Sample Application

2007 National Leadership Grants for Museums

Planning Grant

Denver Botanic Garden
Denver, CO

Denver Botanic Gardens and Partners: An On-line Herbarium for Rocky Mountain Flora

Abstract

Lead applicant, AAM-accredited Denver Botanic Gardens, and the herbaria at partner institutions Colorado State University, the University of Colorado, and the University of Wyoming seek to plan the creation of a thematic, regional on-line herbarium for the express purpose of pooling information resources related to the flora of the southern Rocky Mountain West. Together these four herbaria hold approximately 1.3 million preserved botanical specimens for the function of *ex-situ* research and conservation. At present there is no simple, streamlined method for researchers, whether professional scientist or volunteer botanist, to ascertain the holdings of regional herbaria. A virtual Rocky Mountain herbarium will address this need by providing a single entry-point to specimen data, including digital images of specimens, in order to foster the more efficient comparison of plants from many parts of the world, especially from the Rocky Mountain region and like-climates. The digitization component will also reduce the amount of physical handling required to utilize fragile, historical specimen sheets in research.

The audience for a project of this nature is vast in scope and includes professionals within the field of botany and horticulture as well as individuals from the broad community. As public institutions, Denver Botanic Gardens and the project's university partners have a responsibility to ensure easy and complete access to information and historical holdings. Pooled data will supply invaluable information to curators, taxonomists, conservationists, scientists, ecologists, horticulturalists, educators, and general visitors.

Information sharing among arboreta and other cultural institutions has become increasingly important in order to maximize the impact of professional research, staff, and funding. This collaborative planning project will look to current efforts and models and adapt them to better fit a museum/university partnership. Chicago Botanic Garden's collaborative work in developing *vPlants: A Virtual Herbarium of the Chicago Region* and the nationally-focused *PlantCollections*, will provide valuable insight. A primary goal is to plan for a southern Rocky Mountain virtual herbarium which houses interoperable data that can be easily integrated with national data sharing efforts.

This collaborative planning project is scheduled to commence on November 1, 2007 and end on October 31, 2008. At the close of the period, a comprehensive plan for digitizing selected herbarium sheets and merging data into one on-line resource will be ready for implementation. To reach this outcome, planning activities will include:

- Outlining current database characteristics for each organization, including database structure, content and current data portability;
- Establishing a relationship with Chicago Botanic Garden and *PlantCollections* administrators to ensure product development falls in line with required data and image specifications;
- Visiting an imaging site, such as New York Botanical Garden, to witness best practice in scanning and to evaluate equipment;
- Identifying necessary equipment required to create images to industry standard; and
- Involving the Collaborative Digitization Program, also located in Denver, in process overview.

Upon project conclusion, partner institutions will indicate a greater knowledge of individual databases as well as best practice for portability and interoperability of data. When the ultimate goal of creating the online herbarium focused on the Rocky Mountain region is created, users from all arenas, scientist to hobbyist, will report a measured increase in ease of access to desired specimen information.

Narrative

1. Assessment of Need

In keeping with its stated mission *to connect people with plants, especially plants from the Rocky Mountain region and similar regions around the world*, Denver Botanic Gardens (DBG) has identified the need for an on-line digital resource that shares data about regional flora with a wide public for the purpose of education, information-sharing within related disciplines, and lifelong learning. To this end, DBG has initiated a collaborative effort to create the first on-line herbarium with a specific focus on the southern Rocky Mountain West.

The audience for a project of this nature is vast in scope and includes professionals within the field of botany and horticulture as well as individuals from the broad community. As public institutions, Denver Botanic Gardens and the project's university partners have a responsibility to ensure easy and complete access to information and historical holdings. Pooled data will supply invaluable information to curators, taxonomists, conservationists, scientists, ecologists, horticulturalists, educators, and general visitors.

This joint planning endeavor aligns with IMLS Building Digital Resources purposes, and as stated in the published guidelines for that program, this Collaborative Planning [for Building Digital Resources] project is designed to:

- Plan the digitization, preservation, and aggregation of [digital] content from the herbarium archives of Denver Botanic Gardens, Colorado State University, the University of Colorado, and the University of Wyoming;
- Prepare the development and dissemination of new tools to enable libraries and museums to effectively manage, preserve, present, and/or use digital resources; and
- Increase community access to herbarium resources through innovative approaches and/or improved practice.

