [Botany 2020 conference](#). We also recently submitted her thesis to a conservation journal for publication. Congratulations Maia!



Cycas candida from Queensland, Australia.

Summer bryophyte collecting in California

Jim Shevock

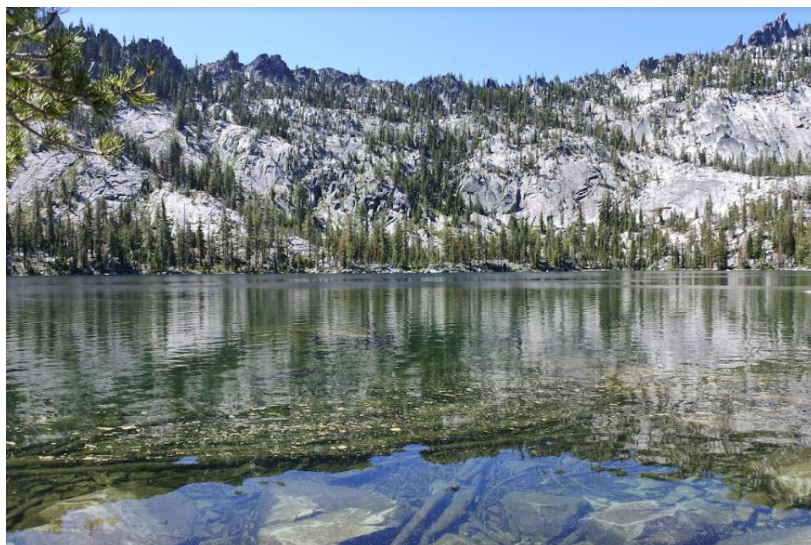
Due to the covid-19 pandemic, this is the first year since 2002 that I will not conduct an international expedition. Basically, summers for me have meant being in China, Taiwan, or the Philippines! So this year, I have mentally prepared to stay close to home, and with this realization, identify areas of California where I could explore and still feel like I was on an expedition with the goal of new bryophyte discoveries. Much of California remains to be surveyed for bryophytes and even for vascular plants, many new discoveries are possible. There are many large areas and mountainous terrain of the state where there have not been a single bryophyte collection made. Ditto for vascular plants too. Why this has occurred boils down to easy access.

There are dozens of square miles throughout California without a single road. While we were in shelter in place mode, I thought about all of the places I could venture as soon as I was permitted to leave the house. Botanical collecting permits were secured for several of the National Forests. I have always done some basic collecting in California every year, but I

decided to concentrate my efforts in some of the most remote areas with a focus on subalpine areas that form the headwaters of the two major northern California river systems: The Klamath and the Sacramento. So the majority of the trips I have taken so far since June have been to Siskiyou County. It is a long drive. From my home to the town of Weed just north of Mt. Shasta (along Interstate 5), the drive takes 5 hours and then to get into some of the more remote areas in the national forest within Siskiyou County takes another 2-3 hours. Siskiyou County is huge. So for these collecting trips you need 3+ days to make it work efficiently. My goal for each trip is to make at least 100 bryophyte collections, and where possible, gather up extra material for exchange. (I have also done one trip so far to the subalpine areas of the central Sierra Nevada about Sonora Pass.)

A large part of Siskiyou County is public land within the Klamath National Forest (NF). This is a really rugged mountainous landscape. For me, the established Wilderness Areas offer the greatest opportunity to discover exciting bryophytes while exploring the most scenic portions of California. Wilderness Areas are congressionally designated landscapes where no mechanized or motorized means of access are permitted. The Wilderness Act was established in 1964 and since that time, many areas have been designated as Wilderness Areas across California under federal law. The two largest wilderness areas in California are the John Muir Wilderness along the crest of the Sierra Nevada, and the Trinity Alps within Trinity, Shasta, and Siskiyou counties. One either rides a horse or hikes into wilderness areas.

