The National Park Service publishes scientific studies of significant natural resources in units of the National Park System. This research is of scholarly quality and may include any discipline of the biological, physical, or social sciences.

Cover photo: View of Grand Canyon from Mather Point, Grand Canyon National Park, Arizona.

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

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First Biennial Conference on Research in Colorado Plateau National Parks

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Contents

Foreword

The papers in this volume are contributions from scientists, students, and resource managers. The focus of their studies is on the inventory and monitoring of the natural resources of National Park Service areas on the Colorado Plateau. Support for these studies came from the authors; from individual parks; from universities; and from the Rocky Mountain, Southwestern, and Western regional offices and from Washington Office programs of the National Park Service. The rich variety of the 46 presentations given at the conference and the 19 papers included here reflects the diversity of science in and adjacent to National Park Service units on the Colorado Plateau. I applaud the efforts of the contributors. With modest funding and a broad base of public and institutional support, they have pursued important lines of work in and about the many national parks and monuments in this important biogeographic region.

There is much to be done. As a people, we face the prospect of extensive local and global environmental changes that have perturbed and will continue to perturb the natural resources of our parks—resources that we are committed to protect from change due to modern human influences. Parks represent examples of natural ecosystems and baselines for measuring future change. To protect them, we must increase our efforts to develop basic information, to inventory and monitor our park (and global) resources, to quantify and evaluate changes, and to design resource management programs that will maintain and restore those resources. We must develop the information necessary to alert our managers, our 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.

The papers in this volume illustrate just a few of the problems we face and describe some of the methods used to monitor and evaluate them. The task has just begun.

DENNIS B. FENN

National Park Service
Deputy Associate Director
Natural Resources

Preface

The 19 papers in this volume were selected from the 46 presentations given at the First Biennial Conference on Research in Colorado Plateau National Parks. The overall theme for this meeting was research, inventory, and monitoring in National Park Service units on the Colorado Plateau. The conference, held in Flagstaff, Arizona, on 22–25 July 1991, was sponsored by the National Park Service Cooperative Park Studies Unit, Northern Arizona University, and the Petrified Forest, Zion, and Grand Canyon natural history associations.

This volume highlights research and resource management efforts to inventory and monitor natural and cultural resources in the national parks of the Colorado Plateau. Many of the inventory and monitoring protocols and techniques used in one park unit should be applicable to other national park units throughout the Colorado Plateau and possibly in other areas with similar habitats. The papers in this book naturally divide themselves into four major sections: biological resources, cultural resources, physical resource management, and GIS and information management. The majority of the papers (10 of 19) deal with biological resources, and 7 of these are concerned with inventory and monitoring of animals. Valdez and Williams and Valdez, Masslich, and Crist describe the ichthyofauna of the Colorado River in the Grand Canyon reach as well as methodologies associated with inventorying the endangered humpback chub (*Gila cypha*). The relation between an exotic game fish—rainbow trout (*Oncorhynchus mykiss*)—and wintering bald eagles (*Haliaeetus leucocephalus*) in Grand Canyon is the subject of a paper by Leibfried and Montgomery. Richard Glinski imparts valuable information on monitoring protocols for peregrine falcons (*Falco peregrinus*), another endangered species.

One of the papers deals with plant–herbivore relations. Gaud, Allred, and States present the results of their investigations on tree selection and utilization of ponderosa pine (*Pinus ponderosa*) by Abert squirrels (*Sciurus aberti*): The larger the tree, the more likely it will be a feed-tree more than once.

Bighorn sheep (*Ovis canadensis*) is the subject in two papers. Charles Douglas investigated the relations between weather and climatic patterns and survivorship of bighorn lambs. Cunningham and Hanna have written a paper that explores the possible effects of realigning U.S. Highway 93 in the vicinity of Hoover Dam (in Arizona and Nevada) on the local bighorn sheep population.

Botanical resources are also represented by three diverse papers. Joyce Maschinski documents various strategies employed in the conservation of sentry milkvetch (*Astragalus cremnophylax* var. *cremnophylax*), an endangered limestone-endemic from Grand Canyon National Park. The late Pleistocene–early Holocene vegetation of Arches National Park is described in a paper by Saxon Sharpe—a documentary and analysis of packrat (*Neotoma*

spp.) middens. Bork and Bork assert that cattle act as a keystone species affecting semiannual grassland vegetation on the Colorado Plateau.

The adverse effects of livestock on archaeological resources is both measurable and substantive according to information presented by Osborn and Hartley. Phil Geib and Geib and Lyneis uncovered archaeological evidence that Anasazi (Fremont) occupation of Glen Canyon was earlier than previously supposed. Furthermore, distinctions among types of Fremont pottery could be discerned on the basis of igneous rock types used as temper.

Physical resources are represented by three papers in three diverse fields. The effects of 10 years of human presence on Colorado River beaches in the Grand Canyon Reach is documented by Beus and Lojko. Avery and Helmke describe the hydraulic setting and dynamics of Montezuma Well, a large water-filled sink hole in Montezuma Castle National Monument. Linda Mazzu's article on the monitoring of aircraft at Grand Canyon National Park and its use as a tool in managing for natural quiet is perhaps the most unusual paper in this collection in that it deals with issues (natural quiet and visitor experience) that are rarely studied. A report on the findings of the conference's symposium on air quality, written by Roger Clark of the Grand Canyon Trust, rounds out this section of the proceedings.

