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Proceedings of the Second Biennial Conference on Research in Colorado Plateau National Parks

Editor

Charles van Riper III

National Biological Service

and

Department of Biological Sciences

P.O. Box 5614

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Flagstaff, Arizona 86011

Second Biennial Conference of Research on the Colorado Plateau

Northern Arizona University

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Foreword

The papers in this volume are contributions from National Biological Service (NBS) scientists, university students, and resource managers throughout the Colorado Plateau. The focus of all studies in this volume is on providing baseline scientific information on the physical, cultural, and natural resources of the Colorado Plateau. Support for these studies came from a myriad of federal, state, and private partners concerned about the well-being of the Plateau's resources.

The rich variety of the 68 presentations given at the conference and the 16 papers included here reflects the diversity of science presently being carried out on the Colorado Plateau. I applaud the effort of the contributors who, with modest funding and a broad base of public and institutional support, have pursued important lines of work in the four states that make up this vast biogeographic region.

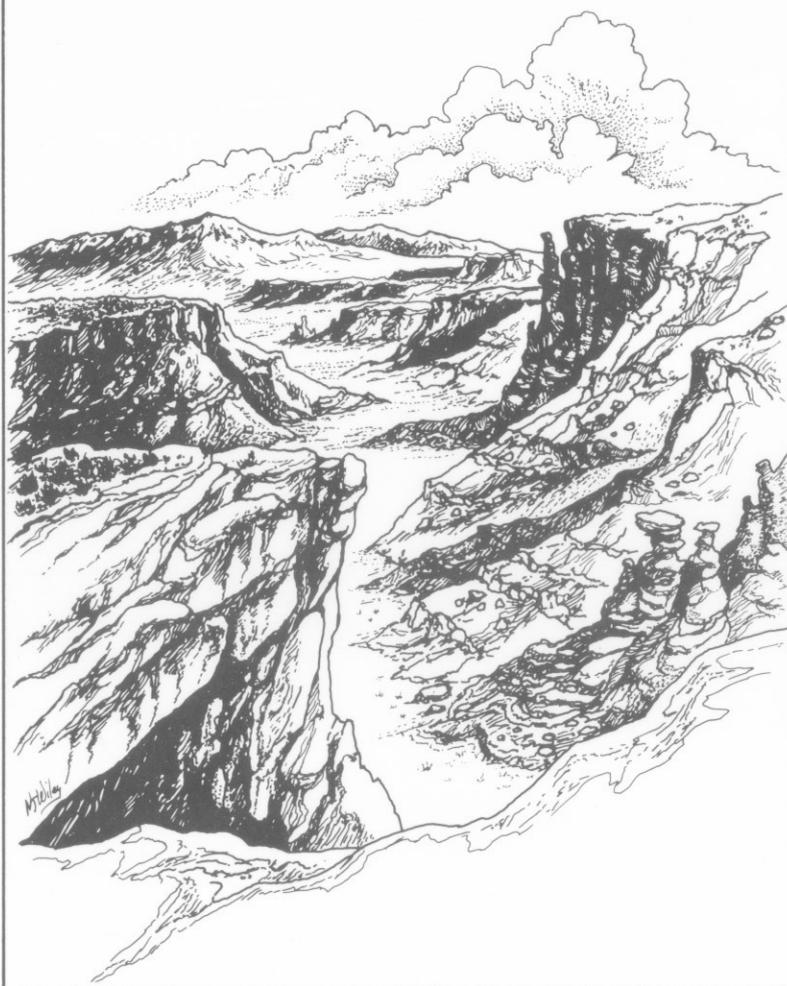
All across America, we face the prospect of extensive environmental changes that will continue to affect the physical, cultural, and natural resources on our federal lands. As the biological and ecological research branch of the Department of the Interior, we in the NBS are committed to providing sound scientific information that can be used by both public lands managers and private landowners to conserve and manage natural resources.

National parks represent the best remaining examples of America's natural ecosystems and, as such, are baselines for measuring future change. To protect parks and other federal lands, we must increase our efforts to inventory and monitor their biological resources, to understand the factors, both natural and human-induced, that threaten them, and to assist with the design of resource management programs that will ensure that future generations can use and enjoy them as we have.

In short, we must provide the sound science needed to conserve and manage the natural resources that sustain us, inspire us, and represent our biological and environmental heritage.