Most wilderness areas are rugged mountainous terrain and generally have the highest elevations because there were no priorities to build roads into such areas or extract timber, and they have remained without road access. It was just too difficult or not economically viable to do so. So, most wilderness areas are the back 40 of national forests and national parks. On the Klamath National Forest, most trailheads into wilderness areas are accessed off of dirt roads, but nearly all of them can be accessed via passenger car but one has to go slow and ensure you do not bottom out on exposed rocks in the roadbed. Part of Siskiyou County is also within the Shasta-Trinity National Forest and a small portion of the Siskiyou and Rogue River National Forests from Oregon venture into northernmost California. Mt. Shasta, an ancient volcano at over 14,000 feet is the highest point in northern California. So within Siskiyou County the Wilderness Areas include the Russian, Mt. Shasta, Marble Mountains, and parts of the Siskiyou, Castle Crags, Red Buttes and the Trinity Alps Wilderness.



Big Duck Lake

Here at CAS, we have a limited number of herbarium specimens obtained from Wilderness Areas. Most botanists do what we call 'roadside botany'. If one plots the collections in the herbarium on a map, it basically displays the highway and road system! It takes a lot more effort to explore areas like Wilderness Areas. At 70, my backpacking days into Wilderness Areas are long over, so I need to either arrange for a multi-day collecting trip where mules carry in all of the gear (food, tent, collecting supplies etc.) or I do day hikes into the wilderness. So this summer I have been doing car-camping and then conducting day hikes from established trailheads into the wilderness, although I must admit there are many areas of wilderness like the large Trinity Alps and Marble Mountains where one cannot access by conducting a day hike. I can do no more at my age now than about a 10 mile round trip hike (only 5 miles in) and still have time to make collections. These are generally steep trails too. One day-hike I did in the Trinity Alps back in June took me 11 hours. A bit amazing that I can still do this! Of course Advil helps a lot.

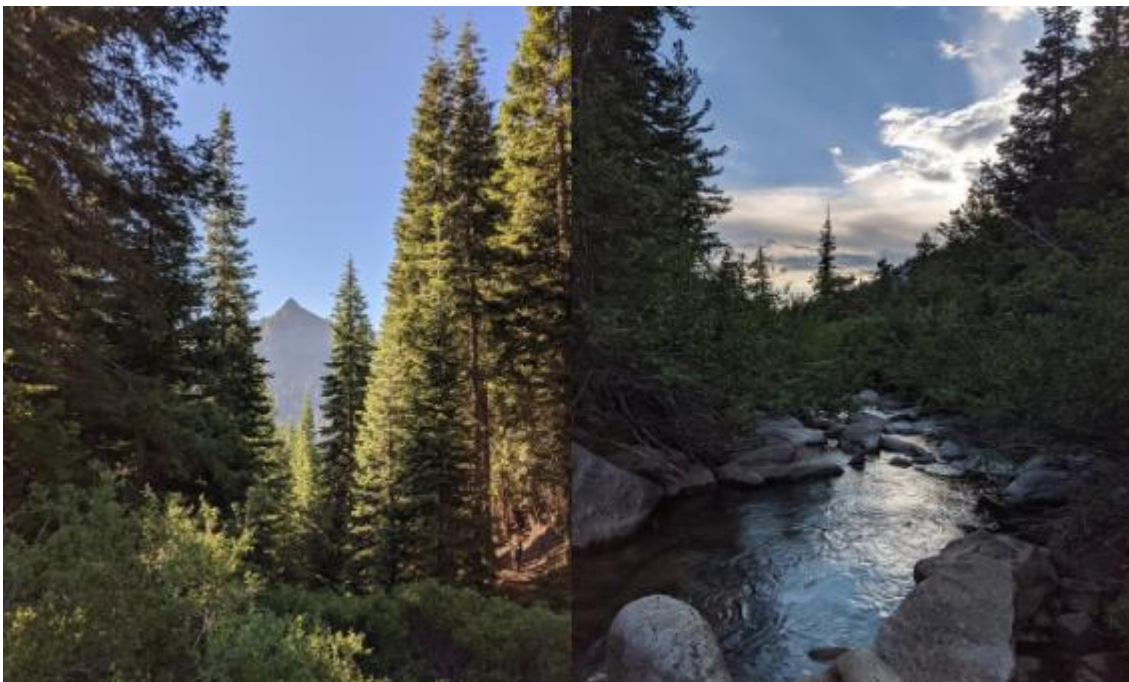
Emily and her husband Dave joined me for two of these recent adventures. We did a couple of hikes together into the Trinity Alps and one very long day hike into the Russian Wilderness. This was fantastic scenery with alpine lakes and still patches of snow about rocky crags well into July. The hike up to Duck and Little Duck Lakes in the Russian Wilderness was particularly spectacular. The forest floor was covered in flowers with lots of the lily *Clintonia uniflora* and several species of *Lewisia*, and slopes were covered of members of the family Ericaceae (the blueberry family) dominated by shrubs of *Vaccinium*, *Ledum*, *Phyllodoce* and *Leucothoe*. Manzanita, one of California's most common shrubs is in this family too.



