

**IDENTIFICATION AND CHARACTERIZATION OF RELICT AND UNIQUE
VEGETATION ON THE GRAND CANYON-PARASHANT NATIONAL
MONUMENT**

**A Cooperative Proposal between
Leila M. Shultz
Department of Forestry, Range and Wildlife
Utah State University**

And

National Park Service

BACKGROUND

Created in 2000, Grand Canyon-Parashant National Monument (PARA) encompasses more than 1 million acres of complex and often remote landforms. Situated at the junction of two major ecoregions—each with unique and diverse floras—PARA contains elements of both the Colorado Plateau and the Mojave Desert. Geologic materials ranging from deeply dissected sandstones characteristic of the Grand Canyon to coarse volcanic intrusions produce a spectacular array of landforms and habitats. Related to the highly variable climatic conditions of the major ecoregions and to the heterogeneous landscape, PARA supports a diverse flora, with vegetation ranging from Ponderosa pine forests on Mt. Trumbull to Giant Mohave Yucca on the lower elevations.

Within the context of this vast and heterogeneous landscape, PARA arguably contains some of the most remote and unsurveyed lands in the American southwest. This complex and inaccessible landscape likely contains relict and unique vegetation types with low amounts of anthropogenic disturbance. Relict areas contain invaluable information for land managers, who are charged with documenting the important resources of PARA, monitoring ecological trends and changes, and with restoring areas impacted by human activities.

Scientifically sound stewardship is best accomplished when the range of normal variability for natural resources is understood. Relicts illustrate vegetation structure, composition, and resource levels which may differ significantly from more modified landscapes (Madany and West 1984). For example, Schmutz et. al. (1967) examined the relict Boysag Point on the north rim of the Grand Canyon and found perennial grasses made up 36% of the cover in the relict area, compared with only 6% in an adjacent impacted area. Relict and unique vegetation surveys were identified as a research priority for adjacent Grand Canyon National Park in 1998 (http://www.nps.gov/grca/research/Research_Needs.pdf, accessed 4 February 2003).

Data from these communities can be used to evaluate the effectiveness of current ecosystem practices and for other management purposes. Vegetation surveys from such areas can be used in guiding restoration efforts and in monitoring ecosystem change, and relicts can be important sources of locally adapted seed for revegetation projects.

The probable inaccessibility of such relict sites, however, dictates that careful examination of existing information about PARA lands should be undertaken prior to expending time and resources for travel. Existing information from such sources as Park personnel, maps, and GIS would greatly aid in the selection of likely areas for survey, and would greatly reduce effort and expense while maximizing the chances of discovering relict vegetation. The goal of this research is to locate and characterize the vegetation of relict and unique habitats in Grand Canyon-Parashant National Monument utilizing a range of existing information to select probable sites.

OBJECTIVES

1. Gather information on potential relict or unique sites through interviews with PARA and Lake Mead National Recreation Area (LAME) personnel, examination of aerial

- photos, examination of existing maps or GIS layers depicting soil types, geology, elevation, slope, aspect, grazing history, and water features such as springs.
2. Develop methodology for selecting sites for field investigation
 3. Survey sites during likely peak of flowering phenology using standard National Park Service (NPS) methodology, collecting voucher specimens of all vascular taxa encountered, and taking digital photographs of each site
 4. Develop GIS layer depicting all sites identified as potentially relict or unique, all sites visited, and all vegetation encountered
 5. Prepare a summary report of full methodology and results for submission to NPS

STUDY AREAS

The Grand Canyon-Parashant National Monument is jointly managed by the Bureau of Land Management (BLM) and the NPS. Preliminary inspection of the maps available indicates that the more remote sections of PARA are the NPS-managed lands on the southern portion of the landbase. We anticipate that the majority of sites of relict and unique vegetation will be found on the NPS portion of PARA, but we may also designate and visit potential areas on the BLM portions of the monument.

PROCEDURES

In order to maximize the chances of locating relict and unusual vegetation in PARA with minimum cost associated with field travel, this research relies on extensive presurvey investigation into potential sites. One of the most important aspects of this will be to interview park personnel who are familiar with PARA. Experts can often give information on areas that could be missed through other methods. In conjunction with the interviews, existing maps, GIS coverages, remotely sensed data, and aerial photographs will be gathered and used to identify potential relict and unusual sites. It is hoped that this methodology could become a model for minimizing costs associated with locating these usually isolated areas within large, heterogeneous landscapes.

A GIS layer of all potential sites identified will be created, and from these areas, sites to be visited during the spring of 2004 will be determined based on their potential as relicts and on accessibility. Selected areas will be visited in 2004 based on flowering phenology and climatic condition. We will use a combination of hiking, backpacking, and ATV or other motorized travel methods to reach the sites as appropriate. Inventory plots designed according to standard NPS methods will be established and botanical voucher specimens collected. Each site will be digitally photographed and the approximate boundaries will be determined using a GPS.

