

## Narrative

### 1. Statement of Need

**Background and Rationale** - In 2005, the Institute of Museum and Library Services (IMLS) "Museums for America" program awarded a 2-year grant to the botany department of the **San Diego Natural History Museum (SDNHM)**. That grant (called "Increasing Access to California's Botanical Heritage") was for the purpose of electronically capturing the specimen label data from historic San Diego county plant specimens housed in SDNHM's own collection. It included the task of assigning geographic coordinates (latitude and longitude and confidence values) to those San Diego county specimen records that previously only had descriptive text indicating where they were collected. Without such coordinates, historic specimens cannot be incorporated into computer-based geographic analyses such as mapping (GIS) and biodiversity analyses, and useful information about our floristic past is lost.

SDNHM has completed the databasing, and is finishing assigning coordinates (a process known as "georeferencing") to its own collections from San Diego county. However, there are additional specimens collected historically in San Diego county that are housed in a number of different institutions around California and those data have not yet been combined with the SDNHM data so that they can be analyzed as a single dataset. Last year, SDNHM took the step of joining the **Consortium of California Herbaria (CCH)**. The CCH serves as a gateway to information for California vascular plant specimens that are housed in herbaria throughout the state. In October 2007 the CCH database included data representing nearly 888,000 specimens, all searchable through a single interface. CCH was originally developed around botanical collections from University of California herbaria, but now includes collections from sixteen institutions that are accessible at <http://ucjeps.berkeley.edu/consortium>. Through this partnership, SDNHM not only shared with CCH the georeferenced data that were generated by the original MFA grant (thus ensuring an additional method of delivering the data to the wider public) but acquired over 33,000 additional data records representing specimens collected in San Diego county that are housed at various other California herbaria. These data records are not duplicates of specimens in SDNHM's own collection and they go back even farther in time (to 1820) than do the SDNHM collections (whose earliest date back to 1874). Acquisition of these data have increased the size of the database of San Diego county plant specimens maintained by SDNHM from about 70,000 to almost 93,000.

These combined data from SDNHM and CCH are being used in a project (funded by a local charitable foundation) that is examining possible changes in San Diego's flora going back to the mid 1800s, and the influence that regional climate change may be having on diversity, phenology, and spatial distribution. The problem is that over 24,000 of the San Diego county data records from CCH (approximately three-quarters of their records) do not include geographic coordinates, and so cannot be included in this (or other) research projects.

**Need** - The immediate need that would be fulfilled by this proposal is to take the georeferencing task begun in the original MFA grant to its logical conclusion by completing the georeferencing of all the available San Diego county plant specimens, including those recently acquired from the CCH. If the proposed project is funded, the quality of the San Diego county data from the CCH would be improved and subsequently shared with a wide audience, those data would become available for spatial analysis for the first time, and SDNHM would be fulfilling key aspects of its mission and strategic plan (see below). The broader, long-term need that this project would fulfill is to provide scientifically accurate, specimen-based botanical data that could be used to study the county's invasive, rare or endemic plants, or could be incorporated into regional conservation planning, or sound land management.

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Mission Statement and Strategic Goals - The mission of the SDNHM and its **Biodiversity Research Center of the Californias** (BRCC) includes the following: conducting collections-based research; preserving specimens and associated information that document our region's natural history and biodiversity; providing scientific knowledge about the natural history of our region; promoting an understanding of the evolution and diversity of southern California; and laying the scientific foundation for SDNHM's operation and programs.

The SDNHM Strategic Plan 2002-2012 (summary attached) includes six Key Result Areas (KRAs), each of which has measurable objectives. KRA 2 states that SDNHM will become established as a leading research institution and forum for scientific discussion and cooperation in and about our region. Objectives focus on guiding the research program as well as strengthening the infrastructure that supports basic and applied research. The objectives under KRA 2 that will be directly addressed by the proposed project include the following:

### **OBJECTIVE 2.3 (Bioinformatics system)**

Create an information system to support stewardship of collections and research priorities.