Geographic information systems and information management, the last section of the proceedings, is represented by two papers. Christopherson, Ball, and Guertin describe how the choice of a digital elevation model in a GIS application may affect the outcome of a viewshed analysis, a common technique used by land-use planners in various agencies. Finally, Fraire and Stohlgren summarize the results of the evaluation of existing inventory and monitoring data bases in the Colorado Plateau park units.

This publication is a direct result of the efforts of numerous agencies and individuals. In the planning stages, Northern Arizona University conference personnel provided advice and assistance in structuring the conference. Conference registration was handled by M. Rasmussen. Northern Arizona University graduate students, directed by Elena T. Deshler, assisted with logistics at the meeting, operated slide projectors, and provided general assistance with the paper sessions. Each paper represents original research and has been peer reviewed by at least two reviewers in that particular research discipline. We thank J. Reese for editorial scrutiny of the book and the many reviewers who unselfishly devoted their time and efforts to improving each chapter. Financial support for this publication was provided with matching funds from the Natural History Associations of Zion National Park, Glen Canyon National Recreation Area, Petrified Forest National Park, and the Washington Office Servicewide Publications Program of the National Park Service. We thank the Western, Southwestern, and Rocky Mountain regional offices of the National Park Service and the faculty and staff of Northern Arizona University for their support throughout the development of these proceedings. We are also deeply indebted to all the talented individuals who gave their valuable time in seeing this product through the publication stage.

We feel that this book, like the products of other symposia focusing on particular problems, should help redirect and improve the quantity and quality of research and resource management action in an area of presently active interest within the National Park Service. If this book acts as a stimulus for additional legislative demands and commensurate funding for work on national park resources of the Colorado Plateau, we will be enormously satisfied that our organizational and editorial efforts of the past year have been well spent, as have those of the authors.

PETER G. ROWLANDS
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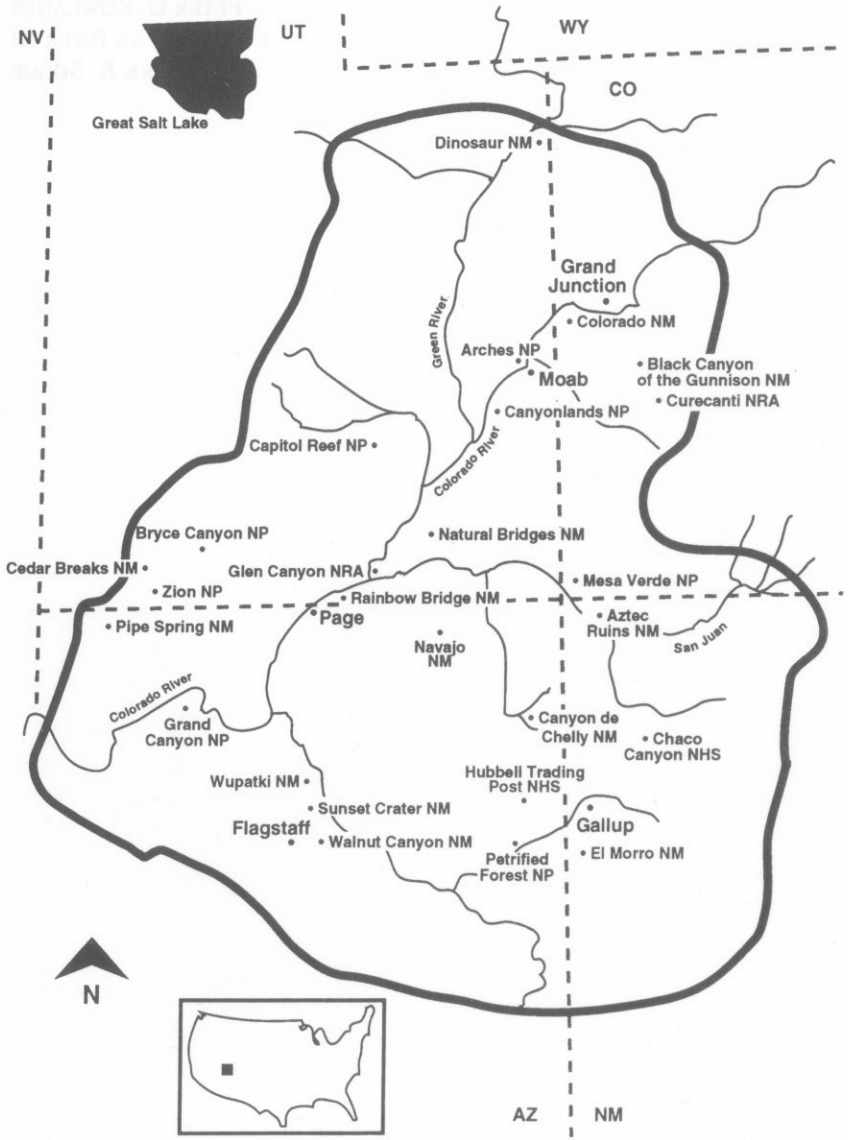

Frontispiece. The Colorado Plateau study area.