

# Archiving Ecosystems

## The University of Arizona Campus Herbarium

By Susan McGinley

Plants pressed to paper—that's the simple, yet powerful concept of an herbarium. Plants collected from the field are mounted on loose sheets of archival paper, then catalogued and stored—a museum for plants. Each sample includes any parts of the plant that are necessary to positively identify it: flowers, fruits, leaves, stems, roots, cones or seeds.

Rich in ecological information, an herbarium collection records the identity and distribution of plants in a geographic location at a precise time, making it ideal for practical, applied research in plant taxonomy, ecology, conservation biology, anthropology, natural resources, biogeography and even pharmacology.

With more than 440,000 specimens, the University of Arizona Campus Herbarium contains the largest collection of plants in the world from the southwestern United States and northwestern Mexico. It also is the largest collection in Arizona; the other major herbaria in the state are at Arizona State University, Northern Arizona University, and the Desert Botanical Garden in Phoenix. One third of the specimens are from Arizona, another third are from Mexico, and the last third are from all over the world.

Two main collections comprise the herbarium. The 400,000-specimen vascular plant group includes plants containing vessels for transporting water and nutrients, such as ferns, conifers, and all flowering plants, which include trees, shrubs, grasses, wild forbs, annuals and perennials, along with crop plants such as cotton and alfalfa. The Gilbertson Mycological Herbarium includes more than 40,000 examples of fungi, including rusts and other major plant pathogens, wood-decay fungi, edible and poisonous mushrooms, and beneficial fungi that assist plants in nutrient uptake and defense against disease.

Between 2,000 and 2,500 people visit the Campus Herbarium annually, including students, associated scientists, and the general public. Every year herbarium faculty and staff provide thousands of identifications of plants and fungi for county agents, researchers, ranchers, farmers, and many state residents.

The herbarium is managed by the Department of Plant Sciences in the College of Agriculture and Life Sciences. The current staff includes Steven McLaughlin, curator of the vascular herbarium; Betsy Arnold, curator of the mycology (fungal) her-



Scientific illustration by Phil Jenkins

*This unnamed species, recently discovered in Santa Cruz County by Steve McLaughlin, is currently being described.*

barium; Charles Mason, curator emeritus; Phil Jenkins, correspondent and senior assistant curator; Edward Gilbert, assistant curator/database specialist; Robert Gilbertson, curator emeritus of the mycology collection; and several graduate and undergraduate students and resident researchers.

The 114-year-old Campus Herbarium actually predates the building that currently houses it, and the opening of the University of Arizona itself. Yet it's young compared to some of the world's oldest herbaria, which date back to the 16<sup>th</sup> century at universities in Italy, Switzerland, England and Germany.

The UA's first botanist, James W. Toumey, started collecting plants in the field when he arrived in 1890 and found out the classrooms weren't ready yet. By the time classrooms were opened in Old Main in 1891, his new herbarium already had 700 specimens in Old Main that were later moved to the Forbes building.

Mason, who later served as curator for 36 years, moved the collection to the basement of Shantz in 1962. He served as curator until 1992, when Lucinda McDade took over. McDade upgraded the herbarium facilities, including adding compact systems and processing a large accumulated backlog of specimens. Steven McLaughlin, the current curator, succeeded McDade in 2000, focusing his efforts on the design and transfer of the herbarium to the newly renovated Herring Hall, where it reopened in September 2004.

Originally designed and built as the Men's Gymnasium in 1903, the Roman Revival building proved to be flexible enough over the next 100 years to house in succession the Women's Physical Education program, the Theatre Arts department, the School of Journalism and the Radio/TV Bureau, the Landscape Architecture program, graduate work in the College of Agriculture and Life Sciences, and now, the Campus Herbarium and the Campus Arboretum.

"The great thing about moving over here is the room to expand not only the collection but also the work space," McLaughlin says. He first worked at the herbarium as a student in 1973 and has used it for the past 30 years as a researcher. "Many times in Shantz there would be no place to work," he says. "When people are identifying their plants they spread out the collections and take up a lot of space." Arnold agrees.