#### **STRATEGIES**

- 2.3.1 Implement an upgraded system for internal management of all collection data with a phased implementation schedule
- 2.3.2 Achieve at least 85% completion of data capture for existing paleontology, botany and marine invertebrates collections and 95% data capture for library collections.
- 2.3.3 Implement web-based data capture systems to facilitate field operations
- 2.3.4 Implement web-based accessibility of specimen data
- 2.3.5 Implement an integrated network of databases with key partners and affiliates

With this project, SDNHM will be expanding the web-based accessibility of data and is integrating data with key partners and affiliates.

Additionally, this project will support several strategic objectives as stated in Objective 2.4 to strengthen the infrastructure of the BRCC:

#### **STRATEGIES**

- 2.4.1 Determine and implement an effective organizational structure to support research priorities and stewardship of collections
- 2.4.2 Improve visibility of BRCC
- 2.4.3 Develop training and educational opportunities
- 2.4.4 Improve quality of collection care and management
- 2.4.5 Establish scientific graphics and publications unit
- 2.4.6 Obtain and expand research facilities and equipment
- 2.4.7 Secure endowment and other funds to support infrastructure

Financial support through this project will enable SDNHM to increase the scientific value and the accessibility of the existing botanical collection data. This will in turn support research priorities and stewardship of collections and will improve the visibility of BRCC. The quality of collection care and management will be improved because the data records will be available electronically and accessible via the web.

For 125 years, the SDNHM has served as a leader for the preservation and interpretation of scientific specimens that document the biodiversity of our area. SDNHM has an extensive specimen collection, scientific knowledge, educational expertise, and exhibition capabilities that make it a driving force in natural history research. The proposed project increases the museum's capacity for collections-based research and supports the mission of promoting an understanding of the evolution and diversity of Southern California and the peninsula of Baja California. This project will enable SDNHM to increase public awareness of,

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and appreciation for, the biological and geological uniqueness of this region, and it will directly impact informed decision-making about environmental issues and community-driven applications, such as land use planning.

Development of Strategic Plan - With the completion of the new building in 2001, the Museum reached a major milestone in the implementation of its previous ten-year plan (1992-2002). A successful \$46 million capital campaign allowed the expansion of our facility from 60,000sq.ft. to 159,000 sq.ft., significantly improving the environment and resources for our programmatic efforts in research, education, exhibits, and collections stewardship. As a final objective in the previous plan, the SDNHM initiated a new 10-year strategic planning process in July 2001 that involved over 60 employees and more than 50 community members. The goal of this process was to create a vision and action plan that would guide SDNHM's future operations for the coming decade. \$270,000 in support was received from a San Diego-based private foundation and from the Lucile and David Packard Foundation to fund these planning activities:

- Organization of the 21-member strategic planning team which included representatives of the community, Board of Trustees and museum staff; formation of additional, supporting task forces to obtain needed background information and research (e.g., market research focusing on the cultural community in San Diego).
- Assessments of SDNHM's Strengths, Weaknesses, Opportunities, and Threats (a SWOT analysis) were conducted by several constituency groups, including the Board of Trustees' Public Programs Committee, its Technology Committee, and SDNHM staff.
- Development of SDNHM web site pages to keep museum members and the public informed about the strategic planning process, and to increase communication among staff and planning participants. A \$20,000 grant from the Irvine Foundation was secured to support use of the SDNHM web site as a communications tool for the strategic planning process.
- Determination of six Key Result Areas (KRA) on which SDNHM will focus its operations over the next decade (please see attached summary.)
- Development of measurable objectives for each KRA, and timelines for achieving them; formation of strategies for achieving these objectives; development of action plans for each KRA, along with a description of required resources needed to implement these action plans; and cost/benefit analysis for each action plan, used to assess the feasibility of each plan and prioritize which ones to implement first.

