

# Proceedings of the Third Biennial Conference of Research on the Colorado Plateau

Editors

Charles van Riper III  
Elena T. Deshler

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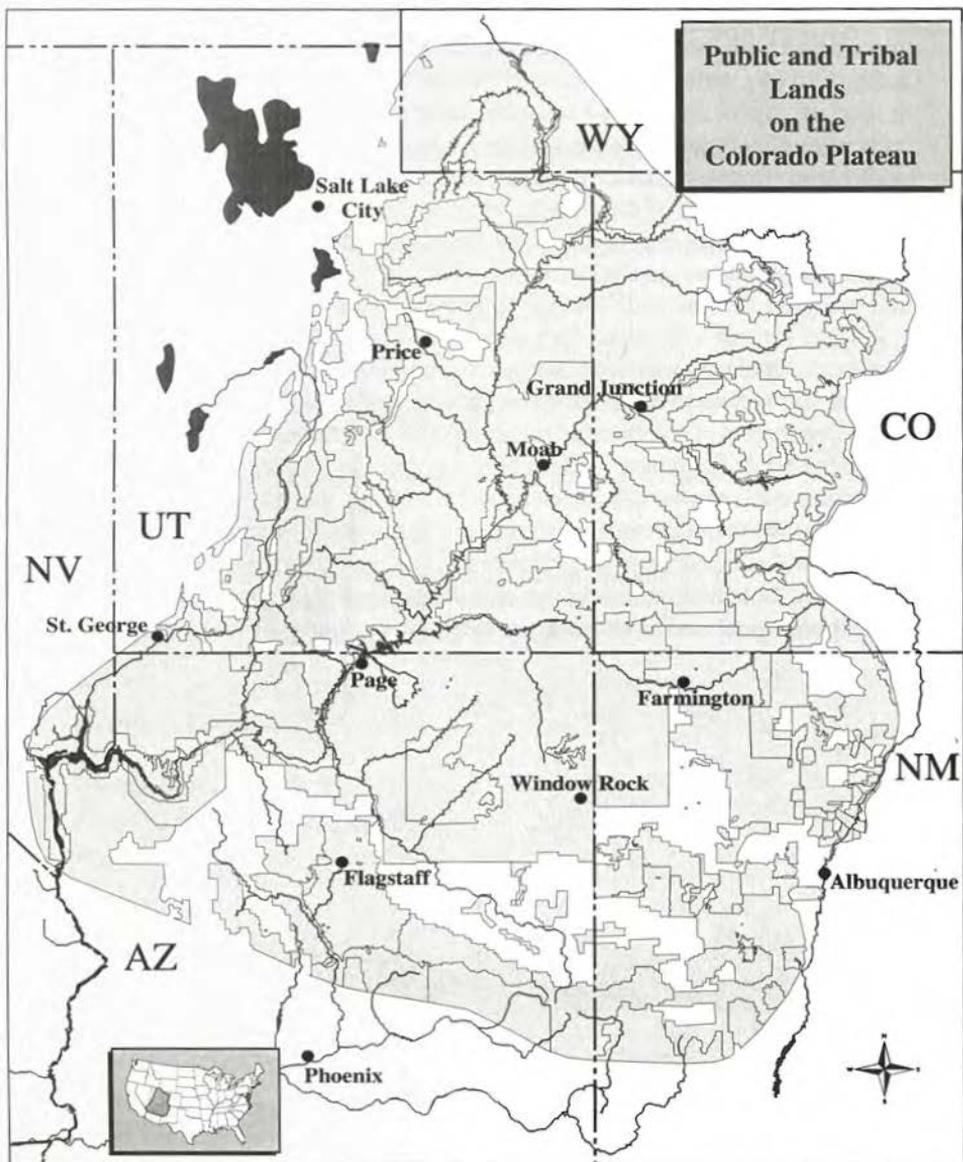
## Preface

The papers in this volume are contributions from federal, state, and private sector researchers, who have come together to share scientific information with land managers on the Colorado Plateau. This Proceedings is the third in a series of publications that focuses on providing information to land managers on baseline scientific information pertaining to physical, cultural and biological resources of the Colorado Plateau. Support for these studies came from a spectrum of federal, state, and private partners concerned about the well-being of the Plateau's resources. I applaud the effort of the contributors. With modest funding and a broad base of public and institutional support, these authors have pursued important lines of work in the four states that comprise the Colorado Plateau biogeographic region.

