THE JEPSON GLOBE

A Newsletter from the *Friends of The Jepson Herbarium*

VOLUME 21 NUMBER 1, Winter 2011

Director's Column:
"Digitizing Pacific Coast Seaweeds: Documenting the Past to Interpret the Future"

By Brent D. Mishler

The University Herbarium has been awarded a major grant from the National Science Foundation to image, database, geo-reference, and curate 102,000 specimens. Targeted species will be all marine macroalgae (seaweeds) that are known to grow in California, Oregon, or Washington, wherever in the world they occur. Once completed, the specimen records will complement our existing on-line resources, forming a seaweed information interchange of authoritative, up-to-date data. Combined, this resource will contain the latest information on identification, taxonomy, distribution, ecology, relationships, and diversity of Pacific Coast marine flora.

Magnificent diversity and abundance of seaweeds along the Pacific Coast of California, Oregon, and Washington reflect the region's rich coastal environments. Seaweeds are the engineers of nearshore environments, providing primary production and habitat for intertidal and subtidal communities, and creating substrate and structure for myriad marine organisms and their developing larvae (including many commercially important species). The dataset to be completed will help to meet the urgent national need to predict, interpret, and act upon the effects of climate change on the marine

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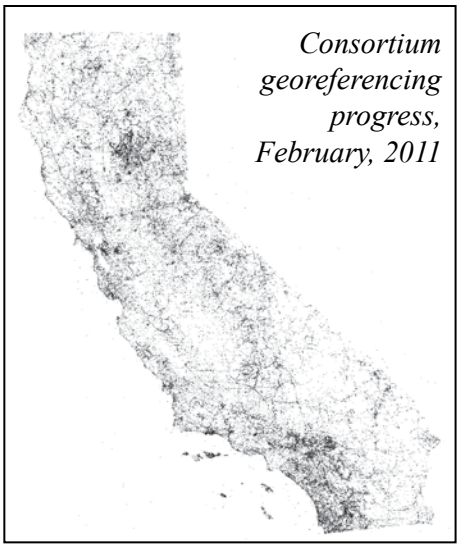

Consortium georeferencing progress, February, 2011

The Consortium of California Herbaria received a landmark grant from the National Science Foundation

Wonderful news – participants of the Consortium of California Herbaria (CCH) have been awarded a $1,900,000+ National Science Foundation grant for a collaborative research project titled "Harnessing the power of herbaria to understand the changing flora of California: A biodiversity hotspot in peril."

To support the national effort to predict, understand, and monitor the effects of climate change, participants of the CCH will database ~338,600 California-collected vascular plant specimens and georeference ~500,000 locations from collections held in California herbaria and at Harvard University (a repository of many older

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Jepson Manual Update

By Bruce G. Baldwin

More good news – the new Jepson Manual (*Jepson Manual* II) has been sent to the publisher! We are hoping to see the book in print toward the end of this year. Final taxonomic treatments (not including a few last minute corrections) are all posted here: http://ucjeps.berkeley.edu/jepsonmanual/review/.

This important milestone could not have been reached without the dedicated authors and editors who have contributed so much to the project – we thank each and every one of them!

We also thank all of our *Friends*, especially sponsors, for their support over the years! You are an amazing group of individuals without whom the herbarium could not have realized this goal.

We intend to continue updating the text of the *Manual* so stay tuned to our web site for an ever-changing Jepson Flora.

ALSO IN THIS ISSUE

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Contributions from Friends

Ferns of Hawai‘i

By Joan Eiger Gottlieb

“Ferns of Hawai‘i” (September 13-23, 2010) was the fourth extended workshop led by UC’s neotropical fern specialist, Dr. Alan R. Smith. The ten days were divided equally between the islands of Kaua‘i (most northwestern and oldest of the major Hawai‘ian land masses at five million years) and the Big Island of Hawai‘i (farthest east in the chain and less than half a million years old).

Part I: Kaua‘i Island

A Civilian Conservation Corps camp at Koke‘e State Park provided our accommodations. This part of Kaua‘i is home to Waimea Canyon, whose rainbow-hued rock layers line an impressive north-south gorge cutting through the western part of the island. The great wet area of Alaka‘i Swamp sits on the lava floor of a 30 square mile caldera near the state park. From Koke‘e Camp the group sampled six nearby trails yielding ca. 75 fern taxa (out of a total of ca. 220 for all the major islands; about 25 more were seen on the Big Island). The Alaka‘i and Pihea trails approached the caldera’s bog area from opposite ends and were tackled on separate days. An impressive 37 ferns were found along the boardwalk of the Alaka‘i Trail, including five species of the endemic, epiphytic, grammitoid genus *Adenophorus*, as well as *Grammitis tenella* and *Lellingeria saffordii*. Two endemic, common tree ferns – *Cibotium glaucum* and *C. menziesii* – were seen, the former with namesake blue-gray frond undersides and the latter bearing copious, stiff, reddish-brown stipe hairs. Alaka‘i was the first of several places where two species of whisk ferns (Psilotaceae) could be compared – *Psilotum nudum* and its flat-stemmed, more pendulous cousin *P. complanatum*.

