UPCOMING EVENTS!

Sat. April 7  Jasper Ridge field trip
Sat. April 21  Picnic Day Herbarium and Conservatory open houses
Sun. April 29  Arboretum/Conservatory Plant Sale
Thurs. May 3  Spring Meeting and Speaker, Judy Jernstedt will speak on “Stalking the wild Welwitschia”
Sat. July 14  Bliss State Park field trip
A year and a half ago (Lasthenia number 46), we published an article by Marcel Rejmanek on the effects of the Wragg Fire on Stebbins Cold Canyon (one year post-fire). We asked Jeffrey Clary, Director of Stebbins Cold Canyon Reserve and Associate Director of the UC Davis Natural Reserve System, to follow up on Marcel’s article and let our readers know how the canyon is recovering. Jeffrey is currently president-elect of the Davis Botanical Society. More information on Stebbins Cold Canyon can be found at naturalreserves.ucdavis.edu.

After multiple years of historic drought and searing temperatures, the Stebbins Cold Canyon Reserve and the surrounding landscape went up in flames in July of 2015. A roadside vehicular fire quickly leapt from Highway 128 up to the thick chaparral vegetation covering the west side of the Blue Ridge. Within minutes, flames reached and enveloped the UC Davis reserve.

The fire was ferociously intense, especially along the upper slopes of the Blue Ridge, the hikers’ destination for panoramic views of the Coast Range and Lake Berryessa.

Given the intensity of the fire and the extremely low reserve of moisture in the soils, the pathway to recovery and revegetation was uncertain. How many of the trees and shrubs in the fire zone were truly dead? Which ones would successfully resprout and reseed? Would invasive species gain a new foothold in the area?

Two and a half years have elapsed since the fire, meaning we are in the midst of the third growing season of the recovery. Each year, the vegetation has been starkly different from the year before. The goal of this article is to track some of the big picture changes that we have observed.

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CONSERVATORY (cont. from page 1)

The Darwin orchid. Photo: E. Sandoval

with the Darwin moth (Xanthopan morganii), using a life-size photo of the moth. This was done as part of one of six exercises that students present to each other during their visit to the Conservatory. We had enough flowers in the fall for all 15 groups to do this!

This past fall, just after the last Lasthenia newsletter went to press, we successfully rooted three Amborella trichopoda cuttings! These are very sought-after plants for systematics research into the ancestral lineages of flowering plants (as well as courses teaching these concepts). Amborella is quite slow to root, and the cuttings took nearly nine months to grow their roots. Is this slow rate of growth perhaps due to Amborella’s adaptation to the low light and cool understory of its habitat in New Caledonia?

As reported in the previous Lasthenia, the mother plant, a female, is now growing quite well in Room A of the Conservatory, so we’ll take many more cuttings this spring in hopes of having enough specimens to guarantee live plants positioned at the base of the angiosperms branch on the Tree of Life demonstration for BIS 2C, where students literally stand amongst the branches of an evolutionary tree of plants. Ernesto took the opportunity this past fall to take some high quality macro photographs of the flowers, now available to educators.

We’re also literally paving the paths for increased capacity of the Botanical Conservatory to provide live plant materials, in this case for BIS 2B lab 1, where students perform rapid biodiversity assessments in one of several “habitats.” This February, the Biological Orchard and Gardens (the BOG), north of the Mann lab building, finally saw the installation of curved concrete paths. The site will provide a real-world opportunity for students to conduct quadrats and/or transects in field-like conditions relatively close to the Sciences Lab Building (SLB). The students will perform their measurements in one of three plots containing South African, Californian, or Mediterranean plants. When possible they will use these plots instead of the three small sampling beds on the east side of the Sciences Laboratory Building, which were first planted in 2008.

Other habitats used by BIS 2B include: the epiphyte walls in the SLB greenhouse, as well as small planters with carnivorous plants, succulents, or shade plants, Fowling plates brought in by 2B staff from Bodega Bay, and an assortment of terrariums and aquariums. These five sets of “habitats” make it possible for up to five concurrent labs to have 24 students performing measurements in six smaller teams of four to get a very good idea of what it takes to sample diversity.