One of the major components of SDNHM's Strategic Plan is KRA 6: Enhancing Financial Stability, which calls for "building a diversified, stable base of support impervious to economic fluctuations, thus ensuring the long-term viability of SDNHM's programs and services." It includes strategies for increasing earned income, such as generating SDNHM's own product line of merchandise inspired by its collections, cultivating corporate support by marketing its facility as a special events venue, and increasing earned income by expanding the research department's environmental monitoring contract activities. These new revenue sources will help fund SDNHM's education, exhibitions, and research.

## **2. Project Design**

Project Goal and Activities - The goal of the proposed project is to increase the scientific value and the accessibility of the botanical specimen database maintained by the SDNHM so that the collections-based data are more readily available for computer-based research, including spatially explicit biodiversity analyses. Such research is an integral component not only of basic scientific research but of applied research, such as that needed for land-use planning by local

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communities.

If funded, the proposed project will retain the Georeferencer hired and trained by the previous MFA grant for an additional 12 months so that she can accomplish tasks including georeferencing, data quality control, data sharing, and cross-checking data previously georeferenced or entered (from specimen label data) by other institutions (Table 1). Capitalizing on the expertise acquired by SDNHM's georeferencing specialist during the previous MFA project will add value to that project, and assure consistency in the quality of the resulting data. Georeferencing protocols will be the same used in the previous MFA-funded project i.e., the manual, computer-assisted georeferencing method developed by the Mountain and Plains Spatio-Temporal Database-Informatics Initiative, known as MaPSTeDI (Murphey et al. 2004). Data will be entered into an existing web-based SQL Server database, using an existing Microsoft Access interface. The botanical specimen database captures 34 fields of data, representing the discipline standards.

Table 1: List of tasks in the proposed project, and the results and outcomes that will follow from completion of the tasks.

<b>Tasks</b>	<b>Outcomes</b>
(1) Georeference all available San Diego county plant specimen records that currently do not include geographic coordinates	<ul style="list-style-type: none"> <li>-increase the number of georeferenced specimen records in SDNHM database from approx 70,000 to over 92,000</li> <li>-improve the quality of the specimen data by adding lat/long, and therefore increase its scientific value</li> <li>-assist other California institutions by georeferencing their SD county specimen data and improving its value with local expertise</li> <li>-create table of standardized SD county placenames with their associated geographic coordinates</li> <li>-increase the amount and quality of <u>historic</u> specimen data for SD county by georeferencing older records than had been previously available (1820s instead of 1870s)</li> <li>-make some SD county plant specimen records available for geospatial analysis for the very first time</li> <li>-increase amount of pre-fire data available for SD county</li> <li>-add value to the original MFA grant by capitalizing on georeferencing experience and applying it to another dataset</li> </ul>
(2) Check quality of geospatial data and correct specimen records if required	<ul style="list-style-type: none"> <li>-provide feedback to participating CCH institutions when problems are detected with specimen records</li> <li>-provide feedback to GNIS to improve and supplement the locality information in their database for SD county</li> <li>-formatting and standardization of geospatial data for SD county plant specimen records will increase scientific value and make them</li> </ul>

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	readily available for incorporation into GIS
(3) Share geospatial data with users, including CCH participants and Plant Atlas project	<ul style="list-style-type: none"> <li>-improve the accessibility of plant specimen data by serving the data online</li> <li>-expand the ways that SD county plant specimen data are made accessible by contributing the newly georeferenced data to the participants in the CCH</li> <li>-expand the online mapping capability of the Plant Atlas project so that CCH data can be visualized</li> <li>-increase the number of georeferenced plant specimen records that can be integrated with the San Diego County Bird Atlas and Mammal Atlas projects</li> </ul>
(4) Verify and cross-check CCH specimen records previously georeferenced by other institutions to correct errors and ensure that geographic coordinates are consistent across localities	<ul style="list-style-type: none"> <li>-improve the quality and therefore the scientific value of data for SD county specimens housed at other institutions</li> <li>-standardize formatting of geospatial information to make it comparable and GIS-ready</li> </ul>

Project Management - Following the previously-funded MFA georeferencing project, the proposed project will be overseen by existing SDNHM staff. It will be managed by the Director of the San Diego County Plant Atlas project, who meets regularly with the Georeferencer, conducts periodic reviews of the georeferencing progress, does spot checks for quality assurance, and prepares progress reports. Scientific oversight and interaction with partner institutions in the CCH will be provided by the SDNHM Curator of Botany. Database maintenance and online mapping capabilities will be handled by the Botany Department's Database Manager. The progress is monitored by plotting the number of records georeferenced each month on a graph.