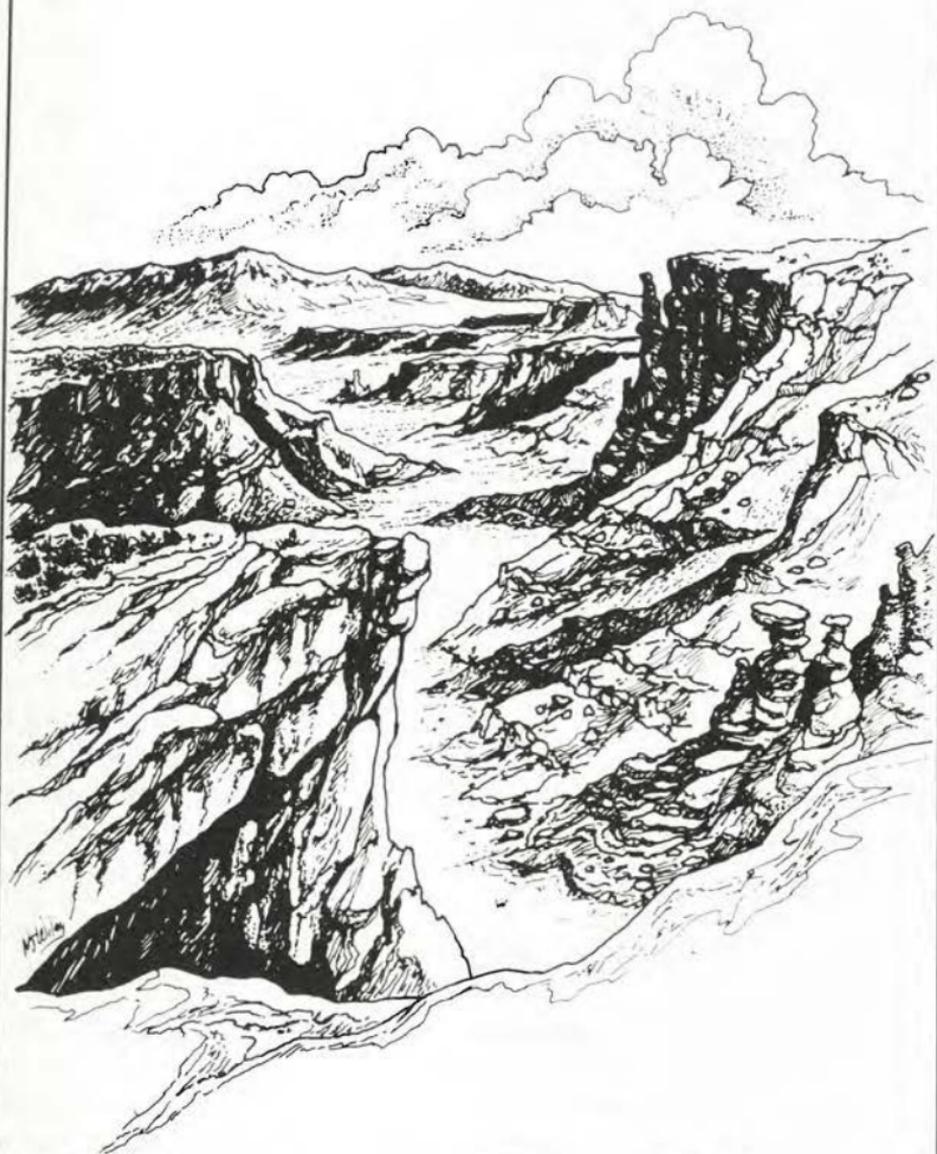
There is much to be done. As a people, we face the prospect of extensive local and global environmental changes that continue to perturb the physical, cultural, and biological resources on our federal lands. As the research branch of the Department of the Interior, we in the USGS are committed to identify, in a sound scientific manner, information that can be used by land managers to protect our resources from detrimental change due to modern human influences. We must develop the information necessary to alert our managers, leaders, and our people to the importance of their natural surroundings as elements of those basic resources that sustain us, inspire us, and represent our natural biological and environmental heritage. Our task has just begun.

DENNIS B. FENN

U. S. Geological Survey  
Biological Resources Division  
Chief Biologist



# Introduction



# **Introduction to the Proceedings of the Third Biennial Conference of Research on the Colorado Plateau**

The 16 chapters in this Proceedings were selected from 83 research papers presented at the Third Biennial Conference of Research on the Colorado Plateau. The conference, held in Flagstaff, Arizona on 17-20 October 1995, was hosted by the National Biological Service's Colorado Plateau Research Station (formerly National Park Service Cooperative Park Studies Unit, and now U.S. Geological Survey/Biological Resources Division/Colorado Plateau Field Station), and Northern Arizona University. The theme of this biennial meeting centered around research, inventory, and monitoring on federal, state, and private lands over the Colorado Plateau.