En route to the Pihea Trail, the Kalalau Lookout (4000') offered panoramic views of the Napali coast. The trail was very steep in places, severely eroded, muddy, and slippery. Two endemic species of the lycopod genus *Huperzia* – *H. phyllantha* and *H. serrata* – perched on tree branches. A prize find of the day was *Schizaea robusta*. Sterile fronds resemble those of a sedge, but the stipes of fertile leaves rise high above them and bear sporangial tips resembling miniature toothbrushes. A dwarf shrub form of the endemic Hawai‘ian ‘ohi‘a lehua tree *Metrosideros polymorpha (*Myrtaceae) predominates in the bog along the Alaka‘i Trail. Numerous red stamens give its flowers the look of pom-poms. The best flowering plant find was *Trematolobelia kauaiensis* (Campanulaceae), a slender tree with wand-like racemes of rose-colored blossoms. An olive-colored Kaua‘i amakihi honeycreeper flew in for a nectar snack.

Alan Smith and *Cibotium glaucum* Photo by Milton Gottlieb

Hawai‘i’s remoteness has led to the highest rate of endemism in the world – 75% of its flora and fauna are found nowhere else. Original, pioneering species in Hawai‘i came from all directions, including E. Asia, the South Pacific, and the New World tropics. Survivors gradually evolved into well-adapted, unique taxa. More than 130 plants and most endemic Kaua‘ian birds are now endangered, with large-scale fencing projects the only way to keep pigs, goats, and other destructive mammalian introductions out of fragile habitats. Constant vigilance is needed to remove the worst of the plant invasives, e.g. Tahili ginger, Australian tree fern (*Sphaeropteris cooperi*), and strawberry guava. At a trail lookout, we could see the flat summit of Mt. Wai‘ale‘ale (rippling water), the 5,148' remains of an ancient volcano that formed Kaua‘i. It is reputedly the wettest spot on earth, averaging 450" of rain per year, and is critical to the watershed.

The Nu alolo Trail behind the CCC camp meandered through a rich, mesic forest (somewhat dry in Hawai‘i’s current, prolonged drought) where beautiful endemics like *Pteris irregularis*, *Doodia kunthiana, Marattia douglasii, Coniogramme pilosa,* and *Elaphoglossum wawrae* were at home. A fenced area gives conservationists protected

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Contributions from Friends

Insects of the Algodones Dunes

By Tom Zavortink and Lynn Kimsey

The Algodones Dunes, the largest dune system in America north of Mexico, are in the Colorado Desert in southeastern Imperial County, California, where they extend northwest from the Mexican border as a narrow band for approximately 45 miles. The Dunes are known for their stark landscapes, extreme environmental conditions, rare and endangered biota, and off-road recreation. The Dunes and the surrounding desert are administered by the U. S. Bureau of Land Management as the 284 square mile Imperial Sand Dunes Recreation Area.

Sand dunes and psammophytic scrub in North Algodones Dunes Wilderness Area. Photo by Tom Zavortink

The Algodones Dunes lie on the bajadas west of the Chocolate and Cargo Muchacho mountains. They are bordered along their eastern edge by rocky and gravely soils with typical creosote bush scrub and, along dry washes, desert microphyll woodland communities. Creosote bush scrub is dominated, of course, by creosote bush (*Larrea tridentata*), but includes many other kinds of shrubs, and is found on well-drained soils of slopes and valleys throughout the warmer deserts of the American Southwest. The desert microphyll woodland includes several species of small, leguminous trees with microphyllous foliage (leaves or leaflets small), such as blue palo verde (*Cercidium floridum* subsp. *floridum*), desert ironwood (*Olneya tesota*), mesquite (*Prosopis glandulosa* var. *torreyana*), and smoke tree (*Psorothamnus spinosus*), that occur along washes in the Colorado Desert where supplemental water is available. Because the Algodones Dunes block the washes on the bajadas and impede seasonal water flow, the immediate edge of the sand dunes and pockets between them receive enhanced amounts of water and deposits of very fine-grained silt. These areas support unusually dense vegetation, including particularly large and closely-spaced blue palo verde, desert ironwood, and mesquite trees. The windblown dunes or "Sand Hills" that are the heart of the Algodones support desert psammophytic scrub vegetation in places where the dunes are somewhat stabilized. This community is dominated by shrubs like Wiggins's croton (*Croton wigginsii*), Mormon tea (*Ephedra trifurca*), desert buckwheat (*Eriogonum deserticola*), and sandpaper plant (*Petalonyx thurberi* subsp. *thurberi*). Some of its species are more common on gentle slopes of the dunes, others more common near the bases of slip faces or in the bowls and troughs between the dunes. Toward the west, the Dunes decrease in height until the gently-sloping surface of the desert is reached. The surface here, and far to the west, is completely covered by sand and supports the growth of creosote bush scrub, although here this community lacks many of the plant species found on the coarser soils along the eastern side of the Dunes. Except for Mammoth Wash at the northern end of the Algodones, none of the washes from the Chocolate and Cargo Muchacho mountains crosses the Dunes, so desert microphyll woodland is absent on the western side.

The Algodones Dunes are in one of the hottest and driest parts of the Colorado Desert. Summers are extremely hot, with high temperatures averaging 100-107°F from June to September, and winters are mild, with average highs and lows of 69°F and 41°F, respectively, in December and January. Solar insolation is intense, with the sun shining over 90% of the daylight hours a year, and the surface of the sand becomes hot enough to blister the skin and delaminate the soles of shoes. Precipitation is scant, about 2.5-3.0 inches per year, and bimodal, with peaks in December to March and July to October. Climatic extremes are typical of desert environments, and nearby Yuma, Arizona,

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(Ferns of Hawai'i, cont. from page 2.)
space for re-introductions of rare trees, shrubs, and ferns. *Doryopteris angelica* and *Microlepia strigosa,* planted here, were in curled up, pre-resurrection mode.