H. RONALD PULLIAM
Director
National Biological Service

Introduction



Introduction to the Proceedings of the Second Biennial Conference on Research in Colorado Plateau National Parks

On 25–28 October 1993 in Flagstaff, Arizona, the National Biological Service Colorado Plateau Research Station (formerly National Park Service Cooperative Park Studies Unit) and Northern Arizona University hosted the Second Biennial Conference of Research on the Colorado Plateau. The conference theme focused on research, inventory, and monitoring on federal, state, and private lands in the Colorado Plateau biogeographic province.

This is the second volume (see Rowlands et al. 1993) of a planned series of Colorado Plateau Research Station proceedings that highlights research and resource management efforts related to physical, cultural, and natural resources within the Colorado Plateau biogeographic province. The 16 papers in this volume were selected from 68 posters and research papers presented at the Second Biennial Conference. Each paper represents original research and has been reviewed anonymously by three peers in that particular research discipline. This volume of proceedings, like the products of other symposia centered around particular themes, will focus attention on some of the salient research being conducted within the Colorado Plateau. I expect this information to stimulate additional support for work on resources of the Colorado Plateau. If the expectation is achieved, the organizational and editorial efforts of the past several years will have paid dividends.

The papers naturally divide themselves into physical resources, cultural resources, and biological resources.

Physical Resources

Hanging gardens are one unique aspect of the Colorado Plateau. May, Fowler, and Stanton describe the geomorphology and community structure of hanging gardens and point out that these gardens occur over sections of the plateau because of unique geologic and hydrologic features. The hanging gardens in each national park on the Colorado Plateau are identified, and a brief classification is provided.

The second paper, by Netoff, Cooper, and Shroba, addresses weathering pits (also known as tanks, caldrons, huecos, dew holes, potholes, water pockets,

and tinajas) in sandstone substrate—another unique facet of the Colorado Plateau. The authors discuss weathering pits in the Glen Canyon National Recreation Area, specifically the series of pits near Cookie Jar Butte. The paper focuses on causes of formation of the pits.

Brown and Davila provide, in the next paper, an insight into how a large-scale mapping project can be beneficial to land managers on the Colorado Plateau. The authors mapped geologic features of Great Basin National Park. The integration of scientific expertise with management needs can benefit all involved parties.

In the final paper of the first section, Dexter, Cluer, and Manone report on the development of a method to monitor sandbar stability along rivers. This research was part of the multimillion dollar Bureau of Reclamation–Glen Canyon Environmental Studies research effort to examine the potential effects of fluctuating flows from Glen Canyon Dam on the down-river resources of Grand Canyon National Park.

Cultural Resources

The four papers in this section were chosen to represent a cross section of cultural and social research being carried out over the Colorado Plateau. The topics presented span a time interval from the archaic (9000 BP) through the Fremont culture (1000 BP) to historical fires in Mesa Verde and a 1993 telephone survey of Arizona residents on perceptions about preservation of Grand Canyon National Park. This section provides the reader with a representative spectrum of research and management alternatives that cultural resource managers can utilize to better know, protect, and preserve archeological, cultural, and social resources over the Colorado Plateau.

One of the continuing controversies that exists on archaic occupation of the Colorado Plateau is whether it has been continually occupied or if humans have moved in and out of the region (e.g., see Berry 1982). The paper by Geib presents an argument, through radiocarbon dating of artifacts, that the central Colorado Plateau has been continuously occupied since 9000 BP.

Some of the most frequently encountered artifacts at archaeological sites on the Colorado Plateau are ceramic potsherds (Colton and Hargrave 1937). In many instances, archaic cultures have been identified as having unique ceramic pottery styles, and the Fremont culture is no exception (Gunnerson 1957). In the second paper of this section, Spurr presents an examination of the compo-

sition of Emery Gray ceramics of the Fremont culture to support the contention that the present classification is not adequate because of inaccurate and inconsistent temper designations.

The third paper provides an example of how research can cross disciplines. Floyd-Hanna, Romme, Loy, and Hanna provide managers with a model that predicts fires and, ultimately, their effects on cultural resources. Because no trees with fire scars were present in their Mesa Verde study area, the authors developed a technique with which to date vegetation recovery.

The fourth paper addresses social research on the Colorado Plateau. Solop and Rodriguez present the results of a telephone survey of Arizona residents that examines public attitudes toward protecting resources of Grand Canyon National Park. Specifically, the authors attempted to gauge frequency of use, levels of concern for protecting Grand Canyon resources, and finally at what level people were willing to endure financial costs to support public policies of park preservation.

