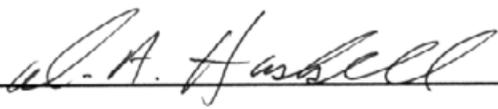


GRAND CANYON NATIONAL PARK

RESOURCE MANAGEMENT PLAN

PART ONE — NARRATIVE JANUARY 1997

Recommended By:

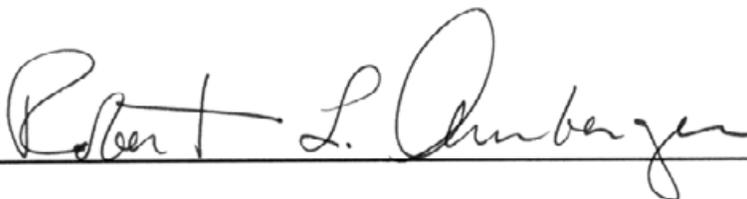


David A. Haskell, Science Center Director

1/15/97

Date

Approved By:



Robert L. Arnberger, Superintendent

1/15/97

Date

THIS VERSION OF THE 1997 RESOURCE MANAGEMENT PLAN WAS REPRINTED IN APRIL 2001. IT CONTAINS ALL TEXT FROM THE ORIGINAL 1997 VERSION.

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PREFACE

PLAN PURPOSE

The purpose of the Resource Management Plan (RMP) is to provide long-term guidance and direction for the stewardship of the natural, cultural and recreational resources of Grand Canyon National Park. Primary stewardship functions include management, interpretation, education, research, inventory, monitoring, mitigation, law enforcement, and maintenance. These functions are required to perpetuate natural processes, and natural and cultural resources in Grand Canyon National Park; to achieve Park purposes and management objectives; and to regulate Park use.

This Plan recognizes that the physical resource provides the basis for unique and valued visitor experiences. These experiences are vastly important; however, their management is beyond the scope of this Plan. Physical resources as they effect visitor experiences will be mentioned in this Plan, and frequent references will be made to other plans which address experience in greater detail.

This Plan draws upon appropriate legislation, National Park Service (NPS) policies and guidelines, goals and priorities established in the 1995 Grand Canyon National Park *General Management Plan*, as well as on a knowledge of Park resources and their special needs. This Plan provides a basis for setting goals and priorities, measuring resource accomplishments against documented needs, and making budget decisions.

This Plan is designed to be revised every four years; project statements will be added and deleted annually.

This RMP is the result of a three-year planning process beginning in 1993 that defined what actions need to be taken to provide for the protection and management of these resources. The initial RMP scoping session was attended by over 60 participants. Resource managers from the United States Forest Service (USFS), Arizona Game and Fish, United States Fish and Wildlife Service (USFWS), Northern Arizona University (NAU) Department of Forestry and Research, the Colorado Plateau Research Station of the U.S. Geological Survey's Biological Resource Division, the Aldo Leopold Wilderness Research Institute, NPS central offices and neighboring parks all contributed significantly to the process.

The RMP is divided into a narrative section and a section containing project statements derived from the RMP computer database. It includes the actions and contributions of all Park operational units and partners in achieving our shared resource-stewardship goals. Although the preparation and implementation of the Plan is the responsibility of the Grand Canyon National Park Science Center, resource management projects routinely involve shared responsibilities and interdivisional cooperation for successful development and implementation. Resource management issues often transcend Park boundaries requiring the coordination of other State,

Federal and local agencies as well as American Indian groups, private interests and landowners.

Relationship To Other Plans

The Park's General Management Plan provides the overall objectives for Park management; the RMP is the primary resource-stewardship action plan. There is another group of plans referred to as visitor-use action plans that focus on the management of visitor activities and recreational resources in the Park. Examples include the Wilderness Management Plan, Colorado River Management Plan, and the Aircraft Management Plan.

It must be stressed, however, that there is an obvious connection between the management of visitor use, experiential resources, and the protection of natural and cultural and recreational resources.

In other cases, resource issues are so complex and/or controversial that they cannot be adequately dealt with in this document. These require their own individual resource action plans. The need for these plans is identified in this document, and their relevance to current management objectives and issues will be described. Some of these plans will require public and peer review; examples include the Fire Management Plan, Cultural Landscape Management Plan, and the Cave Management Plan.

Regional Planning and Coordination

Grand Canyon National Park is located within the Colorado Plateau physiographic region. The resources stewardship actions described in this document are guided by the fundamental tenet of maintaining and perpetuating ecosystem processes and cultural affiliation integrity. It is recognized that the natural and cultural aspects of the Park ecosystem are part of a greater ecosystem of the Colorado Plateau.

This is, and must remain, a distinguishing aspect of Park resources management. It is essential that the National Park Service work effectively with neighboring agencies, tribes and communities in order to assure that the Park remains a place where natural forces continue to shape the landscape and cultures.

The primary mechanism for recognizing issues and planning actions that extend beyond park boundaries is the Grand Canyon Science Center Partnership. A complete description of this partnership is found in Chapter Three of this document.

Definition of Resource Stewardship (Management)

The function referred to as natural resource stewardship or management is defined in the NPS Natural Resource Guidelines (NPS-77):

Natural resource management is the process by which the NPS strives to understand natural processes and human induced effects; mitigates potential and realized effects; monitors for ongoing or future trends; protects existing natural organisms, species, populations, communities, systems, and processes; and interprets these organisms, systems, and processes to the park visitor. This function is broken down into six sub-functions: Research, mitigation, monitoring, protection, interpretation and administration.

Cultural Resource Management is defined in the NPS Cultural Resource Management Guidelines, NPS-28:

Cultural resource management involves Research, to identify, evaluate, document, register, and establish other basic information about cultural resources; Planning, to ensure that this information is well integrated into management processes for making decisions and setting priorities; and Stewardship, under which planning decisions are carried out and resources are preserved, protected and interpreted to the public.

CHAPTER ONE

CHAPTER ONE

Background Information

Park Location

Park Purpose & Significance

Legislation Affecting Grand Canyon

Land Management Zones

Land Use and Trends

Visitor Use Analysis

Compliance

Roles in Resource Management

PARK LOCATION

Grand Canyon National Park lies on the Colorado Plateau in northwestern Arizona. The area is a vast, semiarid land of raised plateaus and structural basins typical of the southwestern United States. Drainage systems are deeply cut, forming numerous steep-walled canyons. The higher elevations of the Plateau are forested; the lower elevations are a series of desert basins.

Fifty-five percent of the Colorado Plateau is Federally owned, including 27 units administered by the National Park Service, 17 national forests administered by the United States Forest Service, 26 designated wilderness areas, 32 million acres administered by the Bureau of Land Management, numerous state parks and countless roadless and remote areas. American Indian reservations occupy 24% of the land and state governments control 6%, leaving 15% of the region's lands in private ownership. (Hecox and Ack. 1996. *Charting the Colorado Plateau: An Economic and Demographic Exploration.*)

Grand Canyon National Park, encompassing 1,218,376 acres, is the largest single protected area within the Colorado Plateau region. The Park is bounded on the north by the Kaibab National Forest and the Arizona Strip District of the BLM, on the east by the Navajo Reservation, on the south by Kaibab National Forest and Hualapai and Havasupai reservations, and on the west by the upper reaches of Lake Mead National Recreation Area.