Foxtail pine and view from the ridge above Little Duck Lake

One of the botanical highlights of this area is the realization that within a 1.5 square mile area of the Duck Lakes area is reported to be the greatest concentration of conifer species in the world. Here with a bit of effort one can see 17 different conifers during a single hike! Some of these

conifers are quite rare in California where this is their southernmost occurrence along the Pacific Slope of North America. The bryophyte collecting was wonderful too. This hike to Little Duck Lake yielded 50 bryophyte collections. It is a lot of work to explore wilderness areas but the collections are well worth it. One never knows what species will be encountered on a particular trail. For bryophytes, it all boils down to how many different microhabitats occur along the route, what type of geology and size of rock outcrops and rock walls exist and of course riparian areas as cascading streams. It really is hard to predict just looking at a topographic map what one will discover but all of these collections add markedly to our understanding of species distributions. Some bryophyte species that I thought were exceedingly rare in California based on the samples available in the herbarium are now becoming more common based on these recent hikes. In this case, these species prefer to be in more rugged and remote environments so they have simply been overlooked due to a lack of exploration and collection. I have also collected species that I've never seen in the field previously, so this too adds to the excitement of discovery and exploration.



L to R: An "Alp" in the Trinity Alps Wilderness Area; Deadman Creek at sunset - Stanislaus National Forest

Of course since the closure of CAS, I do not have access to my 'botany bee' seniors group who a few times a year get-together in the conference room to fold field-collecting packets for various expeditions. I go through a few thousand field packets each year. Among the members of the bryophyte cadre, Alice has been the champion of keeping all of us supplied with the various sized packets we use for accessioning cryptogam collections and most recently, Alice has folded 2,000 field collecting packets for my immediate use. Thanks Alice!

The most recent trip with Emily was to the Stanislaus and Toiyabe National Forests about the crest of the Sierra Nevada in the vicinity of Sonora Pass. We car-camped along Deadman Creek, a tributary to what becomes the Middle Fork of the Stanislaus River about 4 miles west of Sonora Pass. Car-camping is great because you can bring plenty of bottles of wine and/or beer, cheese and a lot more desirable foods and snacks than the typical freeze dried stuff when one has to carry it on your back, as well as all of your camping equipment while backpacking. The Sierran Crest forms the boundary of Tuolumne and Mono counties, and the eastern side of

the crest forms the boundary with the Toiyabe National Forest, and this area has a considerably more Great Basin-type vegetation with sagebrush due to being in the rain shadow whereas most of the snow and precipitation falls on the western slopes of the Sierra Nevada. The higher elevations contain subalpine coniferous forests primarily of lodgepole pine, white bark pine and spectacularly large and stunning western junipers with its distinctive reddish-brown shaggy-like appearing bark. The geology, as seen in the photo with the waterfall, is volcanic whereas the majority of the Sierra Nevada is granitic. It's easy to recognize these rock types by their rock color. Granitic rocks are white to white-grey whereas volcanic rocks are generally brown to reddish-brown. The soils are very different too.



L to R: A view toward the Sierran Crest south of Sonora Pass, Mono County. Looking into the Leavitt Lake area with the Pacific Crest Trail along the distant ridgeline; Jim heading upstream.