This spring and summer we’ll be installing the irrigation at the BOG, and immediately afterward plants will be put in of all sorts and sizes, some moved from the smaller SLB planting beds, to be ready for fall quarter’s five concurrent labs. The BOG project was started in 2012 and, thanks to a variety of recent donations, BIS 2B lab fees, and endowment funds, we’ve been able to fund this major expansion.

Also thanks to the same funding sources, we’ve made a major transition this past year away from pesticide use on popular plants in the Conservatory such as cacao (aka the chocolate tree, Theobroma cacao) as well as coffee (Cof-}

The cacao plant. Photo: E. Sandoval

fe arabica). Marlene Simon, staff horticulturalist, has facilitated the transition on these and a number of other plants with the result that when our department chair brought multiple classes for Conservatory tours earlier this quarter, we were able to harvest cacao pods (the fruit of Theobroma cacao) and allow these tourists to sample the sweet and tart pulp around the seeds. If they were so inclined, we felt at ease in encouraging them to sample the bitterness that a Central American monkey would experience if it were to nibble on the actual seed. To be able to harvest the cacao fruit, we must hand-pollinate the chocolate tree, and thanks to a number of interns and volunteers we have had a steady supply of fruit for the past three years. But only now can we confidently allow its consumption.

The transition to biological pest control, predatory insects that either consume or parasitize pest insects such as aphids, mealy bugs, and mites, has been made possible by funding sources that are vital to the continuation of the Botanical Conservatory. The Conservatory has continued to fulfill and expand our mission to provide as much live plant material for UC Davis and beyond by expanding outdoors (the greenhouses have both environmental and physical restrictions). This is all made possible through our connection to our users and continued generous donations that support our efforts. We, the staff of the Botanical Conservatory, are the caretakers of this wonderful assortment of plants that we have the pleasure of sharing in a multitude of ways, and we are thankful for your help in realizing these ever-growing goals.

E. Sandoval

Ernesto Sandoval with rooted Amborella cutting. Photo: S. Sumrall

Theobroma cacao (aka the chocolate tree). Photo: E. Sandoval
Thank you for your support!

RECENT GIFTS

Herbarium Endowment
Beth Lowe Corbin
Joseph & Susan DiTomaso
Lewis Feldman
Brenda Grewell & Stephen Kidner
Joseph Lin
Sue Nichol
Stephen & Jill Rae
Robert & Thomas Rhode
Craig Thomsen
J. Giles Waines (in memory of B. Webster)

Herbarium Gifts in Kind
Barbara Crampton
Johanna Kwan & Kevin Hague
Marylou and Robert Powell
Marcel Rejmanek

Herbarium Operations
Allyson Ayalon
Dylan Burge
Amy Hiss
Johanna Kwan & Kevin Hague
Katherine Mawdsley
Jack Maze
Jean & Scott Shepard
Shirley Tucker
Chris Walden

Conservatory Endowment
Gerald Dickinson
Stephen & Jill Rae

Conservatory Operations
Carmichael Cactus & Succulent Society
Jade Neely
Reynotta Hoberecht
San Francisco Succulent & Cactus Society

Conservatory Gifts in Kind
Ian Baker
John Brittnercher
Fred Gaumer
Chuck Powell
Barry Rice
Kyle Shankle

Davis Botanical Society
Student Grants Fund
Gerald Dickinson
Brenda Grewell & Stephen Kidner
Emily Griswold
Susan Harrison
Stephen & Jill Rae

Jack Major Student Grant Fund
Anonymous
Mary Hektner

LAW FAMILY ENDOWMENT SCHOLARSHIP STUDENTS

We once again have the opportunity to give out undergraduate scholarships to students who have been involved with the Center for Plant Diversity herbarium. The scholarships are funded by the Law Family Endowment, established by Dr. E. Eric Grissell (see Lasthenia Vol. 41, 2014). This spring we are recognizing three students.