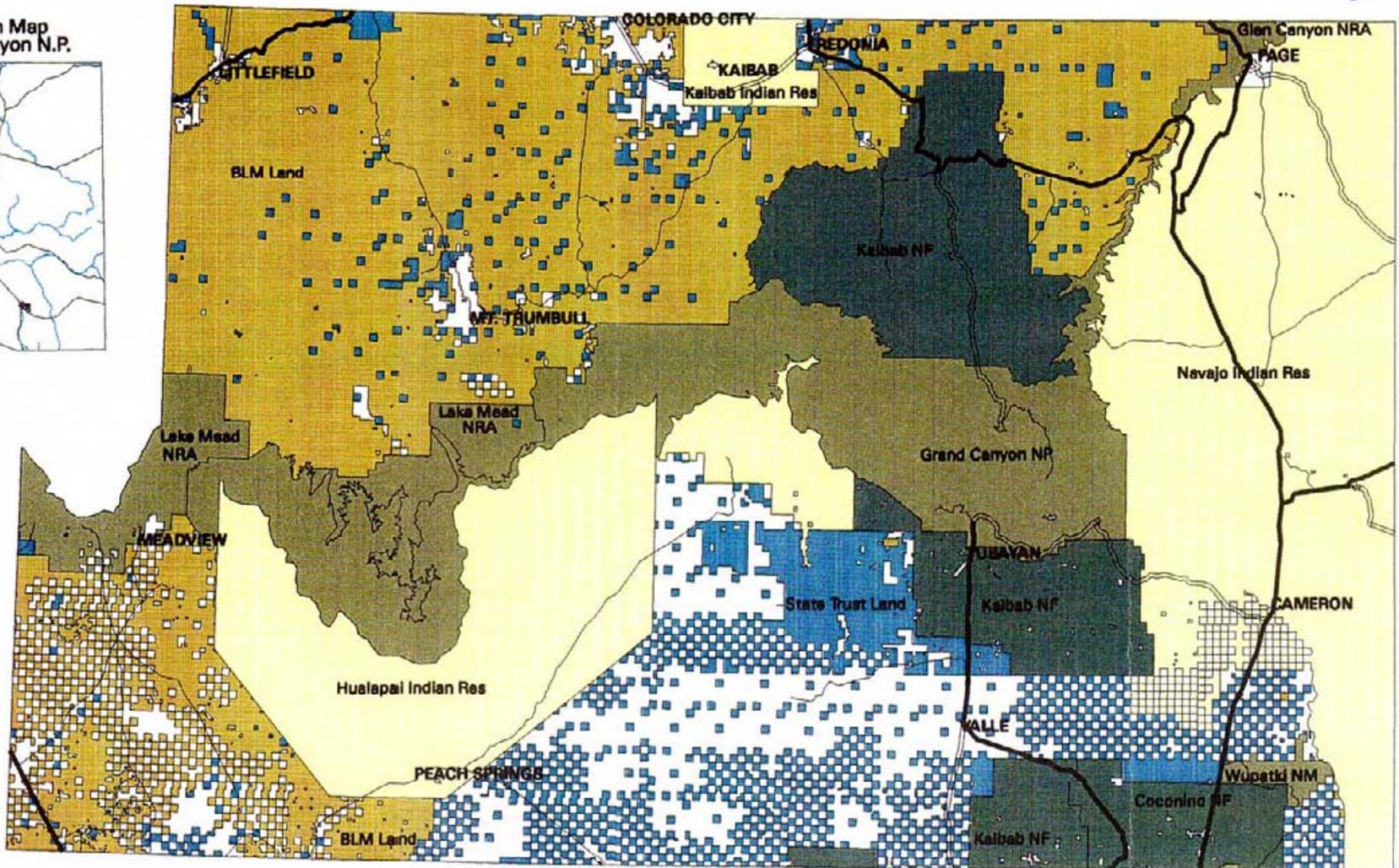
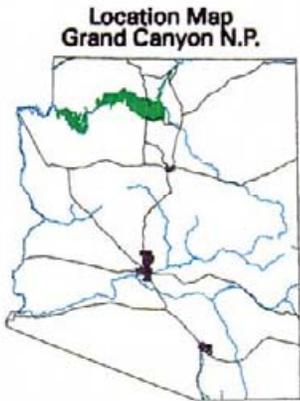
The Park is located entirely within Arizona, in Mohave and Coconino Counties, and is in Congressional District Number Three.

Colorado Plateau Eco-Region

As with most distinctive areas of the world, the landscapes, ecological communities and cultures of the Colorado Plateau eco-region evolved together. However, unlike many regions, the forces of nature and the strengths of early cultures on the Plateau continue to dominate, creating a unique sense of place. This provides a rare opportunity to preserve one of the few places in North America where culture and wilderness successfully coexist.

The following purposes and significance statements were formed during the general management planning process, and are included in the final 1995 Grand Canyon National Park General Management Plan (GMP).