One of our day trips with Emily was to collect plants along the 4WD road to Leavitt Lake. In this basin is the type (original) locality for what was then called *Orthotrichum spjutii* that has now been transferred into a segregate genus named *Lewinskya*. Anyway, this species was reported to have been collected from cliffs of a waterfall. As we walked up the road for nearly a mile we came across a small stream and since there were plenty of flowering plants along the stream we decided this was a good place to do some general collecting. I decided to explore farther upstream to find more rocky areas where rheophytes (aquatic plants) could occur.

Shortly afterwards I could see that there was a waterfall up the canyon. Could this be the type locality for *Lewinskya spjutii*? As I continued to climb up the canyon I could see bryophytes covering the canyon walls. It was rather unstable with loose rocks and gravel, but I continued toward the waterfall. It was in a small bowl-like area with a smaller vertical fall below it, so it took a bit of scrambling along a steep hillside. I finally got onto a wet mossy slope adjacent to the waterfall and slowly climbed down holding on to willow branches as I made my way to the base of the falls.

It was moss heaven. All of the rocks in the spray zone of the waterfall were covered in mosses. After making several collections influenced by the waterfall I looked up on the cliffs above me and saw more mosses that needed to be investigated. It was a bit scary climbing up the slope and onto the cliffs, but there it was... vertical walls of mosses in the genus *Lewinskya*. This has to be where the type specimen was collected decades earlier. Now CAS has a sample of *Lewinskya spjutii*. As I was making this collection, a thunder shower began and now I had wet

rocks to deal with that made the descent off of the cliffs a bit more challenging. By the time I returned back down the stream where Emily was collecting and pressing plants this short thunder shower had passed. It was another great day in the field.

So I am making the best of the situation this year with covid-19 since all of my 2020 international expeditions have been cancelled. While I miss the exotic nature of collecting bryophytes in Asia where they are completely different from those we have in North America, it has nonetheless been great to get out into the forests and explore. I look forward to my next collecting trip and hike into the Trinity Alps, Russian, and Marble Mountain wilderness areas.

“Baling Hay” in Siskiyou County

Emily Magnaghi

The term “baling hay” for collecting plant specimens has a mysterious origin. If anyone has any ideas on this, please let me know. I’m guessing it’s related to the look of a full plant press with stems and blades sticking out of it that relates to the look of a hay bale. A couple of google searches turned up what I expected -- actual hay baling practices. Our resident bryologist, research associate and fellow, Jim Shevock, had been urging me to start “baling some hay!” last fall and I finally made it out to the field with him over the 4th of July weekend.

A tributary stream of Leavitt Creek with waterfall over volcanic vertical walls. Note the mossy rock slab off to the left side where the conifer branch crosses the image. The *Lewinskya spjutii* was collected on cliff faces just to the left and off of this image but you can get a sense of the difficulty to collect on the cliff face.





Jim and Emily on the trail

We trekked up to the northern border of the state, near the Oregon state line, to Siskiyou County and the Russian and Trinity Alps Wilderness Areas. I made 74 collections over three days and we logged about 22 miles on the trails. We visited Little Duck Lake and the vicinity in the Russian Wilderness on day one. This area is also known by some as the Miracle Mile referring to its diversity of 17 conifer species found within a square mile! My husband, Dave, went on a quest to see all of them during our botanizing and he found 16 -- so close! We didn't finish the hike until about 7 pm and were back at camp at 8 pm for some down time.



