

# University of Arizona Herbarium (ARIZ) Tucson

## *Half a Million Specimens and a Century of Research, Service, and Education in Plant and Fungal Biodiversity*

by George M. Ferguson, Collections Manager, and Dr. Michelle M. McMahon, Herbarium Director

From Arizona's earliest steps in higher education to today's modern research university, the University of Arizona Herbarium in Tucson has served as a focal point for plant diversity research and education.

### **Beginnings and Growth of an Arizona Herbarium**

The University was established by an act of the Territorial Legislature in 1885, though it did not offer a course of study until 1891. James William Toumey, a graduate (A.B. and A.M.) of another land grant institution, Michigan Agricultural College, after teaching a year at Michigan, came to Arizona at the age of 26 as Assistant Professor of Botany and Entomology (one of six original faculty) to teach "first-term freshman botany." Five students enrolled for his course, over half of whom were women. On October 3, the term opened and he wrote in his ledger "Work began in the fall when no flowers were to be found." The first term closed Dec 23, 1891. The next term opened with three of the students continuing in "physical botany" the latter part of December 1891 for two hours a day from 1-3 p.m. The day following their examination on March 8, the same three students continued into the spring term in "systematic botany," until May 26, 1892. The focus was in plant families: "At the opening of the term a number of flowers were in bloom and we began on the Cruciferae. Each student was required to have a microscope and work out and make drawings representing his work... the first hour's discussion was given to observation of *Lesquerella gordonii* and the method of tracing it down with artificial key." In the fall term of 1892, Professor Toumey's "structural botany" grew to eight new students, though the only two males soon "changed his course" making it another all-female class. In the summers (except 1893 when he attended Harvard), Toumey made collections all around the Territory to build the herbarium. Specimens "selected from herb" were sent to Michigan and Harvard (Dr. Charles S. Sargent) for identification and Toumey received hundreds of specimens on herbarium sheets of eastern plants "for the herbarium" in Arizona. He sent 500 specimens "collected in trip from Tucson to Grand Canyon, 1892" to U.S. Department of Agriculture (Dr. Fredrick Coville), and received 500, "including about 100 mounted specimens." Some of the tree specimens he sent East were species new to science, for example in his ledger he wrote "Received to Oct 1894 of Dr. Sargent about 100 species of eastern and foreign trees and shrubs," and "Dec 5, 1894 plants sent to Dept.- set of Ariz. oaks," of which one now bears his name *Quercus toumeyii*. By 1897 (the year he married in New Haven, Conn.) he was Professor of Biology, and Director of the Arizona Agricultural

Experiment Station, and in 1900, began the campus plantings of cacti that promised to be of economic value. Toumey was appointed in the summer to the U. S. government's new Division of Forestry, in charge of research in tree planting. In the fall of 1900, when the Yale School of Forestry opened, Gifford Pinchot selected Toumey, a seasoned westerner, as its first professor of dendrology (one of two original faculty), where he remained, becoming Dean. He brought with him to Yale his own herbarium of 2,500 specimens, many duplicates of his Arizona collections, thus establishing the core of the future collections there.

### **The Thornber Era**

With the University's land-grant mission to fulfill, John James Thornber was selected a month after receiving an A.M. degree in Botany at University of Nebraska. In late July 1901, he arrived in Tucson at the age of 29 with Mrs. Thornber, to take up an appointment as Professor of Biology, and Botanist for the Agricultural Experiment Station for the next 41 years. His salary would be \$58.33 a month for his work at the Station, same as Toumey, though soon raised to \$83.33, plus salary from the College of Agriculture similar to Toumey's \$108.33 a month. In the interim 10 months after Toumey left, Dr. David Griffiths assumed charge of range work under cooperation of the U.S.D.A. and the Experiment Station. Professor Thornber became curator of the herbarium of plants, which included collections of fungi and lichens accumulated by Toumey, and Thornber quickly engaged in documenting the flora of the area. In the first two months of his new position, which began August 1, 1901, Professor Thornber had already collected nearly 400 plants, half being grasses, from the University's campus "Forage Garden" of plants useful to livestock, and from the Experiment Station's "Small Range Reserve" (four sections of land along the Southern Pacific Railroad near Wilmot Siding southeast of Tucson, set apart for the purposes of range study by Executive Order in October 1900), as well as from visits to the University's farms near Tempe and Maricopa. In April 1902, President Roosevelt established the Santa Rita Forest Reserve, of which the Experiment Station's "Small Range Reserve" was made to constitute the northern limit of this larger reserve, for the study of grazing range problems. Thornber's research promoted the notion that Arizona rangeland can be restored by fencing and alternate grazing pastures. He devoted a large part of his time to study of Arizona flora, and, during his first decade, Thornber amassed over 6,000 plant collections for the herbarium, eventually contributing more than 10,000 records.