Outreach - Plans for outreach include "returning" the georeferenced data to the host institution (i.e., to the herbarium that houses the specimens and manages the data that were georeferenced). Through their participation in the CCH the new data can then be shared with a wider audience through their web portal (CCH makes the data available through a single online interface located at <http://ucjeps.berkeley.edu/consortium>). The data will also be made available via the San Diego County Plant Atlas project ([www.sdplantatlas.org](http://www.sdplantatlas.org)). Basic online distribution mapping currently can be performed at the Plant Atlas website (under the heading "Website Tools"). Currently it is only possible to map contemporary data gathered by the Plant Atlas project and historic data from the SDNHMs existing collection; however, if the proposed project is funded, it would become possible to add the capability to select the CCH data for mapping as well.

One of the more exciting ways of sharing the data is through **Google Earth** (a capability that is rapidly growing in functionality and popularity, and did not even exist when the original MFA georeferencing grant was awarded). The Botany Department Database Manager is developing a Google Earth application that will allow users to zoom in to San Diego County, and view the locations of plant species in the SDNHM botanical database. The georeferenced data resulting from the proposed project also would be disseminated using that online application. Lastly, the Plant Atlas Director and Curator of Botany frequently give public presentations to disseminate the results of the project, and explain to stakeholders and users of the information how the proposed project increases the scientific value of museum collections and collections

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data. Progress on the project is also reported in the Plant Atlas electronic newsletter, which is produced quarterly and is available on the Plant Atlas website (under the heading "Project News").

Summary - The development of this project was based on strategic goals for the museum and the BRCC. These goals were established after substantial interaction with community members, not only the general public, but staff of governmental agencies (e.g., San Diego Area Government Council, Cleveland National Forest, US Fish & Wildlife Service), and regional universities; all of these groups are "clients" or potential members of the audience for accurate, extensive research data.

### **3. Project Resources: Time, Personnel, Budget**

Time and Personnel - The proposed project is designed to be completed in 12 months. The team of existing, qualified SDNHM staff leading the project includes:

**Mary Ann Hawke Ph.D., Project Director**, is a plant ecologist with over 15 years experience in project management, field-based scientific research and publication, and environmental education. She currently directs the SDNHM's San Diego County Plant Atlas project supervising 4 employees. Responsibilities on this proposed project include project management e.g., supervising and managing the staff and progress; implementing quality control; communicating with project partners, managing the budget, writing reports. (1.0 FTE; 2 months as SDNHM match)

**Jon Rebman Ph.D., Curator of Botany**, has managed the Botany Department for over 11 years, conducts field-based scientific research, verifies plant identifications, teaches and advises students. He specializes in the floristics of San Diego and Imperial Counties and Baja California (Mexico). He will provide scientific and managerial oversight for the proposed project, and acts as the lead contact with CCH and partner herbaria. (1.0 FTE; 1 month as SDNHM match)

**John Sanborn, Database Manager**, has 6 years of collections-related experience at SDNHM including the design and implementation of the Plant Atlas database and webpages, the online data entry interface, and customized online computerized tools to support the activities of the Plant Atlas staff and volunteers. His role in the proposed project will be to develop and maintain the computer programs and/or protocols required to accomplish the project goals (including creation of the Google Earth application and the distribution mapping on the plant atlas website); maintain the operating system to ensure data integrity, ensure the data are served on the web, and handle data transfers with the CCH. (0.5 FTE; 2 months as SDNHM match)