"The mezzanine level, where the fungi are housed, provides one of the best work-



Steven McLaughlin

*Phil Jenkins and Ed Gilbert examine a plant specimen in front of open specimen cabinet. Mounted specimens are stored on separate shelves.*

ing environments among mycological herbaria in the country."

The inviting open arrangement on Herring Hall's entrance floor includes several long tables with dissecting microscopes and plenty of light flooding through the tall windows on both sides of the building. Upstairs, compound microscopes and a small culturing facility provide tools needed for studying and using the fungal collection. In addition, the Campus Arboretum headquarters are located just inside the front door. Visitors coming to identify plants they have brought can learn about the arboretum, and arboretum visitors can learn about the herbarium.

The mycological collection was combined with the vascular plants until 1945, reflecting the traditional study of fungi by botanists, even though fungi represent a unique branch of life. Professors Paul Keener, Robert Gilbertson and George Cummins made major contributions, building an outstanding collection representing all major groups of fungi. By early 2004 the collection included more than 40,000 accessions, the majority collected by Gilbertson and his students.

Arnold has recently added more than 8,000 new accessions of little-known fungi that are beneficial to plants, and is enthusiastic about the future of the collection.

"This collection represents not only an outstanding resource for identifying fungi and understanding fungal ecology, but also a trove of diversity for research in molecular biology and genomics," she says.

All fungi and plant specimens are stored in cabinets. Most are mounted on sheets, although thick stems of plants like cacti and pine cones may be stored in boxes or bags. Envelopes containing seeds, flowers and other plant parts are attached to the mounted pages next to the plants. Fungi are typically in boxes of all sizes, their delicate structures carefully protected to preserve their three-dimensional forms. Each plant or fungus is labeled with its species and common name, the location and elevation where it was found, the date it was collected, and the name of the person who collected it.

Jenkins began working at the herbarium in 1992. He works as a collections manager, preparing specimens, arranging the collection, cataloguing, and handling loans. He also draws scientific illustrations of new species.

"It has amazed me in my time here how many people begin not knowing what an herbarium is and then find themselves needing one," Jenkins says. "There is almost nothing we do that doesn't involve plants. Our food, clothes, plastic, gasoline and oxygen are some of the examples of how we use plants."

Along with the plants and fungi, the Campus Herbarium maintains a fine collection of documents—books, articles and reports—on plant taxonomy, uses of plants, fungal biology, and desert ecology.

"We also have the Shantz collection of historic photographs," McLaughlin says. Shantz, a former dean of the College of Agriculture, took high quality outdoor

photographs that serve as references today. “Several researchers go out and take other photos and compare them with the Shantz pictures to learn how much the landscape has changed.”

The UA Campus Herbarium is unique in that it is one of the few associated with a land-grant institution. Most are connected with botanical gardens or non-land-grant colleges and universities, and don't have the land-grant mission of serving the state by sharing information. Unlike other herbaria that may require badges, the UA Campus Herbarium has an open door policy.

“We encourage agencies—land management, federal, state, and even private consultants to come in with any plant identification problem they have,” McLaughlin says. “We work closely with the poison control center in the state. Phil Jenkins has even looked at samples from the stomachs of people, cows and horses that have been poisoned. We are an important resource for these agencies.”

The herbarium collection expands according to current areas of interest. For example, McLaughlin is studying and documenting every species of plant that grows in Arizona's most recent state parks: Sonora Creek State Natural Area near Patagonia Lake and San Rafael State Park on the Mexican border near Lochiel. Members of the National Park Service are currently collecting specimens for their collection in the herbarium. When the flora of an entire area are mapped, voucher specimens are gathered to verify that the

species listed are actually in the collection. Recent floras include those for the Rio Mayo, Tucson Mountains, Sawtooth Mountains, Roskrige Mountains, and Santa Cruz River, west branch. Herbarium work involves a lot of hiking in the field with a plant press, and every once in a while, there's a surprise.