Land Ownership surrounding Grand Canyon National Park

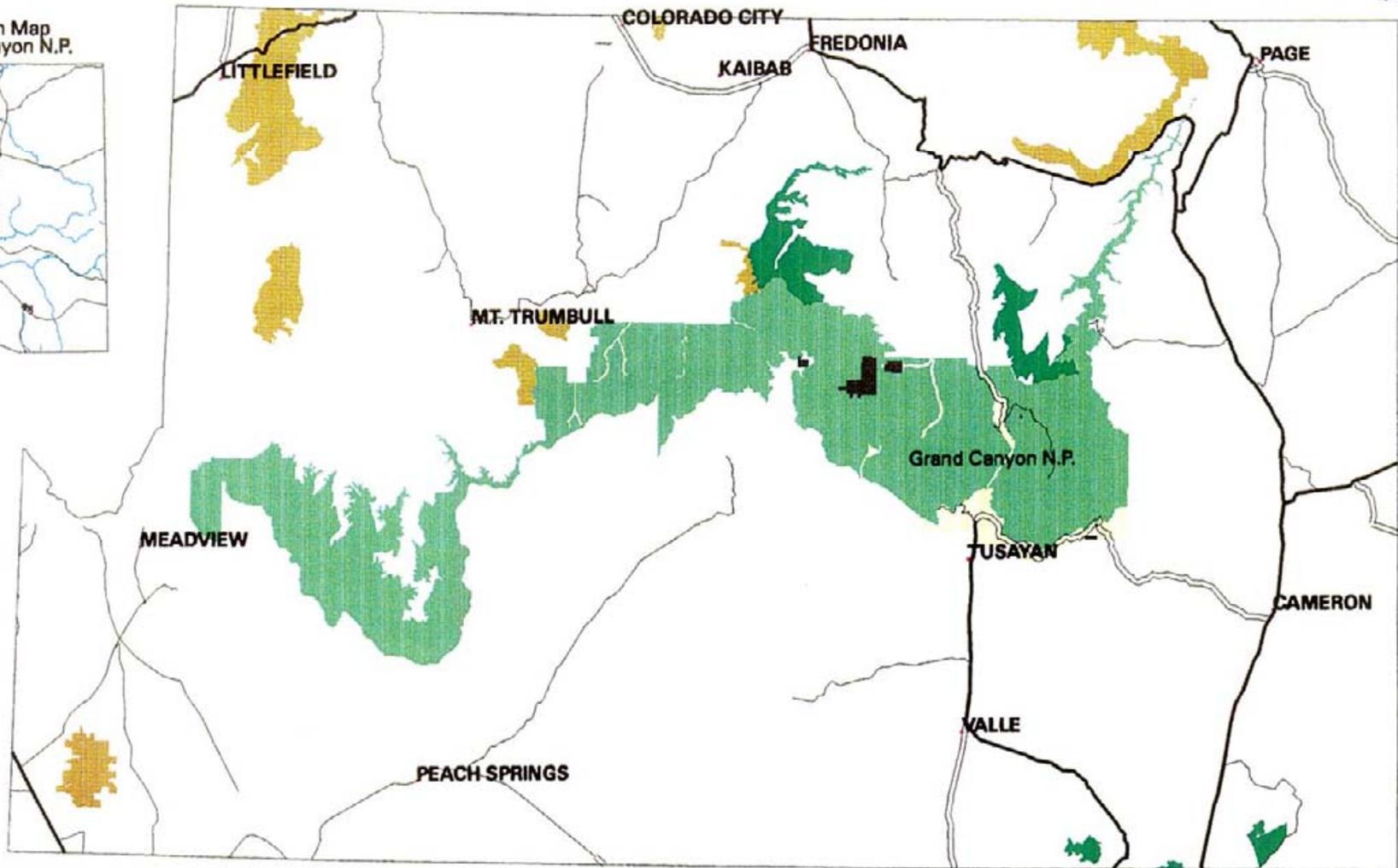


Legend

- | | |
|--------------------|-----------------------|
| Private Land | National Park Service |
| State Trust Land | AZ Game and Fish |
| BLM Land | Primary Highway |
| National Forest | Secondary Road |
| Indian Reservation | Road |

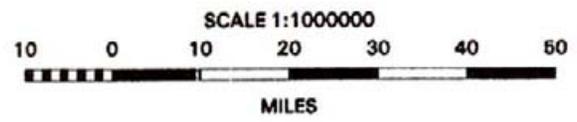


Grand Canyon National Park Proposed Wilderness and other existing Wilderness Areas



Legend

- BLM Wilderness Areas
- NFS Wilderness Areas
- GRCA Proposed Wilderness
- Developed Areas and Roads
- Natural Areas
- Primary Highway
- Secondary Road
- Road



PARK PURPOSE AND SIGNIFICANCE

Park Purposes

- Preserve and protect the natural and cultural resources and ecological processes of Grand Canyon, and its scenic, aesthetic, and scientific values, as a place of national and worldwide importance.
- Provide opportunities for visitors to experience and understand the environmental interrelationships, resources, and values of Grand Canyon without impairing the resources.

Park Significance

World Heritage Site

As a World Heritage Site, the Grand Canyon is recognized as a place of universal value, containing superlative natural and cultural features that should be preserved as part of the heritage of all the world's peoples. The Grand Canyon is unusual in meeting both natural and cultural resource criteria for World Heritage Site designation.

Natural Resources and Natural Ecosystem Processes

Well known for its geologic significance, the Grand Canyon is one of the most studied geologic landscapes anywhere in the world. It offers an excellent record of three of the four eras of geological time, a rich and diverse fossil record, a great diversity of geologic features and rock types, and numerous caves containing extensive and significant geological, paleontological, archeological and biological resources. As stated in the establishing legislation, the Grand Canyon is the "greatest eroded canyon in the United States."

It is considered one of the finest examples in the world of arid-land erosion. The Grand Canyon is neither the world's longest nor deepest canyon, but its volume is immense, averaging 4,000 feet deep for its entire 277 miles; 6,000 feet deep at its deepest point, and 15 miles at its widest. The significance of the Canyon, however, is not limited to geology.

The Park's great biological diversity includes five of the seven life zones and three of the four deserts in North America; from rim to river one encounters the—Lower Sonoran, Upper Sonoran, Transition, Canadian, Hudsonian life zones—equivalent to traveling from Mexico to Canada.

The Park serves as an ecological refuge, with relatively undisturbed remnants of dwindling ecosystems (such as boreal forest and desert riparian communities), and

numerous rare, endemic or specially protected (threatened/endangered) plant and animal species.

Over 1,500 plant species, 287 bird species, 88 mammalian species, 58 reptile and amphibian species, and 26 native fish species are found in the Park.

Research, Study and Education

The Park is a scientific Mecca for geologists, geographers, ecologists and other scientists from around the world. The Park contains six Research Natural Areas totaling 3,580 hectares that provide opportunities for research in ecosystems that remain relatively pristine. The Kaibab Squirrel National Natural Landmark occurs partially within the Park, protecting the ponderosa pine habitat of the endemic Kaibab Squirrel. The Park contains remote caves that preserve exceptionally important fossil records of extinct species and human habitation, providing a window into the mysteries of past cultural and ecosystem changes. The Park and surrounding adjacent protected areas represent one of the largest regions of Wilderness and protected landscapes in North America. When managed properly, this area provides an unequalled research laboratory, a class-room for young scientists, and an incredible resource for all to study and enjoy.

Cultural Resources

At least 4,000 years of human occupation have resulted in a rich and dynamic cultural geographical history which is still evident. Today, eight separate Indian Tribes have identified close cultural and sacred ties to the Grand Canyon, with some considering the Canyon their original homeland and place of origin. Grand Canyon contains more than 3,500 known archeological sites with artifacts indicating 3,000 to 4,000 years of human habitation. A recent finding suggests human use of the Canyon as much as 10,000 years ago. Approximately two percent of the Park has been systematically surveyed.

Euro-American habitation brought western frontier heritage and tourism. The Park's historic properties include 124 buildings listed as National Historic Landmarks, 336 properties listed on the National Register of Historic Places, 44 buildings and structures determined eligible for listing on the National register, and 884 buildings and structures on the List of Classified Structures. In addition, the South Rim Historic Village is being nominated as a Historic Landmark thematic area.

Scenic Qualities and Values

The Grand Canyon has internationally recognized scenic vistas, qualities and values. With ever-changing and colorful scenery of enormous proportions, it is widely considered one of the world's most spectacular landscapes. The great diversity of scenery includes forests, deserts, canyons, plains, plateaus, volcanic features,

streams and waterfalls. The Grand Canyon's air quality greatly effects the clarity and color of the visual scene.