Little Duck Lake

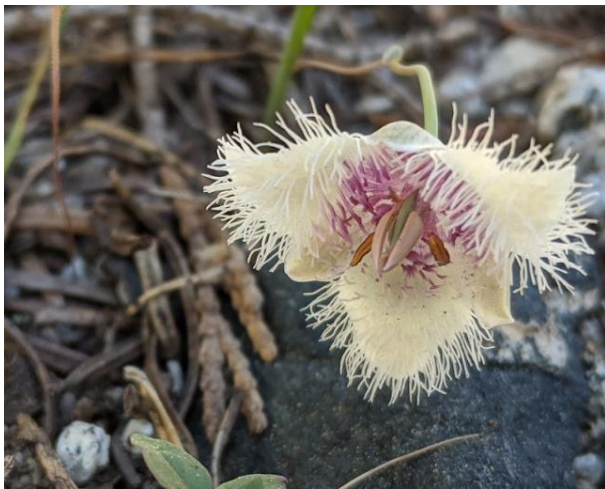
The next day we had a much shorter hike up a trail to Fish Lake in the Trinity Alps Wilderness. This was a misnomer, however, as the lake was actually full of tadpoles and not fish. The trail is

not well used by humans, but there was plenty of bear scat in the area so they are taking advantage of the coronavirus shutdown. We didn't see another single hiker all day, except luckily, Dave happened to run into Jim's bryo colleague, Jason Brooks, while scouting a route to the lake. We had planned on meeting Jason before the hike but missed him and considering the roughness of the trail system there, we could have missed him completely.

After the bryo team wandered off and Dave scaled the cliffs to reach the top of the ridge and the vista from above, I was on my own in bear country without a whistle or spray, hoping they would just fear me and my giant backpack and stay away. I kicked every pile of scat I saw, to see if it was fresh, and luckily they were all dried out. It was a pretty gorgeous area to camp out and collect plants in. One of the bears had nearly squashed some *Ipomopsis aggregata*, scarlet gilia or sky rocket, so I took advantage and stuck them in my press. I was able to find enough of a beautiful purple-blue *Delphinium* (larkspur) to make a few collections. I also collected my first *Calochortus*, *C. tolmiei*, Tolmie's star-tulip or pussyears. CAS doesn't have many specimens from this area so everything I got will be a nice addition to the collection, not to mention the additional collections that will go to other herbaria such as Rancho Santa Ana/California Botanic Garden.



L to R: Thimbleberries - *Rubus parviflorus*; Nuttall's larkspur - *Delphinium nuttallianum*



L and R: Tolmie's star-tulip - *Calochortus tolmiei*



L to R: Pacific bleeding hearts with bumblebee - *Dicentra formosa*; Weeping spruce - *Picea breweri*

Day three brought the adventure to a close and we finished with what Dave and I thought was the best hike of the trip. We followed the Pacific Crest Trail to a split up to the South Fork Lakes in a cirque near the top of a ridge. There were seeps in the rock ledges along the switchbacks, which hosted orchids, Bishop's caps, monkshood, sedges and many mosses. It was beautiful but steep! Jim and I nearly stopped to start collecting but couldn't resist the urge to see the lakes at the top so we kept our resident billy goat, Dave, who seemed to have boundless energy. It was well worth it as the lakes were gorgeous and fairly warm for swimming. We saw a very interesting *Phacelia* on the way up so I had to collect some on the way out. These plants were about a meter tall with up to 20 stems on some of them. Jim has never seen anything like it and neither have I, so I collected extra specimens to send to experts for identification in case it's not in the Jepson Manual.



Leopard lily - *Lilium pardalinum*



L to R: Dave, Jim and Jason (l-r) investigating a seep with albino monkshood; The albino monkshood are just above the leopard lilies in the center, purple monkshood are on the front left, closer to the bottom of the shot



South Fork Lake - Trinity Alps Wilderness

The time seemed to fly by and we were hustling out to get back to the Bay Area by night. I didn't have enough time to collect everything I saw, so there's something for next time. We may venture back to Siskiyou County later in the summer so stay tuned!

Wildflower Safari to the Cape Province of South Africa

Frank Almeda

One benefit of spending so much time at home during the past four months is that I have been able to make good on one of my New Year's resolutions to label images from many of the field and pleasure trips I have taken during the past decade. Before the availability of digital cameras I would take several hundred images on every trip, whether it was a botanical field trip or a pleasure trip. Now when I go on a trip I take thousands of images which means that I have hours and hours of work culling, identifying, and labeling the choice images from each trip.