The last day on Kaua'i was divided between the Limahuli Botanical Garden, near Princeville, and the Kilauea Lighthouse. Many of the species at the Botanical Garden (including natives) were planted out, but it was a singular chance to view *Asplenium nidus, Microsorum spectrum, M. punctatum, Cyclosorus interruptus*, and *Doryopteris angelica*, all of them green and growing on a wet hillside. The woody plants at Limahuli were spectacular, including orange-flowered, Kaua'ian endemic *Hibiscus kokio* (Malvaceae) and native *Acacia koa*. Saplings of koa have bi-pinnate leaves (think *Albizia*) when young, and undergo an amazing transformation to cardboard-textured, simple, sickle-shaped phyllodes (leaf petiole expansions), completely replacing true leaves on adult trees. *Acacia koa* and *Metrosideros polymorpha* are the dominant flowering trees in native Hawai'ian rain forests. At the Kilauea Lighthouse (northernmost spot in Hawai'i) we were greeted by a small flock of nesting, endemic nene ("nay-nay") geese that thrive on Kaua'i in the absence of introduced mongoose. The rarest flowering plant in Hawai'i, – *Brighamia insignis* (Campanulaceae) – a succulent that looks like loose-leaf cabbage on a stalk, is being propagated here.

Part II. Hawai'i Island

The Big Island of Hawai'i is aptly called "The Volcano Island," although all the major land masses in the Hawai'ian chain are volcanic in origin. It is twice the size of all the other islands combined (95 miles north-south and 80 miles east-west) and is home to several massive volcanic peaks, including Mauna Kea (arguably the tallest peak in the world at nearly 14,000' above sea level and 18,000' below the water). Mauna Loa, almost as high, is equally impressive and both peaks can sport seasonal snowcaps. Kilauea is the lowest major volcano at only 4,078' above water but is the most active. First impressions of this youngest Hawai'ian Island were favorable. The large presence of Volcanoes National Park and the good work of several active environmental groups (e.g., The Nature Conservancy, Pele Defense Fund, and Earthjustice) offer hope that the balance between development and conservation may be struck more equitably here than it has on many of the other islands. Our rooms at Volcano Inn near the Park Headquarters were energy-efficient units nestled into a restored grove of *Cibotium*. Rooms were snuggled against the foliage of these impressive tree ferns – a most "frondly" view.

Cibotium glaucum fertile segment Photo by Milton Gottlieb

Six fern-rich sites were explored, starting with the Ola'a Forest Reserve (elevation 3,800' - 4,400'), a fenced set of research transects only a short distance from the inn. The nearly pristine rain forest here was dominated by *Cibotium glaucum* and *C. menziesii.* Four new finds were added to the trip list – *Asplenium lobulatum* (bearing a vegetative bud), *Grammitis hookeri, Mecodium recurvum,* and *Vandenboschia davallioides.* Having no developed trails, these tracts were the most difficult of the trip and ended in a panicky retreat from a colony of very angry wasps.

Thurston Lava Tube at Kilauea Volcano lies at the base of a steep incline into a pit crater surrounded by rain forest. Near the trail entrance *Amauropelta globulifera* arched over the bank. Lava tubes develop when channelized lava flows harden at the surface while hot, molten lava continues to move on and out below, leaving a cylinder up to 30' in diameter. Thurston is 600' long, paved and well ventilated, with pale plants of *Adiantum raddianum* growing around the light sconces. Kilauea Iki Trail in the same area of Volcanoes N.P. descends into a large, collapsed crater through a beautiful fern forest. On fractured lava surrounding the crater, *Polypodium pellucidum* var. *vulcanicum* was a new find. It has long, narrow blades, thick, numerous, crowded, overlapping pinnae, and the diagnostic translucent veins implied in its species name. The more widespread *P. pellucidum* var. *pellucidum* grew nearby in more wooded areas uphill of the crater. Research shows these are true varieties, not merely ecotypes.

The Kipuka Puaulu Loop Trail off the Kilauea Road in Volcanoes N.P. circles an old lava island surrounded by more recent flows. It has well-developed soil and is considered a bird and

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(Ferns of Hawai'i, cont. from page 4)

plant sanctuary. A family of introduced Kalij pheasants crossed our path several times and native forest birds were sighted in the trees. Normally a mesic koa forest, the area was obviously suffering from the long drought afflicting Hawai'i. Crispy fronds of *Asplenium trichomanes* subsp. *densum* and *A. adiantum-nigrum* were found near the trail entrance. On the other hand, bracken – *Pteridium aquilinum* var. *decompositum* – was in prime condition, giving us a chance to note its "pinched" pinna characteristic. *Cyrtomium falcatum*, *C. caryotideum*, and *Pteris cretica* were also in good condition. An evening trip to the drivable end of Chain of Craters Road brought "oo's" and "ah's" for its red-tinged vent "smoke." This area, one of the most geologically unstable sites in the world, is subject to sporadic volcanic activity and sulphurous fumes.