Specifically, Denver Botanic Gardens and partners seek to improve access to content in their respective herbaria and provide a large set of data for national and international audiences. An herbarium, a collection of dried plants mounted, labeled, and systematically arranged for use in scientific study, provides a wealth of information to researchers, whether the professional scientist or the leisure-learning investigator. As outlined by the Kansas State University Herbarium on the entry-page to their virtual herbarium: "The herbarium plays a central role in the study of plant diversity. It allows comparison of plants from many parts of the world, from related groups, from different habitats and from a given area over time. It provides material for fundamental descriptions of plant form, microscopic study of surface features or pollen grains, chemical analyses of leaves or flowers, and genetic (DNA) studies. The specimens are also of general reference value to workers wishing to identify unknown plants or learn more about the distribution and variation of particular species." (http://www.k-state.edu/herbarium/about.html). Denver Botanic Gardens, together with the herbaria at Colorado State University, the University of Colorado, and the University of Wyoming, has identified the need to expand the impact of the typical herbaria resources by pooling resources in order to develop a comprehensive virtual herbarium which concentrates on the flora of the southern Rocky Mountain areas.

Collaborative efforts across the nation provide impetus and initial models Denver Botanic Gardens and its university partners can learn from and expand upon. Current technologies and the favorable reception of educational distance-learning paradigms create a welcoming environment for an on-line repository of

data such as the planned herbarium for Rocky Mountain flora. To date, no on-line resource with the thematic focus on this diverse geographical region exists. The arts and humanities have led the way with on-line information sharing. Like the Library of Congress American Memory Project, the online herbarium for Rocky Mountain flora will focus on "serving the public as a resource for education and lifelong learning."

Select arboreta and other institutions do stand out among their peers for achievements in the advancement of information sharing using the Internet as a mechanism for content delivery. The New York Botanical Garden's William and Lynda Steere Herbarium hosts a virtual herbarium which highlights vascular plants as well as the institution's bryophyte (nonvascular plants comprising the true mosses and liverworts) and fungal collections. This comprehensive resource does include regional specimen catalogs, but its North American catalog does not focus comprehensively on the mountainous regions of the West. The Steere's virtual herbarium highlights Intermountain Flora, Invasive Plant Species of the U.S., and North American Gymnosperms (plants/trees commonly thought of as "evergreen"). A Rocky Mountain collaborative herbarium would clearly complement this current resource.

An exemplary model for regional collaboration exists in *vPlants*: *A Virtual Herbarium of the Chicago Region*. Participating institutions in the IMLS-funded project include The Morton Arboretum, The Field Museum and the Chicago Botanic Garden. Supporting partners consist of: the Chicago Academy of Science, the Illinois Natural History Survey, the Institute for Museum and Library Services, and the Chicago Wilderness Consortium. The emphasis for this initiative is on the Great Lakes region of the north central United States, including counties in four states: Illinois, Indiana, Michigan, and Wisconsin. Just as in the Rocky Mountain West, the multi-state focus area for *vPlants* "shares a unique set of physiographic (relating to physical geography) and floristic (relating to plant life) features that were defined in many ways by the glacial history of the area." (http://www.vplants.org/chicago.html). Currently the *vPlants* site contains data for 72,000 plant specimens in addition to supplementary information provided to assist the layperson in understanding and finding specific information.