Opportunities for Recreation, Re-creation, and Solitude

A diversity of resource-based recreational opportunities are available: the vast majority of the Park provides opportunities for wilderness experiences; hundreds of miles of trails and routes provide access; three inner-canyon trails are designated National Recreation Trails as part of the National Trails system; and the Colorado River within the Grand Canyon provides one of the world's premier primitive river experiences, including the longest stretches of white water in the continental United States.

The Grand Canyon is a place of tremendous natural, scenic and historic interest. For all who visit, it is a place of beauty. For those who seek solitude, it is a place of profound mystery, peace and tranquility. For those who know the Canyon best, these are the most precious and fragile of values. From the native peoples that have called these canyons home, to early European explorers such as Major John W. Powell Major John W. Powell, to modern-day outdoor enthusiasts, philosophers, artists, poets, musicians and photographers, the Grand Canyon of the Colorado River is spoken of as a sublime place of wonder, inspiration and spiritual power.

To Powell it was,

the most sublime spectacle in nature...It is a land of music. The river thunders in perpetual roar, swelling in floods of music when the storm Gods play upon the rock and fading away in soft and low murmurs when the infinite blue of heaven is unveiled. With the melody of the great tide rising and falling, swelling and vanishing forever, other melodies are heard in the gorges of the lateral canyons....Thus the Grand Canyon is a land of song.

In his journal, Powell attempts to sum up his feelings,

The glories and the beauties of form, color and sound unite in the Grand Canyon—forms unrivaled even by the mountains, colors that vie with the sunsets and sounds that span the diapason from tempest to tinkling raindrop, from cataract to bubbling fountain.

The Natural Soundscape

Precious human values and emotions are often the most difficult to preserve. As Powell so eloquently states, the power of the Grand Canyon rests in its unique combination of form, color and sound. To most visitors the importance of form and color are readily evident. The contributions of natural sounds to the environment and human experience is more subtle yet no less important.

Potential Designations

Over one million Park acres meet the criteria for Wilderness designation as part of the National Wilderness Preservation System. If combined with over 400,000 additional acres of proposed or designated Wilderness contiguous to Park boundaries, this area could become one of the largest, primarily desert, wilderness areas in the United States.

The Colorado River and most of its tributaries in the Park meet the criteria for Wild River designation as part of the National Wild and Scenic Rivers System.

LEGISLATION AFFECTING GRAND CANYON

There is a large body of legislation that directs the activities of the National Park Service in general, and the management of Grand Canyon National Park specifically. A summary of all such legislation can be found in Appendix A.

Grand Canyon National Park was first set aside as a “Public park for the benefit and enjoyment of the people” on February 26, 1919 (40 Stat 1175, Grand Canyon National Park Establishment Act).

Major changes were made in the Park boundary in 1975 by Public Law 93-620, the Grand Canyon Enlargement Act. This Act summarizes the Park’s significance, stating that Grand Canyon National Park is a “natural feature of national and international significance.” The Act established the 1,215,735-acre Grand Canyon National Park from a mixture of State and Federal lands which included the former Grand Canyon National Park, Grand Canyon and Marble Canyon national monuments, portions of Lake Mead National Recreation Area, USFS, BLM, and Bureau of Indian Affairs (BIA) lands.

Public Law 93-620 also authorizes the Secretary of the Interior to submit to the Federal Aviation Administration (FAA), the Environmental Protection Agency (EPA), or other responsible agencies recommendations for regulations concerning the use of aircraft in Grand Canyon National Park, if aircraft are threatening public safety, visitor experience, or natural quiet.

The National Park Service Overflights Act, Public Law 91-100 (1987), address the issue of aircraft overflights at the Grand Canyon, requiring the FAA and the NPS to work together to “substantially restore natural quiet to the Grand Canyon.”

Grand Canyon’s international significance was recognized in October, 1979, with the Park’s designation as a World Heritage Site. The high percentage of foreign visitation clearly demonstrates the Park’s international popularity.

The Grand Canyon Protection Act of 1992 charged the Secretary of the Interior to manage the operations of Glen Canyon Dam to “protect the natural, cultural and recreational values of Glen Canyon National Recreation Area and Grand Canyon National Park.” This legislation called for adaptive management of Glen Canyon Dam operations by the Bureau of Reclamation (BOR), supported by a long-term research and monitoring program, to assure that the resources and values of concern were protected.

LAND MANAGEMENT ZONES

Management of natural and cultural environments in a national park system unit is based on management zones identified by the Park’s General Management Plan and Statement for Management, but is derived from the following classifications in *NPS Management Policies* (1988, p.4:1-2):

Natural Zones

“The primary objective in natural zones is the protection of natural resources.... Natural resources will be managed with a concern for fundamental ecological processes as well as for individual species and features.... Managers and scientists...will try to maintain all the components and processes of natural evolving park ecosystems, including the natural abundance, diversity and ecological integrity of the plants and animals” (Ibid p.4:1). At Grand Canyon a Wilderness Subzone includes lands currently designated as potential Wilderness. Although not listed as subzones, other areas have special designations such as Research Natural Areas and Special Habitat Areas.

The bulk of Grand Canyon National Park (1,117,718 acres) is classified as a natural zone. Over one million acres is included in the proposed Wilderness area.

Cultural Zones

The primary objective in cultural zones is to preserve and foster appreciation of cultural resources. Where compatible with cultural resource objectives, the policies for natural zones will be followed. Subzones include: Archeological District(s) Subzone; Historical District(s) Subzone; and Native American Traditional Access Subzone.

The historic zone is comprised of four National Register districts on the North and South Rims. There are three districts on the North Rim: the Bright Angel Lodge District (73.1 acres), National Park Service Headquarters District (2.2 acres), and the North Rim Inn District (77 acres). The South Rim Village Historic District (73.5 acres) extends along the rim from the Bright Angel Lodge to Verkamps Curios. The Grandview Historic District (91 acres) is located just below the Grandview overlook on

Horseshoe Mesa. No formal archaeological districts or American Indian traditional access subzones have been defined.

Development Zones

These zones are managed for intensive visitor use. Visitor facilities such as walkways, buildings and other management facilities occupy much of the zone. The natural aspects of the land within these zones is altered.

At Grand Canyon the development zone is comprised of four distinct areas within the Park: South Rim Village Area (2,200 acres), Desert View (50 acres), North Rim Developed Area (150 acres), and Ranch Phantom Ranch (18 acres).

Special Use Zones

Special Use Zones are defined as where another public/private entity has jurisdiction within the Park. At Grand Canyon, the special use zone includes the 95,300-acre Havasupai Use Land. Figure 1-1 summarizes Grand Canyon National Park management zones.

Figure 1-1. Grand Canyon National Park Management Zones.