Two Nature Conservancy preserves on the western (Kona) side of Hawai'i provided a grand finale for the workshop. Lying between 3,000' and 6,000' elevation on the flanks of Mauna Loa, they are accessible from the nearest paved surface only by 4-wheeled transport over bone-bouncing lava tracks. The preserves, former natural areas at the edge of ranches, have been fenced and hunted free of feral pigs. Kona Hema Preserve was first. On the lower trail, at 3,000' elevation, iconic specimens of *Sadleria cyatheoides* were common, spreading pink (young), green (mature), and gray (dead) fronds over bare lava rock. As we entered a koa forest, there were stunning specimens of *Dryopteris wallichiana* and *D. glabra*, as well as *Dryopteris hawaiienses,* a handsome fern with dark, prominent scales on its rachises and costae. Fertile, green plants of *Asplenium adiantum-nigrum* and *A. trichomanes* subsp. *densum* were a joy after the disappointing, crispy ones at Kipuka Puaulu.

After lunch on the porch of the Nature Conservancy cabin, it was back into the 4-wheelers for the climb to a 6,000' section of the reserve. Weathered lava along the fence was home to several plants of *Pellaea ternifolia*, a diploid Hawai'ian strain in a generally tetraploid complex that appears to have originated from New World sources in the southwestern U.S. or Mexico. A great find was *Polystichum hillebrandii*, an endemic beauty of Asian origin, forming impressive clumps in old pasture grass. On the Hono Moleno Loop Trail through a tract of verdant rain forest, we saw colonies of *Selaginella arbuscula* perched on a moist rock ledge. Along the trail, Nature Conservancy staff members had recently planted 600 seedlings of *Pritchardia schattaueri*, an endemic palm known from only 14 remaining wild specimens.

Polypodium pellucidum var. *vulcanicum*
Photo by Milton Gottlieb

Our last day was spent exploring a second Nature Conservancy Preserve – 3,500 acre Kaiholena. Our shoes were brush-cleaned, a Polynesian chant was recited, and off we went through a fern-rich, wet forest. *Elaphoglossum parvisquameum* was vigorous here, with clear, identifying characters, including parallel veins that coalesce along the frond edge. *Callistopteris baldwinii*, a stunning, endemic filmy fern resembled erect feathers on the wet forest duff. A juvenile plant of *Ophioderma pendulum* dangled from a tree-fern trunk. *Cibotium chamissoi* sported thin trunks draped in skirts of dead fronds.

Hawai'i has three endemic fern genera – *Adenophorus* (Grammitidaceae), *Diellia* (Aspleniaeae), and *Sadleria* (Blechnaceae). Altogether there are ca. 106 endemic fern and 8 fern ally species on the islands. It is notable that widespread genera like *Equisetum*, *Osmunda, and Botrychuim* are absent or nearly so. Microclimates, volcanic soils, spore dispersal, and gametophyte growth requirements are but a few of the factors that may influence the distribution of Hawai'ian pteridophytes. However, introduced plants and animals may be the greatest threat to the continued existence of native ferns and relatives, despite heroic efforts in limited areas by The Nature Conservancy and others.

A Hawai'ian hawk perched photogenically on a fence post as we left the Kaiholena Preserve – a perfect end to the foray. At an evening banquet on the lanai of Volcano Inn, there were heartfelt accolades for trip leader Alan Smith and his energetic, knowledgeable assistants, Heather Driscoll and Amanda Vernon.

References, Acknowledgements, and Notes: Palmer, Daniel D. 2003. *Hawai'i's Ferns and Fern Allies*. Honolulu, University of Hawai'i Press.

A more detailed report and complete fern list for the Jepson Herbarium "Ferns of Hawai'i Workshop," September, 2010, compiled by Joan Gottlieb, Layne Huiet, and Alan R. Smith September, 2010 is available by e-mail to: milton.gottlieb@verizon.net

Grammitis tenella Photo by Milton Gottlieb

(Algodones Dunes, cont. from page 3.)
recorded a record high temperature of 124°F in July 1995, a record low of 13°F in January 2007, and rainfall of over 3.5 inches from the tropical storm following Hurricane Nora in September 1997.

Although portions of the Algodones Dunes are legally closed to vehicle traffic, much of the area is open to off-road vehicles. The region is extremely popular with "duners," and it is estimated that as many as 200,000 people may visit the Dunes on a typical holiday weekend during the cooler months of the year. The recreational use of the Dunes has obvious impacts on the dune ecosystem, and in areas of particularly heavy off-road vehicle traffic, no vegetation remains and sand-dwelling organisms are absent.

The Algodones Dunes are home to several rare, threatened, or endangered plants – Algodones Dunes sunflower (*Helianthus niveus* subsp. *tephrodes*), giant Spanish-needle (*Palafoxia arida* var. *gigantea*), Peirson's milkvetch (*Astragalus magdalenae* var. *peirsonii*), sand food (*Pholisma sonorae*), and Wiggins's croton (*Croton wigginsii*) – and to numerous species of insects that are believed to be endemic. In order to better document the insect fauna of the Algodones, the Bohart Museum of Entomology, with support from the Bureau of Land Management, conducted a survey of the insects from September 2007 until April 2010.