Lastly, and perhaps most importantly, with adequate planning for the Rocky Mountain virtual herbarium, steps can be taken at the outset to ensure compatibility with specifications outlined by Chicago Botanic Gardens and partners in *PlantCollections: A Community Solution*. This forward-thinking collaboration was the brain-child of Chicago Botanic Gardens, coordinated with the American Public Gardens Association (APGA, formerly the American Association of Botanical Gardens and Arboreta) and its subsidiary membership group, the North American Plant Collections Consortium (NAPCC, of which Denver Botanic Gardens is a member for its *Quercus* collection); and funded by an IMLS National Leadership Grant. As stated in the successful Chicago Botanic Garden National Leadership grant application which also identified the need for regional, national, and international information sharing:

> *The fundamental need for a database linking application that can be queried collectively and produce collated reports is recognized by NAPCC curators and scientists nationwide. In fact, a September 2004 NAPCC task force report quoted Dr. Peter Raven, director of the Missouri botanical Garden, as saying: ". . .[NAPCC] need[s] to develop an efficient computer-based system for recording the holdings of the gardens, and preferably the gardens throughout the world.*

> *Without knowing who has what . . . the maintenance and assembly of collections cannot be efficient, and in fact most of what botanical gardens do is wasted or replicated effort, unknown to others, and not generally available."* (pages 1 and 2, *Chicago Botanic Garden Institute of Museum and Library Services National Leadership Grant: Plant Collections*).

Denver Botanic Gardens and partner institutions can coordinate with *PlantCollections* administrators to establish a database with a regional focus on Rocky Mountain flora that can be easily integrated with the larger *PlantCollections* effort.

The consortium of institutions for the Rocky Mountain virtual herbarium will include the following partner profiles and will initially emphasize the Southern Rocky Mountain Region outlined by the Vascular Flora of the Rocky Mountain Region initiative. (This group of collaborators is developing an interactive key for the identification of plants. There is no plan to create an on-line herbarium within this NSF-funded project.) Included in the geographical area are: all of Colorado, nine counties in southern and eastern Wyoming, and eight counties in north-central New Mexico.

Each of the partners already boasts large regional and national audiences and diverse users. The present reach afforded by on-line access is significant, as represented by the 120,000 hits/pageviews on respective partner research websites. Undoubtedly, the opportunity for increasing access to information and augmenting knowledge for the end user exits, especially as the number of requests from international scientists continues to increase. In addition to current on-line services, DBG and its university partners provide on-site assistance as well. Collectively, over 4,000 on-site visitors in 2006 benefited from the information held at the respective herbaria, whether through a tour of the facility or by utilizing identification services. This growing number does not include the numerous telephone requests from researchers for data regarding holdings or the physical loans of specimen sheets. Each of the partner institutions loans specimens for research purposes. The virtual herbarium will create a resource which will limit the need for the transport of fragile specimens across the United States or to other countries. Researchers will be able to more accurately identify specimen sheets prior to requesting items for shipping. For instance, clear, accessible images and specimen data can assist investigators in determining whether a plant has certain flower or fruit features for sampling, etc.

Partners in the collaborative planning project include:

Colorado State University Herbarium – http://herbarium.biology.colostate.edu
The Colorado State University Herbarium is the third largest collection of plants and the oldest herbarium in the southern Rocky Mountain region and has an excellent representation of the Colorado Flora. It serves as a regional center for plant systematic research and receives about four hundred visitors per year. The CSU Herbarium contains approximately 75,000 specimens of vascular plants, primarily from Colorado. At present 50,000+ specimens exist in the herbarium's database and the entire collection is in the process of being computerized.

Denver Botanic Gardens - http://www.botanicgardens.org/pageinpage/herbaria.cfm or http://www.botanicgardens.org/pageinpage/kathrynkalmbachherbarium.cfm
AAM-accredited Denver Botanic Gardens is home to both the Kathryn Kalmbach Herbarium (KHD) of vascular plants and the Denver Botanic Gardens Herbarium of Fungi. Together the herbaria contain over

64,000 preserved and documented specimens, of which some 12,000 specimens are highlighted on-line. Some records contain digital images for review on-line as well. The Kathryn Kalmbach Herbarium originated in 1943 as a project of the Colorado Forestry and Horticulture Association. The KHD became part of Denver Botanic Gardens in 1959, with Kathryn Kalmbach as its first curator. The DBG Herbarium of Fungi represents more than 35 years of collecting in the Rocky Mountain region and includes more than 1,700 species within approximately 250 genera.