“We're still finding species at a small rate that are new to science,” McLaughlin reports. “We've also found species new to Arizona. They're usually in areas where very little collecting has taken place.” The same is true for fungi: Arnold is currently focusing on fungi that live within plants, but do not cause disease—and which may help protect the plants they inhabit.

“These fungi occur in all of Arizona's wild and agricultural plants, but they've never been examined in detail,” Arnold says. “By collecting these fungi, we're uncovering a whole new world of fungal biodiversity—with potentially important uses, in both agriculture and forestry.”

In addition to direct field collecting, the herbarium also expands through gifts and donations, and through exchanges of duplicates with other herbaria, according to McLaughlin. “We can exchange specimens from the Sonoran Desert for items from deserts in Australia, for example.”

In fact, far from staying forever in a cabinet, parts of the herbarium are traveling all the time, on loan to other institutions. “At any time we have 10,000 to 15,000 of our specimens someplace else in the world,” McLaughlin says. ☒

## Who Uses an Herbarium?

**Research Botanists**—to conduct original research on plants, to discover and describe new species, to inventory the plants that occur in specific areas and to document the species that belong to particular groups (e.g., prickly pears, palo verdes)

**Public Agencies**, such as the Park Service, BLM, and the State of Arizona—to identify and inventory plants and fungi for management purposes and to monitor new introductions (i.e. invasive weeds or fungal diseases) to the state

**Ecologists**—to understand changes in plant or fungal communities over time

**Students**—for class projects and for research related to plants

**Forensic Botanists and Law Enforcement Agencies**—to identify plants that are involved in legal cases (e.g., endangered species, plants that are the source of drugs, plants that help identify the scene of the crime)

**Arizona Poison Control**—to identify plants in cases of suspected poisoning

**Arizona Veterinary Diagnostic Laboratory**—to identify plants in cases of pet or livestock poisoning

**Horticulturists**—to identify plants that grow well in gardens and to search for related plants that might do as well

**Homeowners**—to identify weeds as well as desirable plants in their back yards, and for advice on what species to plant, and for help in identifying rare plants

—Phil Jenkins

## Visitors Invited

The Campus Herbarium, located at 1130 E. South Campus Drive, is open to the public from 9 a.m. to 5 p.m. Monday to Friday and other days by appointment. Tours are offered by appointment.

### CONTACT

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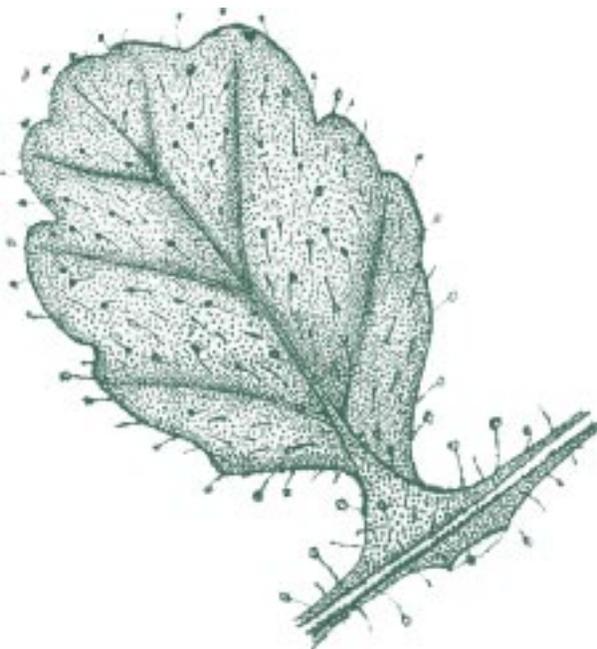
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Scientific illustration by Phil Jenkins



Leaf detail from unnamed species, recently discovered in Santa Cruz County by Steve McLaughlin.