We are awarding the first scholarship to senior Mai Xiong, who is mentioned in this issue in our article on the Hmong plants exhibit. Mai, a Sociology major, first came to the herbarium as a student plant mounter. She then helped curate our Hmong plant collection and was instrumental in making our January 2018 Herbarium Tea/Hmong Plants Exhibit a successful outreach event. Mai helped plan the event, made signage, cooked wonderful food, and did outreach to the Hmong community to make sure that they knew about the exhibit. She is an incredibly organized individual, and I very much appreciated her hard work.

Our second scholarship is being awarded to senior Evolution and Ecology major, Lahari Indraganti. Lahari began volunteering at the herbarium last year as a Junior transfer student. She has volunteered as a specimen filer, taken both the herbarium internship and the plant collection internship, and helped us at numerous outreach events. She is currently working on a senior research project on jewel flowers (Streptanthus) with a graduate student mentor in Evolution and Ecology. Lahari is a joy to work with and always enthusiastic about plants.

Our third scholarship is being awarded to Matthew Conner, a sophomore Plant Sciences major. Matthew wandered into the herbarium as a freshman and began working as a volunteer filer (often with Lahari). Although he was too early in his academic career to receive credit, he joined the herbarium internship this past fall and the plant collection internship last spring. Along with Lahari, Matthew sat in on my one-day introduction to keying workshop last spring, and he has since been teaching himself how to key cultivated plants using both the Jepson Manual and Bailey’s Manual of Cultivated Plants. He is also helping me measure Lycianthes specimens in preparation for writing species treatments. I really appreciate his help with this tedious work! Congratulations, all!

E. Dean

Mai Xiong (left) at the herbarium tea with Leng Yang and Johnny Moua. Photo: E. Dean

Lahari Indraganti at Picnic Day 2017, Photo: E. Dean

Matthew Conner (left) with fellow intern Emily Hernandez. Photo: E. Dean
Dylan Burge, an alum of UC Davis, is a biodiversity consultant based in northern California. He has done taxonomic work on several important native California genera and has donated many interesting specimens to our herbarium. He would like to thank Graciela Hinshaw (Bureau of Land Management) for her work in funding and administering the research described in this article, Landon Eldredge for assistance with bee collection and identification, and Robbin Thorp for assistance with bee identification.

The importance of native bees

More than 80% of the world's plant species depend on insects for pollination, making insect pollinators critical to the health of ecosystems around the world. Insect pollination is crucial for the success of many crops that human society depends on, for example almond, apple, tomato, squash, and more than 120 others. The services provided to humans by insect pollinators are valued at more than 200 billion dollars annually, worldwide.

Despite the value of these organisms, little is known about pollinator diversity around the world, including ecological conditions that maintain healthy pollinator populations. In addition, some recent research suggests that populations of many pollinator species, especially native bees, are in steep decline, likely a consequence of pesticide use, climate change, and introduced parasites. The decline of the bees is particularly worrying, as these insects are the primary agent of pollination among flowering plants, including the crops that are the foundation of human life. Given their importance to humans and the environment, the steep decline of native bees has triggered a surge in scientific and public attention, leading to new research and insights on native bees.

Native bees are different from honeybees

Many readers have probably heard about the problems that are facing honeybees around the world. Honey is produced by the western honeybee, a domesticated species that originated in eastern Africa, but was domesticated by humans thousands of years ago and is presently found world-wide. This domesticated species is suffering from a number of devastating diseases and disorders, most of them linked to parasites (mainly mites) and over-use of pesticides by humans. While honeybees are definitely in trouble, their problems pale in comparison to the plight of the world's roughly 20,000 species of native bees, which are declining in diversity and abundance worldwide, likely due to the same factors that are injuring honeybees. Scientists are hard at work solving the problems facing honeybees, but much less attention is being given to native bees.

How native bees make a living

Native bees are almost all solitary. In contrast, honeybees are colonial, with many workers all serving a single queen, working together to raise hundreds of young and lay in provisions of honey so that the hive can survive the winter. In fact, the term “busy bee” applies better to our native nectar hunters than it does to domesticated honeybees; a solitary bee must construct its own nest (often digging several feet into the ground), collect pollen and nectar to provision the nest, and then lay eggs that will turn into next year’s bees. A solitary bee might visit as many as 300 flowers to provision a single egg, flying several kilometers per day to do so, and then working all night long in its nest. The food that a solitary bee provides to its young is in the form of “bee bread,” a mixture of pollen and nectar that is allowed to ferment, releasing amino acids, sugars, fats, and vitamins (as well as alcohol) that are needed by the growing bee. The adult bee, on the other hand, survives on only nectar.