Biological Resources

The final section addresses research that has been carried out on biological resources across the Colorado Plateau. The section is subdivided into plant and animal groupings. The plant papers encompass a vegetation scheme for the Colorado Plateau, an analysis of hanging gardens, and a chapter on tissue culture techniques for ponderosa pine (*Pinus ponderosa*). The animal papers are organized by taxonomic level, beginning with amphibian surveys and reptile body temperatures as related to movement patterns, through several papers on birds, and ending with a paper on a mammalian reproductive cycle.

The initial paper might ultimately prove to be one of the most important of this volume. Spence, Romme, Floyd-Hanna, and Rowlands provide a vegetation classification scheme for scientists and managers on the Colorado Plateau. This paper is an accumulation of several years of work by the Colorado Plateau Vegetation Advisory Committee (CPVAC), whose charge was to construct a standardized vegetation theme on the Colorado Plateau for managers.

The second paper revisits hanging gardens to address the endemicity of plants. Fowler, Stanton, Hartman, and May examined 48 hanging gardens in Zion and Capital Reef national parks and Glen Canyon National Recreation Area to provide evidence of the importance of these plant species to hanging gardens.

Ponderosa pine is probably the most important economic tree species on the Colorado Plateau. For this reason, silviculturists have paid considerable attention to the production of young trees that would ultimately prove most suitable for timber production. Lin and Wagner, in the third paper, discuss the methodologies they developed to produce plantlets of ponderosa pine from callus induction and differentiation.

The initial animal paper of this proceedings is by Drost and Sogge and deals with a survey of northern leopard frogs (*Rana pipiens*) along the Colorado River in Glen Canyon National Recreation Area. This paper is important because of the serious declines of anuran amphibians throughout much of North America (see the 1990 paper by Barinaga for a succinct overview of this problem).

The fifth paper features reptiles: Graham, Persons, Schaedla, and Moore relate a study of body temperature patterns of western rattlesnakes (*Crotalus viridis*) at Natural Bridges National Monument. Twelve snakes were implanted with temperature-sensitive radios that revealed lower body temperatures than reported from other species of rattlesnakes.

Johnson and Sogge present the first paper on birds—about the influence that livestock corrals and associated food items have on the abundance and distribution of brown-headed cowbirds (*Molothrus ater*) in Grand Canyon National Park. The authors examined five locations where livestock concentrate in the park and found cowbirds frequenting three sites (two in Grand Canyon village and one at Yaqui Point).

The second bird paper is from a 7-year study reporting on observations at a great blue heron (*Ardea herodias*) colony adjacent to Curecanti National Recreation Area in Gunnison, Colorado. Graham and Meyer documented the gradual movement of heron nests west from Gunnison's city borders as the human population expanded and documented the expansion of the heron colony, which doubled in 5 years.

The last paper pertains to the reproductive cycle of Abert's squirrels (*Sciurus aberti*). This mammal is, much like hanging gardens, a unique aspect of the Colorado Plateau (Hoffmeister 1971). Pogany and Allred relate their research in which, from 1992 through 1994, they collected squirrels killed on roads in Grand Canyon National Park and Walnut Canyon National Monument. Each specimen was examined histologically to determine the phenology of the species' reproductive cycle.

Acknowledgments

The Second Biennial Conference and resulting publication result from the efforts of numerous agencies and individuals. In the planning stages, Northern Arizona University Vice President H. Hooper and personnel from du Bois Conference Center provided advice and assistance in structuring the conference. E. Deshler and M. Sogge (Conference Co-chairs) planned, organized, and directed conference logistics. The Colorado Plateau Research Station (CPRS) staff provided support in areas of registration (M. Rasmussen, J. Henderson), paper and poster presentations (P. Deshler, H. McCutchen, P. Rowlands, N. Brian), editorial (C. Cole), and transportation services (C. Drost). Northern Arizona University graduate students (L. Ellison, M. Johnson, J. Bright, D. Willey, P. Hodgetts, E. Nowak), directed by E. Deshler, assisted with logistics at the meeting, operated slide projectors, and provided general assistance with the paper sessions. I thank the many reviewers who unselfishly devoted their time and efforts to improving each paper. A special thanks to D. O'Leary for providing financial support for this publication from the Washington Office Servicewide Publications Program of the National Park Service.

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