Rocky Mountain Herbarium, University of Wyoming - http://www.rmh.uwyo.edu/
This prominent herbarium was founded in 1893 and includes the National Herbarium of the U.S. Forest Service and the Wilhelm G. Solheim Mycological (dealing with fungi) Herbarium. The holdings contain the largest collection of Rocky Mountain plants and fungi in existence. It currently ranks 17th in the nation with over 719,000 specimens in its database (with more than 800,000 accessions total and a backlog of 330,000 collections in various stages of processing) and is the largest facility of its kind between St. Louis, Missouri and Berkeley, California.

University of Colorado Herbarium – http://cumuseum.colorado.edu/Research/Botany/
The University of Colorado Herbarium presently houses approximately 500,000 specimens including 265,000 vascular plants, 115,000 bryophytes, 95,000 lichens, and 25,000 algae and fungi. The Herbarium contains the most comprehensive collection of Colorado plants in the world as well as outstanding collections from the Rocky Mountains, arctic North America, the Caucasus and Altai Mountains of Russia, the Himalaya, New Guinea, Australia, and the Galapágos Islands. In addition to the plant collection, the Herbarium houses an extensive botanical library of books, journals, and reprints. Together, the collections and library represent an outstanding research center devoted to the botanical exploration of Colorado and the Rocky Mountain region, monographic work of selected plant groups, and the conservation of biological diversity.

Together the institutions house over 1.3 million specimens which are not catalogued in one central location for reference. The need to maximize the impact of the housed data and the research expertise within the herbaria of Denver Botanic Gardens, Colorado State University, the University of Colorado and the University of Wyoming is pressing. Again, as stated in the winning *PlantCollections* proposal, "there is a growing interest and appreciation for the possibility of sharing data between institutions, especially as it relates to core programs of curating collections and *ex situ* conservation, especially at a time when technological advances (both hardware and software) make such data sharing more feasible." (page 4, *Chicago Botanic Garden Institute of Museum and Library Services National Leadership Grant: Plant Collections*). Presenting information to others in the discipline strengthens the ability of our nation to accurately investigate topics within the botanical and horticultural field. Duplication of effort is subsequently avoided.

References for additional information on-line:

American Public Gardens Association – *PlantCollections* overview
http://www.publicgardens.org/plantcollections.aspx

Chicago Botanic Garden Research Resources
http://www.chicagobotanic.org/research/resources

Distributed Generic Information Retrieval (DiGIR)
http://digir.net
http://sourceforge.net/projects/digir

Kansas State University
http://www.k-state.edu/herbarium/

New York Botanical Garden's William and Lynda Steere Herbarium
http://sciweb.nybg.org/science2/VirtualHerbarium.asp

vPlants: A Virtual Herbarium of the Chicago Region (The Morton Arboretum, The Field Museum and the Chicago Botanic Garden)
http://www.vplants.org

2. National Impact and Intended Results

Audience members for the Rocky Mountain virtual herbarium include representatives from the following constituencies: curators, taxonomists, conservationists, scientists, ecologists, horticulturalists, educators, and general visitors. This project will have great immediate impact on these regional and national/international audiences; and this influence will be further maximized if leveraged through the *PlantCollections* program. As a result of this regional effort related to Rocky Mountain flora, individuals nationally and internationally will enjoy the benefits of information-sharing and access to this geographic-focused herbarium. Researchers will no longer need to contact numerous institutions in the western Rocky Mountain region to determine holdings and relevancy to research, but will be able to access the on-line herbarium which encompasses the most significant collections of flora of the region.

With appropriate planning and investigation, the on-line Rocky Mountain herbarium can build on the work the American Public Gardens Association and the North American Plant Collections Consortium (NAPCC) members accomplished to identify "the Distributed Generic Information Retrieval (DiGIR) system, developed by the Biodiversity Research Center at the University of Kansas (KU) as the optimum method to link institutions, owing to its relative simplicity and economy." (page 5, *Chicago Botanic Garden Institute of Museum and Library Services National Leadership Grant: Plant Collections*).