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## ARIZ Herbarium *continued*

In 1923, Thornber was appointed Director of the Agricultural Experiment Station and Dean of the College of Agriculture, though stepping down as Dean in September 1928 to return to his teaching as Professor of Botany, and Botanist for the Station until his semi-retirement in 1942. The herbarium in this era was housed in the Agriculture Building, in his office, and at his home on Olive Street where “his basement was a laboratory in itself” (*Arizona Daily Star*, 27 Nov 1962). He remained active for two more decades as part-time Taxonomist at the Station and Emeritus Professor. Dr. Lyman Benson was Assistant Professor of Botany in the early 1940s and, in consultation with Dr. Thornber, in 1940 produced *The Cacti of Arizona* as University of Arizona Bulletin Vol. XI, contributing over 1,000 specimens to the herbarium. The University acquired the approximately 3,000 specimen holdings from The Desert Botanical Laboratory on Tumamoc Hill, including the herbarium of Dr. Forrest Shreve after the Carnegie Institute of Washington ceased operations in Tucson in 1940.

### Mid-century Organizing of the Herbarium

Dr. Frank W. Gould replaced Thornber in the fall 1944 as Assistant Professor of Botany and Assistant Botanist at the Agricultural Experiment Station. His study of grasses (*Elymus* in particular) after receiving his Ph.D. from U.C. Berkeley led to the addition of his grass collections from California and Arizona to the herbarium, about 2,300 records throughout his 5-year tenure at the University of Arizona. His book *Grasses of the Southwestern United States* published by UA Press in 1951 is still an important reference. In 1949, Dr. Kittie F. Parker joined the University’s Botany Department and became curator of the herbarium. Her collections of the sunflower family, especially tribe Helenieae, added about 1,500 plants to the herbarium. Her 1958 *Arizona Ranch, Farm and Garden Weeds*, prepared for the Agricultural Extension Service circular 265, was later published by UA Press as *An Illustrated Guide to Arizona Weeds* with drawings by Tucson artist Lucretia B. Hamilton.

Dr. Charles T. Mason, Jr., came to the University of Arizona in 1953, following four years’ instructorship at the University of Wisconsin, and after completing his doctorate at UC Berkeley. His graduate committee included his uncle, Herbert L. Mason, and he received training in running a herbarium from the curator of the UC Herbarium, Annetta Carter. He began a professorship in the Plant Sciences Department and assumed curatorship of the herbarium. Things were in a state of disarray, as emphasis during the “Thornber Era” had been on adding specimens, so Dr. Mason took on a career-long endeavor to create a museum of regional and international importance for both its historical and newer collections. The approximately 4,000 moss collections of Mrs. Inez Haring and colleagues were acquired during Dr. Mason’s time, and by 1957, the University had acquired the 7,300 plant collections



above Historic Herring Hall, constructed in 1903 as a gymnasium, has been home to the ARIZ Herbarium since 2004. Photo courtesy George Ferguson.

