The Rocky Mountain Herbarium

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The Rocky Mountain Herbarium (RM) is the largest facility of its kind between Saint Louis and the West Coast. Rich in material from throughout US, Canada, and northern Europe, it is the largest collection of Wyoming and Rocky Mountains plants in the world and reflects the region's biological diversity and evolutionary history. It has been enriched over the past 40 years by an unparalleled inventory program involving 50 floristics graduate students, most of whom have become educators or researchers at state and federal agencies or environmental companies. The studies covered most state and federal lands in Wyoming, Colorado, and northern New Mexico, but also major portions of Montana and Idaho and parts of eight adjoining states. With help from staff and associates, the number of new collection exceeds 650,000. The RM, U.S. Forest Service National Herbarium[1], and the W.G. Solheim Mycological Herbarium contain more than 974,600 specimens and an additional 300,000 await mounting. Based on the number of collections, it ranks 15th in the nation of 641 herbaria, 75th in the world of 2,962 herbaria. Also at UW is the A.A. Beetle Grass Herbarium with over 30,000 collections (Ecosystem Science and Management). Thus, holdings at UW exceed 1 million accessioned specimens. The RM database contains more than 850,000 entries and 140,000 specimen images[2], the latter facilitated by collaboration with UW Libraries staff. This treasure trove of primary information, with a mapping function, is used extensively by the scientific community, state and federal agencies, and the public. Our informatics program is part of a regional and national consortium. In the last 20 years alone, the RM has received more than $1,670,000 in mostly federal funding (84 projects) for graduate student education and specimen acquisition, processing, curation, databasing, and imaging. This has led to the employment of over 300 undergraduates, many of whom have been in the internship program. Our studies have vastly increased knowledge of rare plants. Fieldwork completed during the 1990s in Colorado, Idaho, Utah, Washington, and Wyoming resulted in the inventory of 79,391 mi^2 of state and federal lands. Most importantly, 414 species of conservation concern were documented at 1,458 sites; most of these sites of occurrence were new. Additionally, projects completed during the first decade of the 2000s in Arizona, Colorado, Idaho, Kansas, Nebraska, New Mexico, Oregon, South Dakota, Washington, and Wyoming resulted in the coverage of an additional 89,363 mi^2. During this period, 430 plant species of conservation concern were documented at 1,678 sites. As many of the taxa collected during the 1990s had been removed from Natural Heritage lists prior to 2000, this is even more remarkable. This vast increase in knowledge has influenced the removal of many potential or proposed species from the Federal Threatened and Endangered Species List. This work has been done in conjunction with the Wyoming Natural Diversity Database and other Natural Heritage Programs in the region.

The RM Volunteer program, established last year, has contributed more than 5,000 hours of service and we continue to add participants.

The RM continues to serve a critical role in providing plant identifications to the public, UW students and faculty, and state and federal agencies. We work closely with these agencies in documenting the introduction and spread of invasives and noxious weeds throughout the region. The Curator is a coauthor of the *Weeds of the West*. We assist the Wyoming Game and Fish Department and the Veterinary Lab with cases of wildlife and livestock poisoning.

We provide material for use in courses, including plant taxonomy, plant ecology, and general biology, and guide tours for K-12 classes in coordination with Berry Biodiversity Conservation Center, students in UW courses, and the public. We work with UW Extension in conducting workshops and field trips for the public on plant identification.

In addition to education and service, the RM, with the associated branch of UW Libraries (>5,000 printed volumes, 4,600 microfiche titles), serves a major role in research. It contains primary material that supports the writing of popular guides and scholarly works on plants identification, including the floras of Rocky Mountain National Park, the Medicine Bow Range, the Black Hills, Wyoming, and Montana. Staff and associates have described many new species and the RM is a repository for >5,900 type specimens on which new species are based. We have published numerous taxonomic and systematics treatments of genera in the sunflower, carnation, and parsley families of western US and the pineapple family of South America. These treatments are based on morphological and anatomical studies of herbarium specimens and living material, but may also include analyses of chromosome number and behavior, flavonoid chemistry, and chloroplast DNA. We have contributed treatments to the floras of California, Oregon, New Mexico, Missouri, and the Great Plains. For many years the past Curator served on the Board of Directors for the

Flora of North America (FNA) project and the RM is a center for regional review. We have also contributed numerous FNA treatments. Thus far, 20 of 30 volumes have been published by Oxford University Press (12,493 pp.). Upon completion in 2020, it will contain identification keys, descriptions, and illustrations of more than 22,000 species. In conducting research through the years, we have worked at many herbaria in the New World and have borrowed for study, several thousand specimens from all the major collections in North America. Likewise, tens of thousands of specimens from RM have been loaned for systematic study as well.

[1]The U.S. Forest Service National Herbarium was founded in Washington DC in 1911 by William A. Dayton, in 1970 it was moved to the Rocky Mountain Forest and Range Experiment Station in Fort Collins, Colorado, and in 1982 was transferred to the University of Wyoming on indefinite loan.

[2]**Below**, specimens of Rocky Mountain fringed gentian (*Gentianopsis detonsa* var. *elegans*). Compare the quality of the actual plants, one collected by Aven Nelson in 1900, the other by Laura E. Lukas in 2007. The dry climate of Laramie is ideal for preservation, and storage in closed cabinets prevents flowers from fading significantly. The specimen by Lukas was mounted on standard heavy-weight archival paper (100% rag, 11.5 × 16.5 inches). Included are specimen label (lower right), accession number with RM identifier (lower left), and barcode (upper right). The red "db" next to the Lukas label indicates the sheet was databased. The barcode links specimen image to label entry in RM Database (www.rmh.uwyo.edu). For an informative exercise, go the website and enter Gentianopsis, detonsa, elegans, 420+ specimen records appear, many with images (by clicking on the image it can be enlarged five times). The Google map shows the coarse distribution of the species. By clicking on the map several times, it enlarges and the collection sites resolve. Click on a square and the label data appear on the right. If you choose not to enter a scientific name, a polygon can be used to circumscribe an area, then by hitting "search specimens," specimen records of all species appear in sets of 100.