As stated in the Provider Manual posted on the DiGIR website, "Distributed Generic Information Retrieval (DiGIR) is a client/server protocol for retrieving information from distributed resources. It uses HTTP as the transport mechanism and XML for encoding messages sent between client and server. It is an open source project hosted on Source Forge and is currently in late Beta stage of development. DiGIR was originally conceived to be the replacement for the Z39.50 protocol used in the Species Analyst project, but is intended to work with any type of information, not just Natural History collections. A major contributor to DiGIR is the MaNIS project." (http://digir.net).

Because this Rocky Mountain virtual herbarium project involves a greater number of higher learning institutions when compared to recent like collaborations, the model for partnership will inherently be different from that outlined in the arboreta-focused *PlantCollections*. In addition, the geographic focus on the Rocky Mountain region must take into consideration other regional efforts such as the Vascular

Flora of the Rocky Mountain Region collaboration in order to maximize the dissemination of information and to avoid duplication of effort.

The end result will be that the Rocky Mountain herbarium project will be poised to compile and create a substantial amount of data that is readily compatible with *PlantCollections* and the outlined protocol for taxonomic databasing, DiGIR to the greater public. Currently Denver Botanic Gardens is utilizing the common database system, BG-Base 6.4, for collections management. Phase I *PlantCollections* partners, including the United States National Arboretum and The Huntington Library, Museum and Botanic Garden, also utilize(d) BG-Base, so the successful integration of this application into a larger database system is in the process of being explored, implemented, and evaluated by the *PlantCollections* effort.

A primary focus of the virtual herbarium for Rocky Mountain flora will be the interoperability of data and digital products. Future integration into even larger repositories of information and maximizing the impact of research accomplished will be paramount.

3. Project Design and Evaluation Plan

Denver Botanic Gardens will coordinate the development of the Southern Rocky Mountain virtual herbarium with herbaria at partner institutions Colorado State University, the University of Colorado, and the University of Wyoming. By identifying current regional efforts and outlining how these endeavors fit into a national and international approach to botanical research, a new model for collaboration will be created and new information will be pooled for greater scientific impact.

Project objectives include, but are not limited to:

- Outline current database characteristics for each organization, including database structure, content and current data portability;
- Establish relationship with Chicago Botanic Garden and *PlantCollections* administrators to ensure product development falls in line with required data and image specifications;
- Visit an imaging site, such as New York Botanical Garden, to witness best practice in scanning fragile and irreplaceable herbarium sheets and to evaluate equipment;
- Identify necessary equipment required to create images to industry standard;
- Involve the Collaborative Digitization Program, also located in Denver, in process overview;
- Become member organization of Collaborative Digitization Program to obtain access to services;
- Investigate and apply the IMLS "Framework of Guidance for Building Good Digital Collections":
    - Consider: What implications exist for converting non-digital material to digital format? Are there any copyright issues within institutional collections?
    - Consider: What type of file format is best for anticipated/outlined quality? Will multiple images be created to offer a range in image quality? (TIFF, JPEG, MPEG?)
    - Consider: How will a plan for quality control or dissemination control be put into place?
- Attend IMLS Outcome-Based Evaluation training;
- Develop a comprehensive plan and schedule for partnership herbarium sheet digitization;
- Outline steps required to include additional regional institutions for future efforts.

<u>Timeline for Collaborative Planning Project: November 1, 2007 – October 31, 2008</u>

<u>Months 1-3 (November, 2007 – January, 2008)</u>

- Assess current database structures at each institution;

- Determine commonly collected information at each herbaria and how information fields are populated;
- Consult *PlantCollections* (Chicago Botanic Garden et. al) administrators to ensure compatibility of databases and digital products; identify timeframe of *PlantCollections* progression;
- Consult the Collaborative Digitization Program; assess services available technology resources;
- Consult Peak Creative Media to determine organization's role, if any, as technology consultant;
- Hire part-time employee to assist with above efforts;
- Schedule IMLS-sponsored OBE training; and
- Identify desired outcomes for the planning project and identify indicators; brainstorm the same for the digitization project when executed.

Sample project outcomes:

Intended Project Outcome: A majority of partner institutions will be prepared to move forward with the specimen digitization project for the purpose of creating an on-line virtual herbarium.

Indicator: a) Three out of the four or 75% of the planning partners will report their readiness for the project increased to at least 4 on a 5-point scale b) the number of identified specimens per institutions.