Insects were collected at numerous sites within the Algodones on 15 trips to the region. The sites were chosen to include the major habitats within the Imperial Sand Dunes Recreation Area (bajadas, dry washes, silty flats, sand dunes, and sandy plains), all plant communities represented there, and areas open to, and closed to, off-road vehicle use. The insects were obtained by a variety of methods, such as netting them at flowers, sweeping them from plants, removing them from soil and decaying wood, and by capturing them in a variety of traps, including black-light traps, malaise traps, pitfall traps, and pan traps.

Peirson's milkvetch in North Algodones Dunes Wilderness Area Photo by Tom Zavortink

All told, over 330,000 insects were collected in the Dunes. As many as 48,000 were collected in a single black-light trap in one night! Not all of the specimens have been determined to species at this point in time, but still over 1,200 species have been identified, and we estimate that there are at least 2,000 insect species in the Dunes. Numerous new species have been collected, especially in the order Hymenoptera (bees and wasps). The diversity of insects is clearly related to the diversity of plants, with the microphyll woodlands on the eastern side of the Dunes yielding the most insect species. The psammophytic scrub community has yielded fewer insect species, but a higher proportion of these are endemic to the Dunes. We have been surprised by several aspects of the insect fauna of the Dunes. Foremost is the vast number of insects that feed on fungi, which seems particularly strange in an arid region where evidence of fungi is rarely seen. Another is the large number of aquatic insects that originate in the canals along the southern and western edges of the Dunes. These are sources of energy and nutrients for the dune ecosystem that didn't exist until recently. We have been impressed too by the number of exotic pest species like bean aphids, pea aphids, corn earworm moths, and beet armyworm moths that are found in the Dunes during the cooler months. These insects come from the surrounding agricultural areas, and are another recent source of imported organic matter for the dune ecosystem. Taxonomically, some of the more unusual insects we have found in the Dunes are Spongillaflies, small lacewing-like insects whose aquatic larvae feed on freshwater sponges, and Sclerogibbid Wasps, which are parasites of Webspinners (order Embioptera), a kind of insect that we have yet to find in the Dunes.

Malaise trap at edge of dry wash. Photo by Bob Kimsey

At this point in time, we have analyzed the bees of the Algodones more completely than any other group. More than 4,000 bees, representing 157 species, were collected during our insect survey. Seven of these species are undescribed and six are new records for California. An additional seven of the species remain unnamed because they are in genera too poorly known to permit identification. The abundance of the different species varies widely. Ten are represented by more than 100 individuals, but nearly half are represented by five or fewer specimens. Thirty-four species are represented by a single specimen each and 17 species are represented by only two specimens.

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(Algodones Dunes, cont. from page 6.)

Light trap in creosote bush scrub
Photo by Bob Kimsey

The large number of these singletons and doubletons, as they are called, suggests that there are additional species that weren't collected at all. Most of the bees in the Algodones are associated with spring-blooming plants, and 140 species were collected in that season. Sixteen species were collected in only the summer or fall, and one was collected only in the winter. While most species of bees were collected with nets while visiting flowers, 34 were collected only in some kind of trap. Many of these species are the ones represented in our collections by only one or two specimens. The genus of bees with the greatest number of species in the Dunes is *Perdita*, with 38 reported. These are small to minute bees, some less than an eighth of an inch long, many species of which specialize in gathering the pollen of only one or a few related kinds of plants.

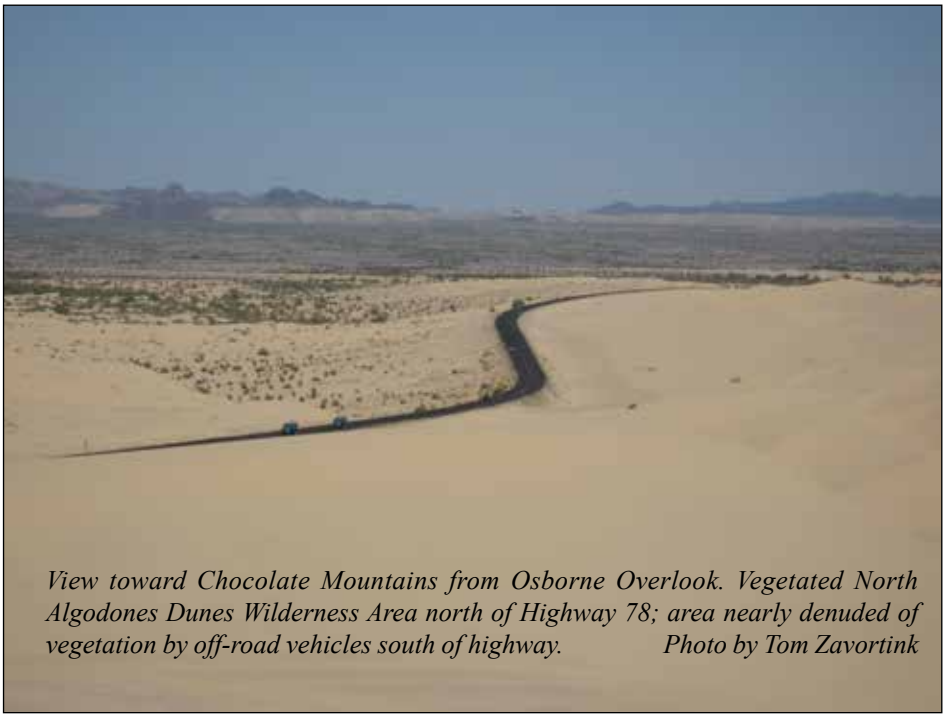
The 157 kinds of bees collected in the Algodones are undoubtedly only a portion of the number that actually occur there. Our belief is that this number represents at best only two-thirds of the species. Even if this proves to be true, and the fauna reaches 235 species, it is still a depauperate fauna for an arid region in the southwestern United States the size of Imperial Sand Dunes Recreation Area. The late Philip Timberlake, who collected and studied the bees of southern California for over half a century, documented about 500 species of bees from the vicinity of Palm Springs. That fauna is believed to be particularly large, though, because of the topographical, edaphic, and botanical diversity of the area around Palm Springs and its proximity to cismontane California. Still, it does help put the size of the bee fauna of the Algodones into perspective.