Management Zone	Acreage	Percent of park
Development Zone	2,418	0.2
Historic Zone	298	
Special Use Zone	95,300	7.8
Natural Zone	1,117,718	92.0
Total	1,215,735	100.0

LAND USE AND TRENDS

Adjacent Land Uses

Grand Canyon National Park is entirely surrounded by other Federal and Tribal lands managed by a variety of agencies and governments. To the west, the Park is bounded by the Hualapai and Havasupai reservations, and portions of Lake Mead National Recreation Area. To the east, the Park is bounded by the Navajo Reservation and Glen Canyon National Recreation Area. On the North and South rims, USFS lands abut the Park, and along the northwest boundary, lands administered by the BLM adjoin the Park. Since these areas are managed for a greater variety of recreational, traditional, and multi-use activities than Park lands, uses along contiguous areas are not always compatible.

The major area of cooperation with **Glen Canyon National Recreation Area** is at Lees Ferry, where the confluence of the Paria and Colorado rivers marks the boundary between the two NPS areas. At Lees Ferry, Grand Canyon river trips launch downstream while numerous fishing trips launch and travel upstream into Glen Canyon NRA. The Lees Ferry site is within the boundaries of Glen Canyon NRA, but both NPS areas have on-site personnel. Glen Canyon NRA is actively involved in the management of a trophy trout fishery above Lees Ferry, and works with the Arizona Department of Fish and Game to stock 50,000 exotic rainbow trout annually. These fish have populated most sections of the post-dam altered aquatic environment of the Colorado River within the Grand Canyon National Park.

The major area of cooperation between Grand Canyon National Park and **Lake Mead National Recreation Area** is Pearce Ferry and the Grand Wash Cliffs. Pearce Ferry is a major takeout point for Colorado River trips.

North of the Park is the **Kaibab National Forest** and the **BLM's Arizona Strip District**. Both of these areas are managed under a multiple-use concept. Within the Kaibab National Forest, the major use is timber production; thinning, slash burning, pest control and other forestry management techniques are regularly practiced. Grazing is also permitted on forest lands. These and other management practices require that Grand Canyon National Park work with national forest personnel to provide boundary protection from fire. The Kaibab National Forest is also designated as a Game Preserve, and is set aside for the protection of game animals and birds (16 USC 684-687).

On the Arizona Strip, use had been restricted to scattered grazing leases and limited recreation until about 1980, when rich deposits of uranium ore began to be mined. There is currently one active mine in the Park's vicinity, and two others under development. The closest mine is 3.5 miles from the Park boundary. Potential impacts from the Arizona Strip include introduction of radioactive wastes and/or mine water into Park watersheds, and increased visitor use resulting from improved access created by other agencies.

Trespass-cattle grazing has occurred on Grand Canyon National Park land, and the National Park Service has constructed fencing to ameliorate this problem. The inexact boundary location, inaccessibility, and need for rock-drilling to set fence posts all make fencing very expensive.

Approximately 400,000 acres of the BLM Arizona Strip District, including several units immediately adjacent to the Park, have recently received Wilderness designation. This designation is compatible with Grand Canyon land use.

To the south, the Park is bordered by the **Kaibab National Forest**, and the **Hualapai and Havasupai Indian reservations**. Issues of concern between the National Forest and the Park are similar to issues on the North Rim, with the exception of a pending land exchange between a private developer and the forest service.

A number of small inholdings within the USFS Tusayan Ranger District are being purchased by a developer to exchange for a more commercially viable parcel of land near the Park's south entrance community of Tusayan. The developers propose lodging, retail, local resident housing, and visitor attractions for the site. The development could significantly increase the number of employees living in the immediate area, impacting schools, law enforcement and other infrastructure elements. It is proposed that this development will be accommodated by drilling a deep well. The Forest Service is also proposing additional campgrounds in the Tusayan Ranger District, and a visitor facility in conjunction with the land exchange, both of which could have Park impacts.

Eastern boundary issues are exclusively related to the Navajo Nation, and are discussed below.

American Indian Neighbors

Grand Canyon's American Indian neighbors called this area home long before the first European arrived. The relationship between the various American Indian groups and the National Park Service is evolving.

Today, as a result of recent focus on developing an understanding and appreciation for cultural differences, there is a strong effort to promote partnerships between these groups and the NPS.

The GMP actively sought participation and input from each tribe, travelling to each reservation and meeting with representatives. There is good communication between these groups and Grand Canyon National Park as a result of these efforts. The ethnography program described in the GMP outlines important issues expressed at these meetings.

Interaction with the **Havasupai** continues to increase due to the overlap in activities between the Tribe and NPS. The Tribe and Grand Canyon are linked through the 1975 Grand Canyon Enlargement Act, along with numerous other laws and executive orders related to government-to-government relations and access to sacred sites. Traditional use continues within those lands identified as Havasupai Traditional Use Lands, including limited grazing, hunting and collecting.

The Park and Tribe have executed many agreements which form the foundation for on-going relationships. The Park and the BIA have executed a cooperative agreement on fire management along the common boundary. Memoranda of Understanding (MOU) have been in effect regarding Great Thumb and Supai Camp. Although both have expired, the Tribe and the Park plan to enter into agreements for these and other areas of mutual concern.

Tribes with Identified Affiliations with the Grand Canyon:

- *Havasupai Tribe*
- *Hopi Tribe*
- *Hualapai Tribe*
- *Navajo Nation*
- *San Juan Southern Paiute*
- *Paiute Indian Tribe of Utah*
- *Kaibab Paiute Tribe*
- *The Pueblo of Zuni*

To the east, the Park is bounded by the **Navajo Reservation**. The administrative boundary for Grand Canyon National Park, as established in the 1975 Enlargement Act, included lands in Marble Canyon which were also included within Navajo Nation lands. When the Enlargement Act was passed, the boundary was to meet with Navajo Nation concurrence.

No concurrence was ever received, hence a debate continues over the boundary location. A Solicitor's Opinion supports the NPS contention that the boundary is one-quarter mile east of the Colorado River in certain sections, and the Canyon rim in others.

Interaction with the Navajo Nation and local chapters continues (primarily Cameron and Gap-Bodaway), with emphasis on regional tourism and backcountry access.

The Department of the Interior, through a Solicitor's Opinion, believes the boundary between the Park and the **Hualapai Reservation** to be the old Colorado River high-water line from Mile 166 to Lake Mead on the south side. The Hualapai Tribe believes that the boundary is the center of the Colorado River. Although the debate continues, the Park and Tribe do continue to coordinate on projects related to the General Management Plan, and impacts due to the operations of Glen Canyon Dam.

Although GRCA has on-going relationships with five additional Tribes, none share a boundary with the Park. The Hopi Tribe, the Pueblo of Zuni, the Kaibab Paiute Tribe, the Paiute Indian Tribe of Utah, and the San Juan Southern Paiute Tribe all have ancestral interests in the Grand Canyon. Consultation continues with all Tribes related to all compliance projects and planning projects which could affect areas of ancestral interest to all tribes.

Within-Park Land Use

Lands in State or private ownership are undeveloped, and not currently used for non-park purposes. Navajo Nation lands however, are currently used for grazing and other non-park subsistence uses (Figure 1-2). Virtually all lands within the Park are

Federally owned. One tract is State-owned land—the Colorado River bottom. There is virtually no potential for development of this land. Public Law 93-620 declares that State lands can only be acquired by donation or exchange.