Data Source: Questionnaire for planning project participants.

Intended Project Outcome: After the one-year planning project, participating institutions and interested audiences are better aware of current data sharing standards/protocols and existing efforts for integrating databases.

Indicator: Three out of the four or 75% of the planning partners will report they are "aware" or "very aware" of current industry efforts and protocols after the planning period.

Data Source: Multiple choice survey to planning project participants.

Months 4-6 (February, 2008 – April, 2008)

- Site visits to institutions currently digitizing herbarium specimen sheets;
- Determine best process and identify equipment costs; and
- Evaluate methods for storing electronic data; determine how images can be attached to database records.

Months 7-9 (May, 2008 – July, 2008)

- Investigate web technology to determine how the virtual herbarium for the Rocky Mountain West could be presented through a unified site;
- Continue discussion regarding data transfers and the housing of information (servers); and
- Identify key specimens to be included in initial digitization effort; determine if current digital specimens are acceptable.

Months 10-12 (August, 2008 – October, 2008)

- Outline determined for technology protocols of creation of virtual herbarium;
- Final reports synthesized into single, shared document to be used as guideline for future funding;
- Develop comprehensive plan and schedule for digitization;
- Determine criteria for and possibility of additional regional institution participation; and
- Evaluate planning process, identifying outputs, outcomes, and indicators.

4. Project Resources: Budget, Personnel, and Management

The on-line herbarium focused on the region of the Southern Rocky Mountains is a planned partnership between the following key players in botanical investigation: Denver Botanic Gardens, the Colorado State University Herbarium, the University of Colorado Herbarium, and the University of Wyoming's Rocky Mountain Herbarium.

Denver Botanic Gardens will manage grant funds, complete required timely reporting, and execute accounting activities pertinent to the spending of grant funds, including distribution to partner institutions. DBG will hire a part-time employee dedicated to the collaborative planning project (see attached job description for Herbarium Intern), coordinate meetings and information sharing, and facilitate the creation of the final plan building the virtual herbarium for Rocky Mountain flora.

As outlined in the Detailed Budget Form, much of the cost sharing will be in the form of Salaries and Wages for staff from the four different institutions. In large part, the IMLS collaborative planning funds will be used to hire a part-time employee at DBG to accomplish and coordinate research and planning tasks, pay technology consultants, and subsidize travel costs associated with the planning project. Funds have been budgeted for two team members to attend IMLS Outcome-Based Evaluation training and a portion of funds requested will also subsidize the purchase of initial equipment, with partner institutions providing the required 50% cost-share for equipment.

Key personnel from each institution are outlined here. (See also Text Responses Document for individual resumes.)

Denver Botanic Gardens

Dr. Anna Sher, Director of Research, Herbaria and Records (RHR), DBG *and* Assistant Professor/Director, Department of Biological Sciences, University of Denver.
Dr. Sher will provide general oversight to DBG staff and brings a vast amount of federal grant management experience as the Principal Investigator for many projects. Under her direction, the DBG RHR department has conducted multi-year field studies to investigate the control of the invasive species, Tamarisk, including the re-vegetation of tamarisk land. Funding is provided in part by the Environmental Protection Agency and the Bureau of Reclamation. Additional activities are supported by collaborators/funders including the Colorado office of the Bureau of Land Management, the Center for Plant Conservation, and the National Fish and Wildlife Federation. For a more detailed overview of current research and conservation efforts, visit http://www.botanicgardens.org/pageinpage/rhrsitemap.cfm.

Additional Staff includes:
Dr. Jennifer Neale, Research Program Manager. Dr. Neale comes to the Gardens with much experience in conservation. Her current research involves long-term monitoring and seed collection for ex-situ conservation of several imperiled Colorado plant species. As a graduate of CU Boulder, she also has held positions within the University of Colorado Museum and Herbarium.

Dr. Janet Wingate, Herbarium Curator. Dr. Wingate has been with the Gardens since 1995, first as Herbarium Manager until 2005, and since that time as Herbarium Curator. Her experience as a professional botanist spans thirty years and has accomplished work funded by the United States Forest

Service, including floristic studies of montane and sub-alpine wetlands, dry montane meadows, and revegetation of plant families: Poaceae, Cyperaceae, and Juncaceae.