As part of the study of the insects of the Algodones, an inventory of the vascular plants was made. We collected numerous plants not recorded from the Algodones before; the flora of the region is obviously only partly documented. Among our new records are large, conspicuous plants such as the composite shrubs alkali golden bush (*Isocoma acradenia*) and scale-broom (*Lepidospartum squamatum*), easily-overlooked annuals like combseeds (*Pectocarya heterocarpa* and *P. platycarpa*), unexpected finds like lizard-tail (*Gaura parviflora*), and weeds such as buffelgrass (*Pennisetum ciliare*). When records from the Consortium of California Herbaria and the Survey of sensitive plants of the Algodones Dunes (WESTEC Services, Inc., Tustin, CA, 1977) are combined with our own inventory, a list of 180 species is produced. Nearly 30 of these are exotic species or aquatic plants associated with the All American and Coachella canals and, in times past, with tank ponds at water stops on the Southern Pacific Railroad; the list of native desert plants is slightly more than 150 species in 35 families. This seems like an unusually small flora for a region as large as the Imperial Sand Dunes Recreation Area, but the limited topological and edaphic diversity in the region and the harshness of the climate and the dune habitat undoubtedly limit plant diversity.

The insects of the Algodones are much better known as a result of our studies. But they are not, by any stretch of the imagination, completely known. Deserts are notoriously variable from year to year, so it will take many years of sampling before the insect fauna is adequately known.

Tom Zavortink (Research Associate) and Lynn Kimsey (Director) are at the Bohart Museum of Entomology, UC Davis

Perdita covilleae bee on fingertip
Photo by Lynn Kimsey



View toward Chocolate Mountains from Osborne Overlook. Vegetated North Algodones Dunes Wilderness Area north of Highway 78; area nearly denuded of vegetation by off-road vehicles south of highway. *Photo by Tom Zavortink*

Grindelia -- Still a Complex Genus!

By Abby Moore
Former Baldwin Graduate Student

In December 2010, I completed my doctoral dissertation on the genus *Grindelia* (Asteraceae). I have since moved to Germany where I began my postdoctoral studies at the University of Mainz. My studies there will focus on two species of *Minuartia* that occur in the Alps. Each of the species has one subspecies that grows on calcareous soils and one that grows on siliceous soils. Working with Joachim Kadereit, I will be investigating how *Minuartia* made the transition between the two soil types. During my years at Berkeley, I studied the evolution of California *Grindelia* and of the genus as a whole in my dissertation work, and, as I will explain below, there are still important questions remaining.

The genus *Grindelia*, commonly known as gumplant or gumweed, is distinctive in that it has a sticky resin that covers the flower heads, forming a white coating over the top of unopened buds. *Grindelia* is well known to California botanists due to both its wide distribution and conspicuous flowers and to the difficulty of identifying the species.

Grindelia is endemic to the New World. Some species occur in North America and Mexico, while others occur in temperate South America, but it is absent from the intervening tropical areas. I used sequence data from different regions (nuclear ribosomal and chloroplast genes) to look at the evolution of the genus as a whole. I found that North American and South American plants represent two major clades or groups that can be explained biogeographically by only one dispersal event between the two continents.

Grindelia camporum
Photo by Steve Matson

South American grindelias are much more diverse in habit than the North American taxa, and the species are generally more easily recognized, with many local endemics. The North American group has many widespread species whose boundaries are sometimes unclear. North American grindelias are divided into two subgroups that mainly occur on different sides of the Continental Divide. The diverse radiation of *Grindelia* in the Pacific States (including California Floristic Province, CA-FP) appears to be most closely related to species from the Great Basin and Colorado Plateau and evidently descended from drought-adapted ancestors. In short *Grindelia* does not represent the well-known pattern of dispersal between the mediterranean climatic regions of California and southern South America.

Grindelia in the CA-FP includes both diploid and tetraploid plants, with tetraploids predominating along the coast and diploids in the interior. The tetraploids are more ecologically variable than the diploids and are much more confusing taxonomically, as is often the case with groups of closely-related, polyploid species.

Unfortunately, there was not enough variation in my sequence data for me to be able to use it to understand the relationships within California taxa of *Grindelia*. I used microsatellites instead. Microsatellites are regions in which a short sequence of nucleotides is repeated many times (for example ACTACTACTACT.....). These regions are particularly difficult for a cell to copy, so they change in length much more rapidly than other sequences do. For this reason, microsatellites are particularly variable and can be used to look at closely related species or at populations within the same species.