Figure 1-2. Ownership of Lands within Grand Canyon National Park. *Please note that these lands are indicated to be within the Park’s administrative boundary, and concurrence has not been received from the Navajo Nation.

Owner	Acreage	Percent
Navajo Nation*	24,288	2.0
State of Arizona	11,860	1.0
Private	392	0.0
Federal (NPS)	1,179,194	97.0
Total	1,215,734.64	100.0

The highest priority acquisitions are the Hearst, Curtis, and Lee privately owned tracts. The Hearst property is the largest tract, consisting of 16 potential mining claims on 325.87 acres below the Grandview overlook and on the north bank of the Colorado River. The Lee property consists of 66.67 acres located on the north side of the Colorado River in the Toroweap Valley.

Lands on the Colorado River’s east side in the former Marble Canyon National Monument are included in the Navajo Reservation. Although these lands are currently used for non-park purposes, acquisition by NPS in the near future is unlikely. Section 5(2) of Public Law 93-620 allows only for the transfer of lands held in trust for Indian Tribes to the United States upon approval of the Indian governing body.

VISITOR USE ANALYSIS

In 1919, the year Grand Canyon became a national park, 44,173 people visited. Since that time, visitation has steadily increased. By 1956, over one million people visited annually. In 1969, the two million mark was topped. In 1976, the Bicentennial year, the Park received 3,026,235 visitors, and hit four million in 1991. In 1996, visitation reached 4.877 million.

Reasons for increased visitation has never been carefully studied. However, population growth, increased mobility, expanded communication/media networks, a growth in discretionary income and time, and an increase in the number of available lodging units/campground spaces have all been contributing factors.

Visitation fluctuates seasonally: 22 percent of visitation occurs during spring, 48 percent during summer, 22 percent in fall, and 8 percent in winter. Visitation surges

during Easter week, Christmas week, and the first two weeks in August. As with all parks, spring and fall seasons are experiencing rapid growth.

In 1991, 4,222,397 visitors entered Grand Canyon National Park (a 12 percent increase over 1990); backcountry users spent 87,384 nights in the backcountry (although an exact figure is not known, the park estimates that approximately 800,000 visitors per year hike below the rims); River runners spent 163,262 user days on the Colorado River. Approximately 20,801 visitors rode mules into the Canyon, while the air-tour industry estimates that 650,000 visitors participated in air tours.

A thorough analysis of existing data, as well as new data-collection efforts, are needed to develop comprehensive visitor profiles, visitor-use patterns, and data gaps for Grand Canyon National Park.

A yearlong visitor survey was conducted in 1991 for the *General Management Plan*. This survey revealed:

- Almost 20 percent of the Park's visitors venture below the rim
- A large percentage of the Park's visitors (about 40 percent) come from other countries
- A majority of Park visitors spend the night in lodges, motels, and campgrounds in, and adjacent to, the Park.
- Most visitors are not traveling as a part of an organized tour group, but rather, are traveling with two or three other people, usually members of the same family, and arrive via privately owned vehicles
- Most Park visitors are well educated and earn over \$40,000 annually.

Further information is available in: *A Study of The Perceptions, Expectations, and Satisfaction Levels of Visitors To Grand Canyon National Park—A Final Report Prepared for Western Regional Office, National Park Service*, by Don E. Albrecht, Department of Rural Sociology and Recreation, Parks and Tourism Sciences, Texas A&M University, College Station, Texas.

A vast majority of Park visitors ranked the following as extremely important

- Viewing the Canyon from Park overlooks
- Knowing that Park resources and values are being protected
- Experiencing natural quiet

NATIONAL ENVIRONMENTAL POLICY ACT AND NATIONAL HISTORIC PRESERVATION ACT COMPLIANCE

National Environmental Policy Act Compliance

Occasionally management and development activities at Grand Canyon National Park have the potential to adversely affect the environment. These include road, trail, and visitor-facility construction; forest-fire suppression; and changes in regulations governing visitor-use levels. Compliance with the National Environmental Policy Act (NEPA) and other environmental legislation is the legal responsibility of the NPS.

Preparation of environmental compliance documentation is detailed in the *Project and Environmental Compliance Guide*, (January 1991), available from Grand Canyon National Park. Such documentation is completed prior to initiating new projects.

Projects involving any of the following elements need environmental clearance:

- ground or vegetation disturbance
- historic sites, structures or districts
- sites with potential archeological resources
- floodplains or wetlands
- threatened, endangered or sensitive species
- wildlife disturbance or population impacts
- changes in carrying capacities or user numbers
- planning and development proposals
- areas designated for Wild and Scenic River status
- prescribed burns
- sites within significant scenic vistas or viewsheds

Several parties involved with environmental compliance determine the appropriate clearance process and whether the proposed project requires a Categorical Exclusion (CA), Environmental Assessment (EA), or Environmental Impact Statement (EIS). In most cases the process includes the project initiator, the primary Park program manager, Park Compliance Coordinator, staff specialists within the Grand Canyon National Park Science Center, and the Superintendent. When working with EAs and EISs, the Public Information Officer directs the public involvement process.

Generally the Resources Management Plan is not the document through which environmental compliance is accomplished. Compliance (including requirements relating to the National Environmental Protection Act (NEPA), threatened and endangered species, floodplains and wetlands, air quality, etc.) is usually accomplished on a case-by-case basis as funding for a resource management activity becomes likely. Each action called for in a RMP project statement must be categorized as follows: environmental compliance has already been accomplished; is

not required; or is required but has not been done and will be done before any irreversible and irretrievable actions have been taken.

Some actions called for in the Resource Management Plan are continuations of existing programs in which compliance has been completed. If not implemented under previous plans, actions called for in this Plan are only proposals and thus not subject at this time to environmental compliance actions under the NEPA. However, before any new actions proposed in this Plan can be implemented, specific environmental compliance actions will be completed.

NEPA requires Federal agencies to 1) consider every significant aspect of a proposed action's environmental impact and, 2) inform the public that environmental concerns were considered in the decision-making process. Thus, NEPA invokes a process of thinking ahead, of determining a cause-and-effect scenario for the proposed actions, and describing those relationships to the public.

The Council on Environmental Quality establishes documentation procedures for implementation of the NEPA process. Three basic routes of NEPA documentation are used to meet legal responsibilities. They are the EIS, EA, and Categorical Exclusion (CA), listed in descending order of complexity. Only the CA does not need public review.

NEPA requirements ensure that any proposal to implement a previously non-operative portion of this Plan will include public comment and input.

National Historic Preservation Act (NHPA) Compliance for Sections 110 and 106

The purpose of NHPA is to preserve historic properties in addition to those of national significance, and establish frameworks to provide needed protection. Sections 106 and 110 of the Act have the greatest influence on Park operations. Section 110 calls for stewardship of resources owned or controlled by a Federal agency.