of Robert H. Peebles and Thomas H. Kearney at the USDA Field Station at Sacaton, prior to its closing, and the approximately 10,000 specimen herbarium of Leslie N. Goodding from the Soil and Conservation Service. Dr. Mason organized trips around the state, and to Mexico, taking his graduate students along. Many of his former students regard him as a supportive mentor and outstanding teacher, and have appreciated the cultivation of lasting friendships among students and staff at a vibrantly active herbarium. The herbarium’s home since 1962 was the basement of the Shantz building, where it remained for 42 years. Adjacent to it were the extensive holdings in the Fungal Mycology collection of Dr. Robert Gilbertson. Upon becoming Emeritus Curator of the herbarium, Dr. Mason had been a preeminent botanist in Arizona for more than 50 years and had built a strong regional collection of accessions from the state, as well as northern Mexico. His book (with his wife Patricia), *A Handbook of Mexican Roadside Flora* in 1987 by UA Press remains a popular guidebook.

### The Move to Herring Hall

In 1992, Dr. Lucinda McDade came from Duke University as Assistant Professor of Ecology and Evolutionary Biology, and Director of the Herbarium. Phil Jenkins was hired as Curatorial Specialist where he provided the herbarium’s public service function for many years, in particular, responding to queries by the Cooperative Extension, the state’s Veterinary Diagnostic Laboratory, and the Poison and Drug Information Center. The Howard Scott Gentry herbarium had been acquired in 1989, with over 10,000 accessions, most significantly *Agave* including type specimens, and other plants from the Rio Mayo Region of Sonora, Mexico, though many were duplicates of Gentry’s earlier distributions. Being a visionary, Lucinda McDade secured grants to continue the processing of these accessions plus a backlog of unprocessed sheets from Thornber and other early collectors. Computer databasing efforts began, a website was initiated for the herbarium, and grants were won

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## ARIZ Herbarium *continued*

for compactor shelving of some cabinet rows. Meanwhile the holdings continued to grow from donations of voucher specimens for *Gentry's Rio Mayo Plants*, UA Press, 1998. Notably, associated researchers contributed thousands of records over the years — Dr. Richard S. Felger, mostly from Mexico, and Dr. Thomas R. Van Devender, as well as Dr. John R. Reeder and Charlotte Goodding Reeder (grass experts retired from Yale University) — all their collections together totaling at least 30,000 specimens.

This recent growth was addressed by Dr. Steven P. McLaughlin, a former student in Biology with Dr. Mason on his graduate committee, and Professor in the Department of Arid Lands, when appointed Director of the Herbarium in 2001. The following is his description of the move: “The very first item I had to deal with was a conceptual plan for moving the Herbarium from Shantz to a to-be-remodeled Herring Hall. This conceptual plan had ARIZ occupying the basement and a new mezzanine of the building; about 20 miscellaneous College of Agriculture and Life Sciences offices were designated for the main floor. After briefly studying this plan, it was obvious to me that the Herbarium could not be fit into the space allocated for it. Essentially it provided for storage of herbarium cabinets but lacked any of the necessary work spaces. After further discussion, it was decided that Herring Hall would be dedicated to housing both the vascular plant herbarium and the mycological herbarium, along with an office for the Campus Arboretum. Before final plans were drawn, I convinced the College to include new rail systems on both the main floor and the mezzanine that could be used to expand the compactor systems, which would allow both collections to grow. In 2002 we had received an NSF grant in collaboration with ASU and NAU to produce an online data base of all of the collections from the state. We thus needed desk space for up to four students to work on entering label data into the database. All these recommendations were included in the final design. Construction took place during most of 2003, and the move of the herbaria from Shantz to Herring required most of 2004. We invited Lucinda McDade back to present the keynote address at the dedication, which took place on September 3, 2004. The remodeling of Herring Hall and relocation of the vascular plant and mycological collections would not have been possible without the support of Dean Eugene Sander, Experiment Station Director Colin Kaltenbach, and, particularly, Assistant Director Randy Ryan who listened carefully to all of our concerns and came up with the creative solutions that made the project possible.”