I looked at ten populations (nine tetraploid and one diploid) of *Grindelia* collected in and near the San Francisco Bay Area using data from six microsatellites (all of which were from the nuclear genome). Most of the different forms of CA-FP *Grindelia* occur in the San Francisco Bay Area, and two of the forms I examined are endemic to this area. I was hoping to determine whether geographically closer populations were more similar to each other than geographically more distant populations, as well as whether populations growing in the same habitat were more similar to each other than to populations growing in other habitats. The results indicated that each of the ten populations was approximately equally distinct from all the rest. There were no strongly supported groupings of populations. CA-FP *Grindelia* appears to represent a monophyletic group observed during early stages of diversification across an unusually broad range of environmental settings. More work is needed to tease apart the patterns of diversification of the CA-FP group.

Grindelia stricta var. *platyphylla*
Photo by Neal Kramer

Grindelia camporum,
showing resin on unopened flower head
Photo by Steve Matson

Seth Adams, Land Programs Director for Save Mount Diablo, presenting awards to David Gowen (l) and Mike Park (r)
Photo by Barbara Ertter

Kudoes To Mike and David!

By Barbara Ertter

On 28 August 2010, at Save Mount Diablo's annual "Moonlight on the Mountain" fete, the first-ever Mary Bowerman Awards for Science and Discovery were presented to Michael Park and David Gowen, "for their work in revealing symbols of Mt. Diablo's mystery and biological richness". In addition, Assembly member Joan Buchanan presented them with a State legislative proclamation honoring them for their achievements.

Park was recognized for his well-publicized rediscovery of the Mt. Diablo buckwheat, *Eriogonum truncatum*, in 2005. The award was given "For his amazing perseverance, expertise, and thousands of hours of work during which Michael Park rediscovered the Mt. Diablo buckwheat, a wildflower not seen in 69 years, and then helped research, propagate and reintroduce the plant to other locations on Mt. Diablo, in the process dramatically improving its long term chance of survival." His discovery was a serendipitous result of a floristic study of the southeast quadrant of Mount Diablo, suggested by Barbara Ertter as a supplement to the recently updated flora of the mountain. Seeds from the few plants originally found have been propagated to thousands at the UC Botanical Garden. These are being used in an effort to establish additional populations at appropriate locations on the mountain.

Gowen, who had himself spent many a trek searching (vainly) for the Mount Diablo buckwheat, was honored for bringing to light "not one but two new and critically endangered plants, Gowen's Navarretia and the Lime Ridge Woollystar, in the process becoming the worlds' expert on them, and for helping to stop the communication towers that threatened them." Both *Navarretia gowenii* and the as-yet unpublished *Eriastrum* had been previously overlooked, in part because of limited access to Lime Ridge during the decades that the area was actively mined for lime used in cement-making. Gowen not only developed the fine eye to recognize the diminutive plants, but sufficient self-taught expertise on *Eriastrum* in particular to analyze and describe new species.

Both Park and Gowen have strong connections to the University and Jepson Herbaria, Park as a graduate student working with Bruce Baldwin, and Gowen as an avid avocational botanist who credits Barbara Ertter and others in the Jepson Herbarium for guidance, training, and inspiration. Both spend significant time in the herbarium, identifying their respective collections from the East Bay and elsewhere in California. The Jepson Herbarium is understandably delighted with the honor given to Park and Gowen and hopes its resources will continue to inspire, aid, and abet research by equally dedicated individuals.

The Jepson Herbarium Projects & Resources

The Jepson Flora Project
The Jepson Manual & *Jepson Desert Manual*
Online Interchange for California Floristics
*A Flora of California (*electronic)
Educational Services & Resources
Botanical Workshops & Courses
Plant Identification
2,200,000+ Worldwide Plant Specimens
Botanical Library & Archives
Publications & Research Projects
Constancea: UC publications in botany
Director: Brent Mishler
Deep Green Plant Phylogenetics: Novel Analytical Methods for Scaling Data from Genomics to Morphology
Moorea Biocode Project (a complete inventory of an island ecosystem)
Systematics and ecology of *Syntrichia*
Curator: Bruce G. Baldwin
Systematics and Evolution of Calif. tarweeds and relatives (tribe Madieae, Compositae)
Unravelling the dynamics of mating-system evolution in tribe Collinsieae
Curator of Ecology: David Ackerly
Niche conservatism, functional trait evolution, and the diversification of the California vernal pool flora
Ecological Flora of California
Curator of Monocots: Chelsea D.Specht
Evolution and biogeography of Calif. alliums
Systematics and evolution of *Heliconia*
Floral developmental evolution in the tropical gingers (Zingiberales)
Curator of W. N. Am. Botany: Barbara Ertter
Flora of Mount Diablo & Flora of the East Bay
North American Potentilleae
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(Consortium, continued from page 1.)

California specimens). The plants targeted are dominants in California habitats (i.e., woody plants and grasses) and those most imperiled by threats to biodiversity, including climate change (i.e., alpine plants and those listed by the California Native Plant Society as of conservation concern). As it is gathered, specimen data will be available online at the Consortium of California Herbaria (CCH) Web portal (http://ucjeps.berkeley.edu/consortium). The project will also accomplish the seamless inclusion of data from California specimens housed in the museums of SEINet (Southwest Environmental Information Network). This is a major step toward building a United States Virtual Herbarium that will provide information on the distribution of plants nationwide.