Stewardship includes identifying and evaluating all resources, and nominating to the National Register of Historic Places those resources thought to have local, State, regional, or national significance.

Until a resource is determined not to have historic significance, it must be protected as a historic property. Section 106 requires a Federal agency to take into account the outcome a proposed action might have on a property that is included in, or eligible for, inclusion in the National Register. It also provides that the Advisory Council on Historic Preservation be provided opportunity to comment on the proposed action. Actions proposed within this Plan will be reviewed for compliance with Section 106 on 106.

The cultural resources aspects of this Plan were reviewed and approved in consultation with the Arizona State Historic Preservation Officer (SHPO) and the Advisory Council on Historic Preservation prior to the finalization of this document.

Developing and implementing a comprehensive, integrated resource management program at Grand Canyon National Park requires the active participation of all Park divisions. The components of an integrated resource management program include: management direction; planning and compliance; consultation and coordination; education and interpretation; research and study; inventory and monitoring; restoration and rehabilitation; maintenance; law enforcement; and mitigation.

ROLES IN RESOURCE MANAGEMENT

Park Staff Roles and Relationships to Resource Management

Grand Canyon National Park Science Center

The resource management program is coordinated by the Science Center, but all Park staff has responsibility for protecting Park resources or supporting those that do.

The Science Center is responsible for resource planning, program coordination, research, long-term monitoring, and the implementation of actions requiring expertise in natural science, social science and cultural resource management.

Division of Visitor Services and Interpretation

This Division is responsible for providing a comprehensive interpretive and educational program that includes complex resource issues. Public education is a key element in a proactive resource stewardship program. This program is being expanded to meet the informational and educational needs of Park neighbors, other government agencies, and those involved in the political process.

Division of Visitor and Resource Protection

This Division is responsible for protecting resources through public education by providing information regarding regulations and proper behavior; enforcing regulations; issuing backcountry permits and monitoring use; and through implementing the Park's wildland and structural fire management programs. This preventative role is essential to resource management program success.

Division of Maintenance and Engineering

This Division is responsible for site and structure maintenance; restoration and rehabilitation of historic structures; resource impact mitigation of recreational use and facility development; and trail maintenance.

Division of Administration

This Division provides support for Park operations including resource management. This is a critical and essential function that has a substantial bearing on resource management program effectiveness.

Division of Concessions Management

This Division assures that all concession operations contribute as true stewardship partners, in all aspects of the resource management program. Areas where concession operations can be most effective include visitor education, recycling, water conservation, and the effective maintenance of historic structures.

Public Affairs Office

The Public Affairs Office has the responsibility for developing and maintaining a proactive public relations strategy focused on gaining public support for NPS and Interior positions, Park programs and projects.

Office of the General Management Plan Implementation Team (I-Team)

The I-Team was established in 1996 to implement the Park's new General Management Plan. The primary focus of this work group is to oversee major changes in developed area facilities and roads, establish a transportation system, and provide leadership in the development of strategies to increase external funding sources to support the GMP.

Superintendent's Office

The Superintendent's Office is responsible for resource stewardship program leadership and oversight by establishing goals; formulating strategies; approving priorities; allocating personnel and funding needed to successfully implement projects and programs; and evaluating resource program effectiveness and efficiency. This office represents the National Park Service and Grand Canyon National Park when dealing with issues that are politically sensitive. A goal of this Plan is to provide scientifically valid information to Park management for making informed decisions that protect, restore and preserve the Park's natural and cultural resources and associated values.

Partner Organization Roles in Resource Management

Federal, Tribal, State and Local Government Roles

Government agencies and American Indian tribes that manage lands adjacent to the

Park boundary or share regulatory authority for the preservation and use of Park resources are essential resource management program partners. In some cases the role of these organizations are incorporated in law, others are documented in formal agreements, while some are informal working relationships. The science program components of these relationships are documented more fully in Chapter Three—**Grand Canyon National Park Science Center Partnership**. In general, an objective of this Plan is to improve the effectiveness of working relationships with partner organizations.

Cooperating Association and Non-Government Partners

Grand Canyon Association (GCA) is a not-for-profit organization which fosters, supports and enhances NPS educational and scientific operations. The Association is as a retailer of interpretive and educational material for Grand Canyon National Park. Materials produced and sold include various types of books, educational videos, music, and artwork. The Association strives to educate the public on subjects dealing with natural and cultural history, and issues facing the environment. They offer classes through the **Grand Canyon Field Institute** as a way to further the public's knowledge, understanding and appreciation of the Grand Canyon.

The Grand Canyon Fund (GCF) was established as a not-for-profit organization in 1995 to raise monies in support of implementing high priority actions needed to improve Park facilities, and protect resources. Many of these needed actions are defined in the *General Management Plan* and this Plan.

Non-government Conservation Organizations

Numerous conservation and advocacy organizations are actively engaged in insuring that public values associated with Grand Canyon National Park are not diminished, and that park resources are effectively protected. The role that these organizations play in articulating public interests, views, and needs, and being engaged in creating effective solutions to management issues, is essential to the preservation of this Park and to maintaining the integrity of the National Park System.

CHAPTER TWO

Present Resource Description and Status

Natural Resources

Natural Quiet

Geologic

Water

Air

Vegetation

Wildlife and Fisheries

Cultural Resources

Archaeological

Ethnographic

Historic

Museum Collection

Recreational and Experiential Resources

Developed Areas

Proposed Wilderness

Regional Recreation

NATURAL RESOURCES

Natural Quiet

Since the time of John Wesley Powell, the first Euro-American to record an exploration of the Grand Canyon, this area has been known for its unique combination of immensity and quiet. The clear skies, desert light, dry air, limited vegetation, geologic grandeur and starkness all contribute to creating an area that has long been revered and sought for its quietness and solitude. Indeed, archaeological and ethnographic information suggests prehistoric and historic American Indian groups sought and revered the Canyon for many of these same reasons, just as contemporary American Indians continue to do. The present-day importance of these characteristics can be observed at least twice daily in the large number of visitors who flock to rim overlooks, and watch in silence and awe as the sun sets or rises. For visitors to the inner canyon who actively seek out opportunities for solitude and natural quiet, the meaning, importance, and value of quiet and natural sound is greatly magnified.

Just as natural quiet is important to visitor experience and Park appreciation, it is also critically important to other protected Park resources. "Non-natural sounds" (i.e., introduced, human-caused or mechanically produced sounds) may, depending on location, volume, and timing, produce direct and indirect negative physiological and behavioral responses in wildlife. Non-natural sounds also may have negative impacts on cultural and historic resources including possible damage to fragile archaeological

and historic structures from vibration and acoustic impacts. Similarly, non-natural sounds may negatively impact areas used as ceremonial, sacred, or traditional-use sites.