The resulting well-lit and spacious work areas of Herring Hall provided a wonderful place for the research and curatorial tasks of a herbarium. Constructed in 1903 as a gymnasium, Herring Hall, the second oldest building standing on campus, was placed on the National Register of Historic Places in 1986. Hence, its interior renovation endeavored to reflect some of the building's original uses; the main floor resembles a basketball court, the side walls have the outline of bleacher seats and a basketball backboard and hoop are suspended from the mezzanine providing for a most interesting and unique herbarium work space setting.

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## ARIZ Today

Two years later, Dr. McLaughlin retired and in September 2006, Dr. Michelle (Shelley) McMahon, a former student of Dr. McDade, arrived from U.C. Davis to take a position in Plant Sciences and as Director of the Herbarium. Dr. Elizabeth (Betsy) Arnold, also a former student of Dr. McDade, had been hired into Plant Sciences and as curator of the mycology collection the previous year. Together they immediately began seeking support for additional storage for the collections; by then tens of thousands of plant specimens and nearly the entire fungal collection were at risk of insect infestation. In 2008, the National Science Foundation awarded funding for mobile carriages and hundreds of new cases, to go on the floor rails that Dr. McLaughlin had ensured were in place for both collections. The mycological-botanical collaboration continues as ARIZ embraces the future, a future that includes continuing to open up the collections to online access, bringing the collections in line with modern systematics, and teaching students and visitors to see the details that really matter for understanding our botanical and mycological floras.

Online access to the label data allows researchers to aggregate data in new and creative ways; projects using ARIZ specimen data have included studies on wild crop relatives, geographic distributions of tree species, and current and projected ranges of invasives, to name a few. In addition to the “virtual” data, visitors travel to view the physical specimens; recent examples include research on epidermal phytoliths, and pollen and seed morphologies. Visiting researchers also work on regional floras, as well as taxonomic revisions, and thousands of specimens are sent on loan each year to other institutions for taxonomic study. Modern taxonomic research frequently involves DNA analysis, and such research often results in better understanding of relationships among species. These in turn result in name changes, requiring updates to the specimens and to the database. On a larger scale, the last few decades of very active research by the world-wide systematics community has produced a substantial revision of our understanding of plant families. In 2009 an international group of researchers, the Angiosperm Phylogeny Group, proposed a new classification (their third and most complete), nicknamed “APG III.” This system has been adopted in most recent texts and textbooks. The timing of the publication happily coincided with the cabinet installation project at ARIZ, so the collection was rearranged according to the new evolutionarily-based classification scheme.

ARIZ currently holds an estimated 420,000 plant specimens, including algae, bryophytes, and vascular plants, and over 40,000 fungal and lichen specimens. Four to six thousand specimens are deposited each year, and every specimen that is added to the collection is added to the online database accessible through the website.

## Hours of Operation and Public Outreach

ARIZ is open to the public 8:30 am to 4:30 pm, Monday through Friday, and staff are available to help with plant identifications, access to our extensive botanical literature (including the UA Science Library’s botanical holdings), and training in use of the collections. Campus courses and off-campus tours are frequent and welcome. As part of the UA, Arizona’s Land Grant Institution, ARIZ is particularly dedicated to providing plant identification services and is doing so at an unprecedented rate (nearly 1,000 plants were identified last year), due in part to the ease of emailing photographs. Workshops have been offered at the herbarium as continuing education for the public (for example, grass identification) and future workshops are being planned. For more information, visit [ag.arizona.edu/herbarium](http://ag.arizona.edu/herbarium) or email [herbarium@ag.arizona.edu](mailto:herbarium@ag.arizona.edu)



## Welcome to Claire McLane

At the beginning of the year Claire McLane replaced Anna Van Devender as the Arizona Native Plant Society’s Administrative Assistant. Since then she has been doing a superb job handling the many administrative details of the Society. Claire is a second-generation Tucsonan, with a strong connection to the Sonoran Desert and culture. She received her B.A. from Prescott College in Cultural Regional Studies, focusing on the U.S./Mexico border region. Claire is now a full-time mom of a dynamic little boy, and she enjoys being outside as much as possible, gardening, photographing, and writing. Thank you, Claire, for keeping the Society on an even keel.