Native bees of the Pine Hill gabbro

I am currently studying the relationship between native plants and pollinators in the Pine Hill area of El Dorado County. The Pine Hill area supports a unique, hyper-diverse assemblage of plants (more than 10% of California’s native flora is found here), several of them endemic to the region. Hyperdiversity in this area is associated with outcrops of gabbro rock. Soils derived from gabbro are unique, with low nutrient levels and high iron and magnesium content, similar in some ways to serpentine soils. They are thought to exert a very strong influence on plant ecology and evolution, supporting unusually high levels of diversity, as well as five rare plant taxa, all of which are considered endangered at the state or federal level. Supported by the BLM Pine Hill Preserve, I am studying bee species that pollinate plants on the Pine Hill gabbro.
with the goal of identifying ecological factors that predict highly diverse and robust native bee communities.

In the past year and a half, I have collected native bees at 20 sites around the Pine Hill Preserve, using hand nets as well as a diversity of traps that are out all year, ensuring that a large cross-section of native bee diversity is captured for later analysis. Captured bees are preserved dried on pins and identified. Although the number of bee species foraging at a site on a given day might be as low as six or seven, each species of bee has a unique phenology—a special time of year when it flies. Thus, over the course of the year, hundreds of bee species are able to co-exist by focusing on the types of flowers that bloom while they are foraging. On the Pine Hill gabbro, bees fly long into the summer, as many native plants bloom much later on gabbro than they do on adjacent soils. This research will continue for at least two more years, with one year dedicated to bee collecting, and another to writing. Overall, the results of this work will aid in preservation of bee diversity in the Pine Hill Preserve and in other parts of California by providing data on how plant diversity influences pollinators.

What you can do for native bees

While it may seem that native bee decline is inevitable, given the many challenges that these species face, as well as the lack of knowledge of basic aspects of bee ecology, there is still hope for native bees. Part of the solution to native bee decline will come from major changes to the way that humans tend their crops, which is tied to public awareness of how crops are grown. As a consumer, you can choose organic fruits and vegetables, which are grown without the use of the pesticides that are known to kill native bees. If you are a gardener, you can also help native bees by planting flowers that provide the nectar and pollen that bees need. Those who are interested in native plant gardening to support native bees should consult the recommendations of the Xerces Society, a non-profit that focuses on bee conservation.

D. Burge

HEDGEROWS AND NATIVE POLLINATORS

Over the past 10 years, the staff of the UC Davis Center for Plant Diversity have assisted with plant identification for numerous hedgerow research projects. Our current Davis Botanical Society Board President, Neal Williams, has written this article on the importance of hedgerows to California pollinators.

California’s native flora plays a fundamental role in supporting natural ecosystems. This same native flora is playing a novel role as a central element of strategies to help diversify agricultural landscapes and support pollinators and pollination in California.

Native pollinators, especially bees and butterflies, have grabbed the attention of the public as well as scientists around the world. These insects play an important role in sustaining populations of native plants across California, but they also contribute pollination service to agriculture. Intensive agricultural landscapes that blanket many parts of California are not only denuded of their native plant diversity, but offer unpredictable and insufficient resources to sustain many of our native pollinators. A leading strategy to mitigate these threats is to plant hedgerows and wildflower borders within agricultural lands.

Hedgerow and wildflower plantings benefit pollinators and, with informed plant choices, also support native plant diversity. These plantings aren’t quite natural communities because they bring together species that would rarely occur side by side, but nonetheless come from the same floristic province. Because plant materials can be sourced from local ecotypes, they offer novel ways to promote California’s flora and a diversity of bees, butterflies, and other pollinators.