During the past few months I have labeled images from trips to the western U.S, Costa Rica, Ecuador, and Sri Lanka, and I am now working on a long trip that we did to Southern Africa in September and October of 2015. Our pleasure trips have always involved birding and botanizing so there is a definite natural history theme to every trip we do.

Mary Beth and I first went to South Africa and Namibia in September of 1985 long before these countries were popular tourist destinations. We were guests of the late George E. Lindsay, a longtime Executive Director of the California Academy of Sciences who was trained as a botanist and traveled extensively with his wife Gerry. The 1985 trip was a wonderful experience since Mary Beth and I had never been to the African continent before. George told us that the wildflower displays on our 1985 trip were disappointing; he had seen some spectacular wildflower displays in South Africa on previous trips in the early 1980s. Despite the fact that we saw no dazzling wildflower displays in 1985 we saw many interesting plants and animals that were new to us, so we were still happy campers as they say. We were enthralled by the diversity and beauty of the South African flora and fauna, and the majestic coastal and mountain landscapes throughout the country.

Mary Beth and I always told ourselves that we would return to South Africa and Namibia again someday so before my formal retirement in late 2014 we began planning a trip to South Africa 30 years after our first trip in 1985. Our 2015 trip took us to the western Cape Province of South Africa for the wildflowers but we had no idea whether it would be a special year for the wildflowers. To our surprise and delight it turned out to be the first stunning wildflower year they had had in over 10 years! You will undoubtedly recognize some of the plant images in the attached powerpoint link below because many South African species are prized cultivated ornamentals in the Bay Area and in other parts of coastal California.

We also traveled to Namib Desert safari camps in western Namibia, the Okavango Delta region in northern Botswana, and ended the trip at Victoria Falls on the Zimbabwe/Zambia border. We were joined by friends De and Henry Mally, Phyllis Faber, and Diane Renshaw.

I have now finished labeling all the South African images from the 2015 trip so I have [assembled a downloadable powerpoint/PDF](#) highlighting some of the areas and wildflowers we saw. I have also included just a few animals. The fauna will constitute another future powerpoint that I am calling Wildlife Safari to Southern Africa. That will happen once I get the remaining three thousand images culled and labeled.

Hello, I'm Rose

Rose De Guzman

It has recently come to my attention that I never got to meet most of our lovely Botany volunteers. So I thought I should virtually introduce myself to all of you. I am the new Curatorial Assistant and I started the week right before we all went into Shelter in Place. I know, perfect timing!

My past work mostly involved birds. I worked in various places up and down California doing field work. My favorite field experience, though, was being able to work in Australia studying Red-backed Fairywrens.

I came to the Academy as a volunteer about four years ago in the Geology Department. After two years, I was hired as a Research Assistant working mostly on digitizing and organizing invertebrate specimen data. I now split my time working as a Research Assistant for Geology and as a Curatorial Assistant in Botany. I love being able to work with the variety of specimens from both departments and I am continually learning so much. Venturing outside of my bird comfort zone has been exciting. I always had such an appreciation for plants, more specifically flowers (I mean, my name is Rose afterall!). I look forward to learning and growing in this role with all of you.



L to R: Here's a photo of me about 10 years ago banding a male Red-backed Fairywren in Australia; Image from eBird (<https://ebird.org/species/rebfai1>) of a male Red-backed Fairywren.

The world's most endangered group: cycad mini-class

Nathalie Nagalingum

In my [latest breakfast club talk](#), I introduce you to cycads, which are iconic, palm-like plants that coexisted with dinosaurs and that are today considered the most endangered organism on Earth (even more so than corals or any species in the Animal Kingdom). You'll learn about these ancient plant wonders—threatened by poaching and land conversion across their native

range in Australia, Africa, Asia, Central America, and Mexico—and explain how, though my research, I work to help save them.

For past and upcoming breakfast club mini-classes on the Academy's [website](#). There are panel discussions on coral reefs, lectures about the critters in your home and so much more.



Nathalie with an “Extinct in the Wild” cycad at Kirstenbosch National Botanical Garden, Cape Town, South Africa.