This is the third volume, in a planned series of Colorado Plateau Biennial Conference Proceedings, that highlights research and resource management efforts related to biological, physical, and cultural resources within the biogeographic province of the Colorado Plateau. Many of the papers published in this Proceedings Series have emanated from questions that arose while examining Colorado Plateau resource issues. Because of resource similarities across the Plateau, techniques that work in one management unit are applicable to numerous other management areas. Many protocols, especially those related to monitoring techniques, presently being utilized in lands over the Colorado Plateau stem from aspects of the scientific works published in this Proceedings Series.

Each paper selected for publication represents original research and has been peer-reviewed by a minimum of two reviewers in that particular research discipline. As with the previous two volumes, the papers naturally divide themselves into three major sections: (1) physical resources; (2) cultural resources; and (3) biological resources. However, in this volume the preponderance of contributed papers are from the biological resources arena. Therefore, we start the volume with biological papers, followed by chapters that deal with physical resources, ending with chapters on cultural aspects of the Colorado Plateau.

## **Biological Resources**

It is fitting to begin this section, and book, with a chapter dealing with a unique aspect of the Colorado Plateau -- an endangered native fish, the humpback chub. The R. Valdez chapter is a capstone work that summarizes the many years of research that he has conducted on this endangered species within the 226 miles of the Colorado River from Glen Canyon Dam to Diamond Creek. Valdez and Ryel provide a detailed section on fish

distribution patterns among regions of the river. Chub reproduction, coupled with age and growth patterns, provide insight into why this species has become endangered. The authors also provide information on survival, predation rates, and parasite levels within the chub population. The second chapter moves to mammals, with S. Rosenstock providing information on the desert rodent communities of grassland, shrubland, and woodland habitats of Capital Reef National Park. The relatively simple small mammal assemblages that he found parallel the morphology and resource use of small mammals in other North American deserts, suggesting consistent mechanisms that minimize competition and facilitate coexistence. A second mammal chapter, by R. Ockenfels et al., deals with home range size and movement patterns of pronghorn antelope in northeastern Arizona. These authors found that females had larger home ranges than males and that the home range patterns of both sexes were greatly influenced by anthropogenic barriers. The pronghorn freely crossed pasture fences and unfenced roads, but were restricted from crossing fenced roads and fenced railroad rights-of-way. The authors do provide several management alternatives on how to alleviate problems associated with maintaining pronghorn movement across the landscape in Arizona. Chapter 4, by D. Foster et al., is the final mammal study and provides information on distribution of bat species over 5 million acres of forested lands on the southern Colorado Plateau. The authors mist-netted, recorded vocalizations, and utilized an echolocation device at water holes, in an effort to determine the presence and relative abundance of bat species throughout forested regions around Bryce Canyon National Park. The 14 recorded bat species represent sound baseline information for this mammal over portions of the southern Colorado Plateau.

The narrow strips of riparian vegetation, present throughout the southwestern United States, are extremely important to wildlife, and especially so to avian communities. However, these narrow habitat bands provide a challenge to the development of census and monitoring techniques because of the difficulty in identifying techniques that will realistically define changes in avian species numbers and community composition. In Chapter 5, D. Felly and M. Sogge provide a comparison of survey techniques for monitoring birds in riparian vegetation patches along the Colorado River corridor within Grand Canyon National Park. They compare absolute-count with point-count surveys. Their conclusions encourage managers to employ point-count surveys in this habitat, as the authors feel it would be the most effective tool to monitor trends in breeding bird abundances and species composition. The following two chapters also deal with birds, specifically with management questions related to the wild turkey in Arizona. Chapter 6 analyzes the effect of timber harvest on Merriam's turkey loafing habitat. In their analysis of pre- and post-timber harvest sites, B. Wakeling et al. conclude that turkeys need a high canopy density, low horizontal visibility, and contiguous suitable habitat if an area will continue to be used for loafing.

In the next chapter, the same lead author documents winter movement patterns of turkeys as related to their over-night roost sites. Wakeling's findings demonstrate that turkeys concentrate their activities close to roost sites (< 8 km), therefore suggesting that forest manipulation activities should be avoided within .8 km of known roosting areas.

The next five chapters (8–12) of this Proceedings deal with vegetative aspects of Colorado Plateau ecosystems. Haywood et al. assess potential use of the model PROGNOSIS in Arizona forests. The PROGNOSIS model predicts potential suitable wildlife habitat from canopy closure estimate data taken during determination of a stand density index (SDI). The data set developed by the authors, from 230 random vegetation plots over 10,000 ha in the Kaibab Forest, revealed that the PROGNOSIS model explained less than 50% of the variation in the Arizona forest SDI data set. Thus, the authors caution on the use of PROGNOSIS for defining suitable wildlife habitat in Arizona, suggesting that small vegetation sample plots do not provide an accurate indication of forest cover. Chapter 9 documents the status of the rare Goodding willow along the Colorado River in Grand Canyon National Park. Mast and Waring, through tree core sampling, demonstrate the influence of Glen Canyon Dam and flood events on this tree species. The authors also document a recent shift in the distribution of the Goodding willow from the upper to lower canyon regions.