Native forbs and shrubs are a good choice for building pollinator plantings because they are often well adapted to regional soils and are highly drought tolerant. These characteristics increase the probability of successful establishment. Native plants can be drawn from a wide palette of colors, flowering phenology, flower traits, and sometimes even pollinator visitation that can be used to help design plant mixes. With such information in hand, researchers can work with NGOs, native plant nurseries, and seed producers to source plant materials and then partner with farmers, land managers, and regional Resource Conservation Districts to install habitats.

Information collected by researchers at UC Davis and UC Berkeley documents striking increases in the diversity of pollinator species supported by such plantings. In one study of wildflower borders along crop fields, 47 different native bee species were collected, over 6 times the number found in other parts of the landscape. Hedgerows also support rare species and those with specialized habitat needs over time.

Pollinator plantings are implemented following principles of plant restoration and a series of streamlined, though perhaps not always easy, steps. Solarization uses the sun’s energy to kill invasive weeds prior to planting the seed mix. Mechanized drop seeders speed the work of sowing large plantings.

Much of the effort to date has explored the use of native plants and plantings in agricultural landscapes. Native plants also offer options for urban landscaping, where they can support diverse pollinators and provide amazing displays for humans as well.

N. Williams
A landmark year, with plants in many areas growing taller than a person! These weeds served the useful role of temporarily hedging in the trails and keeping hikers from straying cross-country, as is tempting when natural barriers are removed by wildfires.

Year 2 – Winter/Spring 2017

The second post-fire season featured near-record high amounts of rainfall, and the canyon responded with lush carpets of green. Unfortunately, much of the lush green was the result of non-native species taking advantage of the favorable conditions.

In particular, Italian thistle (Cirsium pynocephalus) grew thick and tall along the trails and across great expanses of still-open chaparral areas. The annual grasses had another great year. Yellow starthistle (Centaura solstitialis) reappeared in some natural areas, and super-sized purple starthistle (Centaurea calcitrapa) showed up around the parking lots - our steward and his volunteer crews hand-removed those prickly monsters.

Through the sea of weeds, native trees and shrubs began to make themselves visible again, as resprouts and seedlings took hold.

Year 3 – Winter/Spring 2018

So far this year (as of February 23rd), limited rainfall has kept weed growth stunted. Italian thistle looks like it will be far less common, and many wild oats plants are starting to mature and flower at just a few inches tall. Whether March rainfall will be enough to favor new waves of weeds remains to be seen, but it seems like they always find a way.

In this context, the regrowth of native trees and shrubs is much more visible. Seemingly every skeleton of live oak (Quercus wislizeni), chamise (Adenostoma fasciculatum) and toyon (Heteromeles arbutifolia) has a vigorous tangle of regrowth, now beginning to completely shade out neighboring understory weeds. Glossy new seedlings of buck brush (Ceanothus cuneatus) are also pushing skywards.

It is clear that these native woody plants intend to reclaim the territory temporarily lost to the understory weeds. Because of this natural process of shading out light-hungry non-natives, we are holding off on most intensive weed control efforts, focusing instead on any new arrivals (such as the purple starthistle).

It is also apparent that after just three growing seasons, there is enough biomass at Stebbins Cold Canyon to carry a new wildfire, should we have the misfortune to have another one break out in the area.

I encourage everyone to take advantage of the mild spring conditions to visit the canyon and see fire recovery in action. Happy trails!

J. Clary

Biodiversity Day 2018 was a Big Success!

Biodiversity Museum Day started at UC Davis in 2013 with six campus natural history museums, including the Center for Plant Diversity Herbarium and the Conservatory. This event was designed to allow the public, students, staff and faculty to visit our great collections, many of which are not regularly open to the public. This year, thirteen museums and collections participated in the event. There was a lot of positive feedback from all of the participants, including the Herbarium and the Conservatory, both of which received nearly 1000 visitors.

Both the Herbarium and Conservatory offered much to see and do. The Herbarium had a make-your-own herbarium specimen craft table where kids glued dried plants onto cards, demonstrations on pressing and mounting plants, flowers to view under the microscope, specimens on exhibit (including a portion of the Hmong exhibit from January’s tea), tours of the collection, and a table of touchable plants, that we referred to as the “plant petting zoo.” On the tours, guests got to see some of our special specimens, such as one of our oldest specimens, an Adiantum pedatum (maiden hair fern) collected in 1878.

