

# **CONSTRUCTION OF A COMPREHENSIVE HERBARIUM DATABASE FOR GRASSES (POACEAE) FROM EASTERN WYOMING AND WESTERN SOUTH DAKOTA**

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## **ABSTRACT**

This report documents the construction of a comprehensive database for essentially all grass specimens collected from western South Dakota and eastern Wyoming. We have included data from 15 herbaria, with the largest contributions from the University of Wyoming, Black Hills State University, and South Dakota State University. The total number of specimens observed was 10,253 representing 208 species.

## **Keywords**

Herbarium, database, Black Hills, Great Plains, grasses, Poaceae

## **INTRODUCTION**

The flora of the Black Hills (including the Bear Lodge Mountains of eastern Wyoming) is unique, with elements of the eastern deciduous forest, the Great Plains, the boreal forest, the Rocky Mountains, and the southwestern United States (Van Bruggen, 1996). According to the Atlas of the Flora of the Great Plains (Great Plains Flora Association, 1977) there are at least 128 species in the Black Hills that are disjunct by 300 miles or more. There are also apparently a large number of hybrids that have yet to be studied (e.g. Schnabel and Hamrick, 1990; Fassett, 1945). The Black Hills/Bear Lodge Mountain region is an obvious feature when observed on the ecoregion province map by Bailey et al. (1994). The density of globally rare G1 to G3 species in the Black Hills is 2.5 times greater than anywhere else in the Great Plains (Ostlie et al., 1997). Samson et al. (1998) reported that the Black Hills and surrounding grasslands in South Dakota and Wyoming are a priority landscape of biological significance. Unfortunately, "basic floristic information is still lacking for...the grasslands of

Montana, Wyoming, Colorado and the Dakotas” (Great Plains Flora Association, 1986). The grasses of the Black Hills, Bear Lodge Mountains and the surrounding region are relatively unknown as is evidenced by the distribution maps for numerous widespread species indicating their absence in our region (Flora of North America, 2003).

Grasses (Poaceae = Gramineae) are the most important group of plants on the planet by nearly any measure including ecological and economic value. World-wide, there are an unknown number of species, but estimates from 7,500 to 10,000 species are common. Grasses inhabit nearly any environment and are especially important because of their predominant role as foods. About 70% of the cultivated land is planted in crop grasses and over half of the calories consumed by humans are from grasses (Judd et al., 1999).

A major obstacle to the study of the flora of eastern Wyoming and western South Dakota is the distribution of specimens, as they are distributed in a number of small herbaria, often in locations that are frequently neither well known nor accessible. No other herbarium in the region has a web accessible database. Our goals in implementing this project include creation of a database of all grass specimens from western South Dakota and eastern Wyoming including the Black Hills & Bear Lodge Mountains, to include all available label information, and to make the data available in user friendly form to all interested persons via the World Wide Web. We anticipate that this database will serve as a baseline for future studies.

## MATERIALS AND METHODS

An herbarium is a collection of dried plants that are mounted, labeled, and systematically arranged for use in scientific study. The labels of modern herbarium specimens usually contain the following information: family, genus, specific epithet, subspecific designation (if applicable), authority, country, state, county, locality description, date of collection, elevation, township, range, and section (subsection if available), habitat description, collector, collector number, herbarium, and herbarium accession number. The herbaria listed in Table 1 were visited. Grass specimens from the study region were removed from cabinets, the identification was confirmed, updated or corrected, the data were entered into the database, the entries were verified, and the specimens were re-filed. Current plant species names were used according to the USDA plant database (<http://plants.usda.gov/>).

Quality control is a major concern when managing a database. All data entries were verified, frequently by another member of the team to allow “fresh eyes” to check for errors. The complete database was proof read for typographical errors. One member of the data entry team checked the data to ensure that the habitat and locality data agreed.

Unfortunately, not all specimen labels have adequate information, especially for plants collected prior to the 1960s. We have made every reasonable attempt to georeference locality data using paper and electronic maps and geographic literature (e.g. GNIS at <http://geonames.usgs.gov/>) to correct and enhance the

locality data. Longitude and latitude data for most of the specimens have been determined using the program TRS2LL (<http://members.cox.net/azregion/trs/trs.htm> or [www.geocities.com/jeremiahobrien/trs2ll.html](http://www.geocities.com/jeremiahobrien/trs2ll.html)).

The database has been modeled after the system in use by the University of Wyoming (RM). It includes a front-end for data entry using Microsoft (MS) Access and a backend consisting of three dBase IV files. The advantages of the system are accuracy and ease of data entry, large data capacity (nearly 500,000 specimens are in the current RM database), and automatic addition of new specimens to the database as labels are prepared.

The MS Access front-end provides a form for easily entering the data. The use of the form greatly reduces the number of typographical errors in the database by enforcing the use of predefined taxon names and authorities. This is accomplished by referring to look-up tables of binomials and trinomials of taxa present in the region. The three dBase files in the backend include the actual data file, a family file, and a scientific name file. The latter are used as the look-up tables. Furthermore, the use of dBase files allows us to use two dBase scripts. One of these sorts the data and the second converts Township, Range, Section (TRS) data into Latitude and Longitude (LL) data. The use of dBase files also facilitates the printing of labels using P-Label software (<http://www.flmnh.ufl.edu/herbarium/pl/>).

## RESULTS

Numbers of specimens from the herbaria studied are included in Table 1.

**Table 1. Number of grass specimens from western South Dakota and eastern Wyoming in herbaria with significant holdings of grasses from the study area.**

Herbarium	Number of Specimens
Badlands National Park	74
Black Hills State University	2623
Dakota Wesleyan University	201
Devil's Tower National Monument	163
Jewel Cave National Monument	72
Milwaukee Public Museum	275
Mount Rushmore National Memorial	17
South Dakota State University	1715
USDA Forest Service, Custer, SD	93
USDA Forest Service, Newcastle, WY	69
USDA Forest Service, Spearfish, SD	70
USDA Forest Service, Rapid City, SD	109
University of South Dakota	855
University of Wyoming	3759
Wind Cave National Park	158
<b>Total</b>	<b>10,253</b>

We observed a total of 10,253 specimens of 208 species of grasses from the study area, the majority of which were located at the University of Wyoming, Black Hills State University, or South Dakota State University. An online version of the database is available at <http://www.bhsu.edu/artsscience/asfaculty/mgabell>.

## DISCUSSION

Previously Rydberg (1896) reported 72 grass species in the Black Hills, while McIntosh (1931) listed 142 species from the same area. Over (1932) indicated that there were 174 grass species from the state of South Dakota. Van Bruggen (1996) stated that there were 29 additional species, (for a total of 203 species) from the state. We report that from our study area of all counties west of the Missouri River in South Dakota and Crook and Weston Counties of Wyoming, there are 208 species of grasses.

This project has provided a readily available and user friendly database to allow a better understanding of which grasses are present (or absent) in the region, where they are distributed, the dates of first and last collection, frequency of collection (implying conservation status) and type of habitat. The database includes native and introduced species (including weeds) that can be used by researchers, land managers, weed control officers, and the general public.

Due to the ephemeral nature of electronic media, (Besser, 2000; Lawrence, 2000) copies of the database in print and electronic form have been placed into the BHSU Herbarium and special collections section of the Black Hills State University Library.

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