This five-year project will also provide tangible benefits to the public, students of all levels, and the research community. Specimen data will be downloadable so that anyone can use the information to pursue interests and questions (e.g., understanding current plant distributions, identifying plants of a particular place, predicting future plant migrations). Undergraduate students will be involved extensively with data entry, providing them with skills and training applicable to future professional pursuits. In sum, the project will make major portions of the immense data held in herbaria directly available for use by anyone with internet access.

(Seaweed Grant, continued from page 1.)

environment. The information will be useful for marine scientists, as well as for those concerned with marine fisheries, conservation, teaching, and learning about the Pacific Coast.

Mugs for Sale!

We recently got a new shipment of beautiful *Friends of the Jepson Herbarium* Mugs. These lovely twelve ounce mugs feature a golden *Friends* logo on a cobalt blue background.

Mugs are $5 (cash is appreciated!) and are available from the Herbarium during business hours (Monday-Friday, 8 am-12 noon and 1-5 pm) and at on-campus Jepson Workshops.

If you take your mug with you to the field, please take a photo and send it to us! We might include it in a future issue of the Globe.

Thank you Peter Stekel!

The workshop program is better equipped in 2011 thanks to Jepson *Friend* Peter Stekel. Peter responded to our request for workshop supplies in the last *Globe*, donating funds to purchase a new collapsible table, a set of serving trays, and a pocket-sized digital camera. The table will give us enough horizontal space to complete a camp kitchen, even in an undeveloped campground. The durable, washable serving trays provide a stylish and sanitary surface for treats at on-campus workshops. And the digital camera will help us to document our programs: thanks to a 10× optical zoom, we may even capture some photos of people (and not just plants). Thank you, Peter, for your support!

New camera in action at the Lichens and Soil Crusts workshop. Photo by Jeanne Marie Acceturo

Cal Day, the University of California, Berkeley's annual open house, will be held on Saturday, April 16, 2011. From 9 am to 4 pm, some of the world's top departments and research museums (including the University and Jepson Herbaria) become open classrooms for children and adults and offer the public free admission.

It's a day like no other. Spend it in Cal classrooms and labs, museums and performance halls, libraries, and arenas. Admission is free.

The complete program of Cal Day events will be available online after March 24 at **http://calday.berkeley.edu/**.

Campaign for the New Teaching Lab is Under Way!

Thanks to all of our *Friends* who have already contributed to our campaign to support the development of a first-class teaching lab for the Jepson Workshop program. Our goal is to create a well-equipped, dedicated space for holding workshops, botany lunches, and other public programs.

We have just purchased and installed a ceiling-mounted projector. This new system not only projects beautiful, crisp images but also enables us to amplify sound from an instructor's laptop computer.

Our next major purchases will be a class set of 20 Leica dissecting microscopes and eight sturdy laboratory tables. So far, we have received donations designated for the purchase of seven scopes and seven cases: a great start towards our goal! If you would like to contribute to the Campaign for the Workshop Teaching Lab, please see the membership form on page 8, or contact Staci Markos (smarkos@berkeley.edu). With your support we'll be studying in style!

We'd like to extend our deepest thanks to the following *Friends*:

Patricia Coffey
Alison Colwell
Joseph Copp
Beth Lowe Corbin
Patrick Creehan
Christopher Davidson
Peter Garcia
Robert Garner
Lawrence Janeway
Catherine Rose

Spring Semester 2011 Botany Lunch Schedule

Botany Lunch is held Fridays at 12:10 pm. in 1002 Valley Life Sciences Building. The room is right off the hallway near the north entrance of the ground floor of VLSB. ALL WELCOME!

March 18 Frederica Bowcutt (Member of the Faculty, The Evergreen State College, Olympia WA.) *Jepson in Defense of Tanoak.*

April 1 Eduardo Ruiz-Sanchez (Post Doc, Specht Lab) Lab Otatea*, a Mesoamerican bamboo: phylogeny, taxonomic revision and new species.*

April 8 No Botany Lunch. Jepson Workshop: A Crash Course in Flowering Plant Families

April 15 Rikke Reese Naesborg (Research Associate, University & Jepson Herbaria) *Saxicolous lichen communities at Sunset Crater, Arizona.*

April 22 Matt Ritter, Associate Professor, Director, Plant Conservatory, California Polytechnic, San Louis Obispo. *Diversity of Cultivated Trees in California*.

April 29 Elizabeth Zacherias (Research Associate, University & Jepson Herbaria) *Phylogenetic Relationships of American Atriplex*.

May 6 Yockteng Benalcazar (Visiting Research Scholar, Specht Lab) *Evolution of Passiflora-insect interactions*

If you are interested in giving a seminar for the Spring 2011 season, contact Andrew Doran at 643-4344 or andrewdoran@berkeley.edu.

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Jepson Herbarium Public Programs

The following workshops still have space. Register soon - they are filling quickly!

Rare Flora of the Santa Cruz Sandhills
May 6-8, 2011

Mimulus
May 20-22, 2011

Potentilla
July 15-17, 2011

Introduction to Plant Morphology
July 30-31, 2011

Aquatic Plants
August 13-14, 2011

Insect-induced Plant Galls of California
September 18, 2011

Mimulus congdonii
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For more information, contact Jeanne Marie Acceturo
(510) 643-7008, jmarie@berkeley.edu or visit our Web site: http://ucjeps.berkeley.edu/workshops/

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