At the Conservatory, guests were able to tour the collection and experience a wide assortment of succulents from South Africa to South America, ponder the purpose of carnivorous plants, and/or be in awe at the amazing large leaf of Amorphophallus titanum. Other notable plants for the day’s visitors included cool stuff such as seeing the chocolate and coffee trees in fruit as well as sampling the sweetener found in Stevia leaves. Although it was a bit busy with lots of bodies in the Botanical Conservatory, everyone seemed to enjoy themselves.

We would like to thank all of the staff and volunteers who helped us make this day a success. We could not have done it without you! For more information about this annual February event or to learn more about all the participating collections please visit the event website at http://biodiversitymuseum.ucdavis.edu/

T. Barry & E. Sandoval
In January, the Center for Plant Diversity hosted a well-attended Herbarium Tea with an exhibit featuring our specimens of Hmong culinary and medicinal herbs. The specimens were also exhibited at Biodiversity Museum Day in February and will be put up again at Picnic Day in April. The January exhibit and tea refreshments were organized by undergraduate Mai Xiong and herbarium curator Ellen Dean, with additional setup help by a number of other herbarium staff and volunteers.

Mai, an active member of the campus Hmong Student Union, connected with the herbarium several years ago when she became one of our plant specimen mounters. As someone who grew up farming and using Hmong herbs, Mai told us early on about her interest in the herbs used by her family. Ellen encouraged her to collect some of the plants used by her family, and Jean Shepard (our collection manager) involved Mai in curating some of our Hmong specimens that still needed specimen labels.

Fast forward to the fall of 2017, when Mai heard about our plan to exhibit some of our Hmong specimens, she went into high gear organizing all aspects of our tea, including making exhibit placards, adding live plants to the exhibit, taking Ellen to a Hmong New Year celebration, inviting local Hmong students, taking Ellen shopping for typical Hmong snacks, and making the Hmong three-colored dessert Nab Vam. We are very grateful to Mai for her help.

The Hmong people are most recently native to the mountains of northern Vietnam, Laos and southern China. They were displaced by the Vietnam war and immigrated to the United States between the late 1970s and mid-1990s, often with long stops in refugee camps in Thailand and elsewhere. There are large populations of Hmong in the United States in California and Minnesota. In Hmong culture, the boundary between food and medicine is not well defined, and many plants are used for both food and medicine. Their connection to the plants that they used in their homeland continues here in the United States.

So, how did the Center for Plant Diversity acquire more than 100 specimens of Hmong herbs? Our Hmong specimens were collected for two different research projects. The first was Dr. Jan Corlett’s PhD project in the UC Davis Dept. of Nutrition documenting the plants grown in home gardens and used by Hmong families in Sacramento between 1997-1999. The second was Richard Molinar and Michael Yang’s Cooperative Extension project documenting the plants grown and used by Hmong families in Fresno between 2005 and 2011. The plants studied and collected by Jan Corlett, Richard Molinar, and Michael Yang were identified at UC Davis by Ellen Dean. Ellen identified the specimens using keys in many different floras (Thailand, Vietnam, China) and other books, as well as lists of plants in research articles that document herbs used by different southeast Asian cultures.

Jan’s project culminated in an article in the journal *Economic Botany* entitled “Hmong Gardens: Botanical Diversity in an Urban Setting,” a highly cited work that includes a list of all the plants she documented. Richard and Michael’s project included an excellent community-centered conference in Fresno on Hmong plants, with field trips to Hmong farms. They also produced a poster that Ellen presented at a national botany conference.

In the fall of 2005, the museum Copia in the city of Napa mounted an exhibit on Hmong herbs that highlighted Jan’s specimens. The Copia curators created beautiful signage, and they acquired a valuable Hmong story cloth for the exhibit. When Copia lost its funding, they donated the exhibit signage and cloth to the Center for Plant Diversity. This signage and cloth were part of the herbarium tea exhibit in January, along with the specimens themselves. A much smaller exhibit was arranged for Biodiversity Museum Day and will be shown again on Picnic Day. We are grateful for all the help we have received in mounting this exhibit several times.

E. Dean