Plant specimens will be prepared according to standard herbarium practices and deposited in an herbarium to be selected by NPS. We will follow park national standards for plant nomenclature insofar as possible by using the USDA Integrated Taxonomic Information System (ITIS) and PLANTS databases, which follow the Flora of North America and Synonymized Checklist of North American Plants (John Kartesz 1999). Plant specimen data, plot data, and digital images will be provided as archival hard copies and digitally on CD. A summary report describing the methodology of selecting the sites and of the findings at each site will be also be prepared and submitted in both formats

described above. Publications in peer-reviewed journals may be anticipated from this research, but they are not required as part of this contract.

ANALYSIS

The methodology established in this research will initially be assessed by the presence or absence of relict vegetation at the sites visited during 2004. Future analysis of the data gathered could include comparison of taxa encountered with known and potentially occurring taxa resulting from data mining work being conducting for PARA (to be completed before the end of this research). Other future analysis could include comparison of plot data with known vegetation types or with other plot data collected by PARA.

DELIVERABLES

FOR FY 2003

-A final report detailing findings for pilot study. A hard copy and an electronic version shall be provided to the Monument, and 2 hard copies and an electronic copy shall be provided to the Colorado Plateau CESU

FOR FY 2004

- GIS layer of potential relict or unique communities w/info on why each selected, also with each site visited indicated
- Report of methodology used to identify relicts and results on archival hard copy and CD
- Digital images of sites provided on CD
- Vouchered plant specimens for plants encountered in plots, deposited at institution/herbarium designated by PARA
- Plot data for each site on CD and hard copy

TO BE PROVIDED BY COOPERATOR

- Motorized vehicle travel (ATVs, other vehicles as appropriate)
- Lodging in bunkhouses as appropriate
- Existing maps, imagery, photographs, GIS layers as described above for site selection

P.I. JUSTIFICATION & INSTITUTIONAL COLLABORATION

Dr. Leila Shultz will (1) be responsible for the verification of names in the NPSpecies Database, (2) participate in one of the field trips, and (3) provide full use of the facilities of the Floristics Laboratory (Department of Forest, Range, and Wildlife Sciences). Dr. Shultz is known internationally as a member of the editorial board for the Flora of North America Project <http://www.fna.org> and has thirty years of field experience working with floras of western North America and was curator of the Intermountain Herbarium for 20 years. As a Research Professor at Utah State University, she maintains an affiliation with Harvard University in her role as a member of the editorial board for the Flora of North America project. A short curriculum vitae is attached. The Department of Forest, Range, and Wildlife Sciences will be the cost center for the project.

PROJECT SUMMARY AND SCHEDULE.

This is a two-year project. The first year (FY 2003) is a pilot study, followed by the full study in the second year (or when funding allows) This research consists of the following tasks:

1. Pilot study, performing all tasks below on a small portion of the Monument to be selected (April 2003-September 2003). The only deliverable for this portion of the work will be a final report detailing the findings from the pilot study.
2. Analyze existing data (October 2003-December 2003)
 - conduct interviews of NPS personnel
 - collect and review existing maps, imagery, and photos
 - collect and review GIS layers such as soil type, elevation, water sources
 - review aerial photos and satellite imagery
3. Identify all potential sites and select sites for visitation in field season (January 2004-March 2004)
 - generate GIS cover of potential sites of relict and unique vegetation
 - prioritize sites based on existing information and access
 - identify best survey times for maximum flowering phenology
 - identify means of best access to sites
4. Actual field survey of sites selected (March 2004-July 2004)
 - timing of surveys will depend somewhat upon weather conditions
 - sites accessed using most appropriate travel methods
5. Collation of all data and deliverables (September 2004)
 - preparation and delivery of report and other deliverables

Literature Cited

Madany, J. and N. West. 1984. Vegetation of two relict mesas in Zion National Park. *J. Range Man.* 37(5): 456-461.

Schmutz, E. M., C. C. Michaels, and B. I. Judd. 1967. Boysag Point: A relict area on the north rim of the Grand Canyon in Arizona. Paper No. 1110, Arizona Agricultural Experiment Station, Tucson. 7 pp.

Budget for FY 2003 (Pilot, year 1)

PI Salary

3 days * 8hrs * 50 1,200

Benefits (39%) 468

PI donates office space, use of computer, GIS software, 5 days for specimen ID

Botanical technician Salary

Field (gathering data and surveying) 15 days * 8hrs * 20/hr.....2,400

Lab/museum (analysis, vouchering) 15 days * 8hrs * 20/hr 2,400

Benefits 384

Field technician Salary 20hrs * 13.40/hr	268
Travel 3 trips * 1100mi * \$0.30.....	990
Per diem 10 (Bot. tech) + 5 (Field tech) + 3 (PI) * 19.....	342
ATV use and safety training	***donated by NPS?
Lodging in bunkhouses?	***donated by NPS?
Direct Costs.....	8,452
Estimated Indirect Costs (15% of total contract).....	1,268
Total	9,720