The next two vegetative chapters deal with broad scale analyses of forest stand structure over the southern Colorado Plateau. In Chapter 10, Garrett et al. examine North Kaibab National Forest over-story between 1910 and 1993. They compare analysis from USFS surveys of forest structure from 1910, 1955, 1977 and 1993, showing that smaller and larger classes of trees have increased in density, even with forest product removal. They caution that, with current forest management practices, 25% of the forest is at high risk and 65% at medium risk to catastrophic wildfire or insect/disease loss. Menzel and Covington (Chapter 11), utilizing dendroecological techniques, demonstrate a similar change in the ecotonal *Pinus ponderosa* and *Pinus edulis* forest at Walnut Canyon National Monument, east of Flagstaff, Arizona. They show that subsequent to Euro-American settlement (circa 1876), trees less than 10 cm and those greater than 10 cm diameter at breast height (dbh) have increased in numbers, with the former class going from 72 to 333 stems/ha, while the latter increased from 9.0 to 19.1 m<sup>2</sup>/ha. In this forest, however, the contribution of *Pinus ponderosa* larger than 10 cm dbh actually decreased (from 80% to 68%) while numbers of *Pinus edulis*, *Quercus gambelii*, and *Juniperus* spp. increased in this tree size class. The authors conclude their chapter with seven management alternatives that might be employed to restore this forest to pre-European conditions.

The final vegetative and biological chapter (12 by T. Graham) describes recovery of a hanging garden from a 1990 fire. Hanging gardens occur over sections of the Colorado Plateau because of unique geologic and hydrologic

features. Previous work on this garden in 1983, by Dr. Stanley Welsh of Brigham Young University, provided a baseline of information from which Graham could compare the 5-year recovery of this isolated vegetative community. After monitoring (on an annual basis) soil bacteria, nematodes, and fungi, along with plant species, Graham concluded that recovery for all groups was directly related to soil moisture content. Those areas that did not receive direct moisture from the seeps were still devoid of plants and most microorganisms in 1995, while watered locations have recovered a complete complement of flora and soil fauna.

## **Physical Resources**

The Proceedings now turns to physical aspects of the Colorado Plateau. Chapter 13 by Meretsky and Melis is a transition work that outlines the coordination of biological with physical analyses of data collected during Phase II of the Glen Canyon Environmental Studies (GCES) project. The GCES research effort, directed by Dave Wegner, was a multimillion dollar Bureau of Reclamation project that spanned a period of 12 years, examining the impact on resources along the Colorado River from construction of the Glen Canyon Dam. This chapter summarizes work from Phase II (1989–1993) and how biological and physical information was integrated to produce the 1994 final GCES Environmental Impact Statement. Chapter 14, by Chadwick and Kennedy, describes the depositional environment of Tapeats sandstone in Grand Canyon National Park. From 21 localities, their paleoslope and sedimentological data suggests that this sandstone layer was deposited in deeper waters, not in near-shore environments as was formerly believed. In some instances they argue that sediments were deposited at an excess of 200 m below storm wave base. Further support for their conclusions are provided by the breccia matrix that they examined at 91-mile canyon, which indicates sediment deposition in a reducing environment.

## **Cultural Resources**

Chapter 15 is a brief summary on baseline noise levels and the potential invasion of natural quiet to visitors at Bryce Canyon National Park. To complete this study, Dan Foster established five monitoring locations throughout the park, recording ambient noise levels of jets, helicopters, and fixed-wing aircraft from May to August of 1995. His results establish the types and duration of non-natural noise occurring in the park, providing a baseline that will aid NPS managers in working with future impacts that degrade 'natural quiet' within the region.

The Proceedings closes with an archeological chapter that describes a high altitude agricultural site on the Colorado Plateau. The authors, W. Fawcett and J. Bright, claim that this is one of the highest elevations at

which intensive agriculture existed during the first millennium A.D. The water control features that they found, coupled with corn remains at different levels in the excavated cave floor, led the authors to suggest that the inhabitants relied heavily on domesticated cultigens, thus indicating that not all Anasazi were hunter-gatherers during this prehistoric time period.

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This book, like the products of other symposia that are centered around a particular problem, should help to focus attention on some of the salient research presently being carried out within the Colorado Plateau. Hopefully, the foundation provided by the research projects published in this Proceedings will help to redirect, and ultimately improve, the quality of research and resource management actions within the Colorado Plateau biogeographic province. Moreover, if this book acts as a stimulus for additional legislative demands and commensurate funding for work on resources of the Colorado Plateau, it will demonstrate that the organizational and editorial efforts of the past 2 years have been well-spent.

CHARLES VAN RIPER III  
Colorado Plateau Research Station