Cindy Tejral, Manager of Plant Records. Ms. Tejral holds a M.S. in Public Horticulture and a B.S. in Horticulture. She manages the Gardens' plant database (BG-BASE) for accessions totaling over 15,000 and related mapping efforts (BG-Map), including labeling systems for the institution. Each year she processes more than 3,000 new accessions, assists with research projects and manages volunteers.

Temporary Herbarium Assistant. (See Text Responses Document for job description.)

Colorado State University Herbarium

Dr. Mark P. Simmons, Assistant Professor and Curator of the Herbarium, Department of Biology, Colorado State University. Dr. Simmons has been with CSU since 2001 and has secured and managed numerous fellowships and grants during and prior to this time. Funders include: the National Science Foundation, Bureau of Land Management, the National Geographic Society, and Cornell University. In the year 2000, Dr. Simmons was awarded the *Systematic Biology* Publisher's award for Excellence. In addition, he has been a grant reviewer for the Austrian Science Fund, the Colorado Native Plant Society, and the National Science Foundation, among others. He will oversee the CSU Herbarium's participation in planning for a collaborative on-line regional herbarium.

Additional Staff includes:
Jennifer Ackerfield, Collections Manager, CSU Herbarium. Ms. Ackerfield holds an M.S. in Botany and a B.S. in Botany from Colorado State University with concentrations in systematics and plant identification. She has been managing the CSU Herbarium collection since 1998.

University of Colorado Herbarium

Dr. Tom Ranker, Professor, University Museum and Department of Ecology and Evolutionary Biology and Curator of Botany, University Museum, University of Colorado at Boulder. Interim Director, University Museum, University of Colorado at Boulder, 2006-2007 academic year.
Dr. Ranker has been with the University of Colorado since 1990 and has secured and managed numerous extramural research grants in this time. As PI a variety of multi-year NSF grants, he has accomplished conservation and research work with the more than $317,081 awarded to his efforts (additional awarded funds managed by other institutional partners.) Collaborative efforts include: Linked Databases and Interactive Key for the Vascular Flora of the Southern Rocky Mountain Region and the Origin of the Hawaiian pteridophyte flora. Dr. Ranker will oversee the participation of the CU Herbarium in the planning project.

Additional Staff includes:
Tim Hogan, Assistant Curator of Botany, University Museum, University of Colorado.
Mr. Hogan holds a M.S. in Basic Science and a B.A. in Biology and Physical Geography. He has been with the University Museum as both Herbarium Assistant and in his current capacity since 1991.
He is a regional reviewer for the Flora of North America Project and is part o the Science Advisory Board, Southern Rockies Ecosystem Project.

Nancy D. Lederer, Collection Manager of Botany, University Museum Herbarium, University of Colorado. Ms. Lederer holds bachelor's degrees in both biology and in elementary education. She has

managed the University Museum Herbarium (CU) collection since 1996. During that time she has published often about the flora of Colorado.

University of Wyoming's Rocky Mountain Herbarium

Dr. Ronald L. Hartman, Curator/Director, Rocky Mountain Herbarium, University of Wyoming. Dr. Hartman' research interests include the flora of the Rockies and he has been Principal Investigator on more than 50 major floristic studies in the region. An additional six are in progress and three are planned for 2007. He is responsible for databasing over 700,000 specimens. He sits on the Board of Directors for the Flora of North America and is the Rocky Mountain Regional Coordinator. He has published numerous articles, including many on *Caryophyllaceae.*

Schedule of Completion : November 1, 2007 – October 31, 2008

Activity	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT
Database Assessment												
I.D Needed Information												
Consult CDP & Other Orgs												
Hire p-t Employee												
Schedule Training & Plan OBE												
Site Visits												
I.D. Equip & Methods												
I.D. Web Technology												
I.D. Servers & Specimens												
Determine Protocol												
Synthesize Guidelines												
Complete Plan												
Determine Criteria												
Evaluate												