Budget for FY 2003 (Pilot, year 1), broken out by Salary, Benefits, Other:

Salary:

PI Salary 3 days * 8hrs * 50.....	1,200
Botanical technician Salary:	
Field (gathering data and surveying) 15 days * 8hrs * 20/hr.....	2,400
Lab/museum (analysis, vouchering) 15 days * 8hrs * 20/hr	2,400
Field technician Salary 20hrs * 13.40/hr	268

Benefits:

P.I. Benefits (39%).....	468
Botanical Technician Benefits	384
Field Technician benefits	-0-

Other:

Travel: 3 trips * 1100mi * \$0.30990.....	341
Per diem: 10 (Bot. tech) + 5 (Field tech) + 3 (PI) * 19.....	342
ATV use and safety training	***donated by NPS?
Lodging in bunkhouses	***donated by NPS

Direct Costs.....	8,452
Estimated Indirect Costs: 15% of total contract	1,268

Budget for FY 2004 (year 2)

PI Salary	
5 days * 8hrs * 50	2,000
Benefits	560
PI donates office space, use of computer, GIS software, 5 days for specimen ID	
Botanical technician Salary	
Field (gathering data and surveying) 35 days * 8hrs * 20/hr.....	5,600
Lab/museum (analysis, vouchering) 125 days * 8hrs * 20	20,000
Benefits	2,125
Field technician Salary	
30 days * 8hrs * 10/hr	2,400
Benefits	-0-
Travel	
5 trips * 1100mi * \$0.30	1,650
Per diem	
35 (Bot. tech) + 30 (Field tech) + 5 (PI) * 19	1,330
ATV use and safety training	***donated by NPS?
Lodging in bunkhouses?	***donated by NPS
Archival paper for labels.....	50
Direct Costs.....	35,715
Estimated Indirect Costs (15% of total contract)	5,358
Total	41,073

LEILA M. SHULTZ

RESEARCH PROFESSOR

DEPARTMENT OF FOREST, RANGE, AND WILDLIFE RESOURCES

UTAH STATE UNIVERSITY, LOGAN, UTAH 84322-5230

Email: shultz@cc.usu.edu

EDUCATION

PH.D. 1983	Botany	Claremont Graduate School
M.A. 1975	Organismal and Environmental Biology	University of Colorado
B.S. 1969	Biology and French	University of Tulsa

EXPERIENCE

1995-present. *Floristics Laboratory Director*, Utah State University.
1992-95. *Research Taxonomist*, Harvard University.
1991-92. *Acting Curator and visiting professor of Botany*, University of Oklahoma.
1978-92. *Curator of the Intermountain Herbarium*, Utah State University.

CURRENTLY FUNDED RESEARCH

Biodiversity Inventories in the state of Utah for the Utah National Guard

Flora of North America Project, Chanticleer Foundation.

RELEVANT PUBLICATIONS:

Shultz, Leila M. 2002. *Artemisia* Linnaeus, pp. 117--120, 127. in Baldwin, Bruce B., Steve Boyd, Barbara Ertter, Robert W. Patterson, Rhomas J. Rosatti, and Dieter H. Wilken, eds. ; Margriet Weatherwax, Managing Editor. *The Jepson Desert Manual: Vascular Plants of Southeastern California*. University of California Press, Berkeley. 624 p.

Flora of North America Association. 2002. *The Flora of North America North of Mexico, Vol. 26 : Liliidae: Liliaceae through Orchidaceae*. Oxford University Press, New York.

Shultz, Leila M, ed. 2001. *Chenopodiaceae*, provisional treatments for The Flora of North America North of Mexico. *Volume 4: Caryophylliidae*. (author of treatments of *Aphanisma*, *Allenrolfea*, *Axyris*, *Beta*, *Polycnemum*, *Spinacia* and taxon editor for the family treatment). Copyright Flora of North America project.

Shultz, Leila M. 2000. Using Geographic Information Systems in Floristic Studies. *Sida. Bot. Misc.* 18: 73—81.

Shultz, L. M, N. R. Morin & R. D. Ramsey. 1998. Floristics in North America: Tracking Rare Species Electronically in C. I. Peng, ed. *Rare, Threatened, and Endangered Floras of Asia and the Pacific Rim*. Institute of Botany, Academia Sinica, Monograph Series No. 16: 259--273.

Flora of North America Association. 1997. *The Flora of North America North of Mexico, Vol. 3 : Magnoliidae and Hamamelidae*. (Shultz as Taxon editor for

Canabaceae, Moraceae, and Urticaceae, and author of Ulmaceae). Oxford University Press, New York.

Albee, B., L. M. Shultz & S. Goodrich. 1988. *Atlas of the Vascular Plants of Utah*. University of Utah Museum of Natural History, Occasional Publication 7, Salt Lake City. 670 p.