**Mary Alice Kessler, Georeferencer**, has worked in the SDNHM Botany Department for 4 years. A life-long San Diegan, she has extensive knowledge of the region and a working knowledge of local plants. Responsible for researching San Diego county localities, and assigning point coordinates (lat/long) to plant specimen records in the database based on information written on the specimen label. Performs quality control of specimen data and shares data with CCH. Maintains a table of county place names along with their geographic coordinates. (1.0 FTE; 12 months on requested IMLS funds)

Budget – The proposed project requests \$33,172 from IMLS (to pay 75% of the Georeferencer's salary and benefits) which will be matched by SDNHM with staff salaries. The \$33,750 match from SDNHM will be composed of 25% of the Georeferencer's salary (\$13,200), one month of the Curator's time (\$6040), 2 months of the Project Director's time (\$10,698) and two months of the Database Manager's time (\$5954). Personnel costs are based on actual salaries and fringe benefit levels.

#### **4. Impact**

Products- the products that will result from the proposed project include the following:

- 1) Database of approximately 93,000 georeferenced plant specimen records for San Diego county plant collections that is formatted in a way that makes it GIS-ready;
- 2) Georeferenced San Diego county plant specimen records that will be "returned" to their respective host institution, increasing the scientific value of their data;
- 3) Table of standardized San Diego county placenames with their associated geographic coordinates that can be shared with others;
- 4) Google Earth application for mapping San Diego county plant specimen data, including the data to be georeferenced by this project.

Measurable Results – See Table 1 for a summary.

Long-Term Impact -The proposed project will allow SDNHM to enhance its collections care and management capability as well as expand its capacity to facilitate use of collection specimens and specimen-based data. It will foster the exchange of information and research between SDNHM and other research institutions, universities, conservation organizations, and government agencies. The implementation of this project will also help SDNHM to strengthen its leadership role in the coordination of biodiversity research efforts in the southern California region. This project will fulfill the MFA goals to strengthen the ability of the museum to serve its public more effectively by supporting activities that advance the institutions' mission and strategic goals. Finally, it will expand SDNHM's capacity to engage and serve the community, by supporting its community-based project (the Plant Atlas) and by providing important scientific information that can be used to inform the process of conservation, land use planning, climate change research, pre- and post-fire studies, and other applied uses of georeferenced data.

#### **LITERATURE CITED**

Murphey, P.C., R.P. Guralnick, R.Glaubitz, D. Neufeld, and J.A. Ryan (2004) *Georeferencing of museum collections: A review of problems and automated tools, and the methodology developed by the Mountain and Plains Spatio-Temporal Database-Informatics Initiative (MaPSTeDI)*. *Phyloinformatics* 3:1-29 (<http://www.phyloinformatics.org/abstract.php?id=3>)

## BUDGET FORM - PAGE FOUR

### Section B: Summary Budget

	\$ IMLS	\$ Cost Share	\$ TOTAL COSTS
1. Salaries and Wages	27,643.20	28,124.84	55,768.04
2. Fringe Benefits	5,528.64	5,624.97	11,153.61
3. Consultant Fees			0.00
4. Travel			0.00
5. Supplies and Materials			0.00
6. Services			0.00
7. Student Support			0.00
8. Other Costs			0.00
<b>TOTAL DIRECT COSTS (1–8)</b>	<b>33,171.84</b>	<b>33,749.81</b>	<b>66,921.65</b>
9. Indirect Costs			0.00
<b>TOTAL COSTS (Direct and Indirect)</b>	<b>33,171.84</b>	<b>33,749.81</b>	<b>66,921.65</b>

### Project Funding for the Entire Grant Period

1. Grant Funds Requested from IMLS	40,055.00
2. Cost Sharing:	
a. Cash Contribution	
b. In-Kind Contribution	40,752.90
c. Other Federal Agencies*	
d. TOTAL COST SHARING	40,752.90
3. TOTAL PROJECT FUNDING (1+2d)	80,807.90
% of Total Costs Requested from IMLS	49.00%

\* If funding has been requested from another federal agency, indicate the agency's name:

**Schedule of Completion**  
*(revised July 2007)*  
*San Diego Natural History Museum*