Grand Canyon's quiet is not the absence of sound—it is not silence. It is the presence of the sounds of nature in the absence of human-caused or mechanically produced sounds. It is the sound of wind in the trees, the sound of animals, and of water flowing. These conditions of natural quiet typically vary from moment to moment and place to place with changes in vegetation, terrain, meteorological conditions, and the presence of animals. The changes in natural sound levels combined with the ability to discern natural sounds from discrete sources make the impact of natural sound conditions and natural quiet all the more valued and significant to the listener. The presence of natural quiet tends to heighten the stimuli and impact received through other senses.

Natural sounds and natural quiet have long been regarded as Park resources. They are among the conditions and resources the National Park Service is mandated to protect and "leave unimpaired for the enjoyment of future generations." This mandate, under the Organic Act, was strengthened under the Redwoods Act of 1978 which specified that resource preservation is the primary responsibility of the National Park Service. Thus, under law, policy, and visitor expectation, natural quiet is a resource to be protected.

Geologic Resources

The Grand Canyon of the Colorado River is a world-renowned showplace of geology. Geologic studies in the Park began with the work of Newberry in 1858, and continue today. The Grand Canyon's excellent display of layered rock is invaluable in unraveling the region's geologic history. Extensive carving of the plateaus allows detailed study of Earth movements. Processes of stream erosion and vulcanism are easily seen and studied.

The Colorado River has carved the Grand Canyon into four plateaus of the Colorado Plateau Province. The Province is a large area in the Southwest characterized by nearly-horizontal sedimentary rocks lifted 5,000 to 13,000 feet above sea level. The Plateau's arid climate produced many striking erosional forms, culminating in the Grand Canyon. The Canyon's mile-high walls display a largely undisturbed cross section of the Earth's crust extending back some two billion years.

Three "Granite Gorges" expose crystalline rocks formed during the early-to-middle Proterozoic Era (late Precambrian). Originally deposited as sediments and lava flows, these rocks were intensely metamorphosed about 1,750 million years ago. Magma rose into the rocks, cooling and crystallizing into granite, and welding the region to the North American continent.

Beginning about 1,200 million years ago (late Proterozoic), 13,000 feet of sediment and lava were deposited in coastal and shallow marine environments. Mountain building about 725 million years ago lifted and tilted these rocks. Subsequent erosion removed these tilted layers from most areas leaving only the wedge-shaped remnants seen in the eastern Canyon.

Rock layers formed during the Paleozoic Era are the most conspicuous in the Grand Canyon's walls. Coastal environments and several marine incursions from the west between 550 and 250 million years ago deposited sandstone, shale and limestone layers totaling 2,400 to 5,000 feet thick. Layers from the Cambrian, Devonian, Mississippian, Pennsylvanian and Permian periods are present.

Erosion has removed most Mesozoic Era evidence from the Park, although small remnants can be found, particularly in the western Grand Canyon. Nearby rock outcrops suggest 4,000 to 8,000 feet of sedimentary layers from the "Age of Dinosaurs" once covered the Grand Canyon area. Cenozoic Era (the "Age of Mammals") layers are limited to the western Grand Canyon and terraces near the River itself. A few sedimentary deposits formed in lake beds, but the most spectacular recent deposits are the lava flows and cinder cones on the Shivwits and Uinkaret plateaus. Volcanic activity began about six million years ago and has continued to within the last several thousand years. Spectacular lava cascades down the Canyon walls have helped date the Grand Canyon's carving.

The Grand Canyon itself is a late Cenozoic feature, characteristic of renewed erosion during this time. Vigorous cutting by the snow-fed Colorado River carved the Canyon's depth. Canyon widening is held in check by the region's dry climate. The asymmetry between rapid downcutting and slow widening results in the Grand Canyon rather than a more typical broad (and nondescript) river valley. Although violent storms may send flash floods gouging down narrow side canyons, the lack of steady moisture has created a stark landscape of mostly naked rock.

Harder, erosion-resistant rocks such as the Coconino Sandstone and the Redwall Limestone have eroded into bold cliffs. Softer layers melt into slopes like the Tonto Platform (Bright Angel Shale) and the Esplanade (Hermit Shale). The oldest, crystalline rocks are chiseled into the craggy cliffs of the Granite Gorges.

Nearly 40 identified rock layers form the Grand Canyon's walls. They have attracted students of earth history since 1858. Because most layers are exposed through the Canyon's 277-mile length, they afford the opportunity for detailed studies of environmental changes from place to place (within a layer) in the geologic past. Geologic evolution through time can be studied through the changes between different layers.

It was the work of geologists that began changing the public's opinion of the Grand Canyon region from that of "a worthless locale" to "the most sublime of earthly spectacles." After nearly 150 years, geologists are still not finished studying the

Grand Canyon. In the mid-1970s, a new rock layer was identified in the Canyon walls. Scientists continue investigating how environment affects rock formation. Perhaps the biggest question of all, how the Colorado River chose this course and begin carving the Canyon, still awaits a clear answer.

Soils

Geology and slope strongly influence most Grand Canyon soils. Currently, soils throughout the Canyon are categorized as poorly developed. Soils are highly variable, ranging from moist forest soils of the North Rim to shallow, dry mineral soils and bedrock exposures of the inner canyon. Inner canyon soil textures are sandy loam, sands, or loamy sands. It is likely that there are a few silt loams or clay loams in the Hermit and Bright Angel shales and in the Toroweap Valley.

Most soil types erode very easily and regenerate slowly. Their sandy nature allows water to be absorbed immediately, leaving the ground dry shortly after rain showers. The soils are typically fragile and require little disturbance to create erosional problems.

Large Park areas show essentially no human impacts to soils. Other areas were used for farming, grazing and mineral extraction. Developed areas have heavily impacted soils. Soil ("cryptogamic") crusts are very sensitive soil systems, specific to arid lands. These crusts cover a significant portion of inner canyon soil. Cyanobacteria form the crust, while other bacteria, algae, fungi, lichens, and mosses are often present. These crusts play important roles in reducing soil erosion, increasing water conservation and in promoting nitrogen fixation. They create a more favorable environment for vascular plants to germinate under arid conditions. These crusts are highly susceptible to trampling and air pollution.

Soil surveys exist for about 23% of the Park (188,000 acres on the Sanup Plateau and 93,500 acres on the Havasupai Traditional Use Lands). These areas were surveyed as part of grazing allotment analysis. Extensive soil surveys, however, have not been conducted for much of the Canyon.

The soils along the Colorado River are known in more detail. Land areas along the River are characterized by fine-grained beaches, coarse-grained cobble bars, and tributary fan deposits. The fine-grained deposits found on river terraces may be classified according their age (pre- or post-Glen Canyon Dam), how they were deposited (floods, wind action, or underwater reworking below present high water) and soil grain size (cohesive silts, and sands with negligible silt).

Cave Resources

Hidden within the Grand Canyon are hundreds of caves. Most are dissolved into the limestones in the Redwall and Muav formations, although caves occur in other formations. The caving community is well aware of these caves; hikers frequently visit

Cave of the Domes on Horseshoe Mesa. Caves throughout the Park contain unique cave formations or “speleothems”; mummified remains of extinct Ice Age fauna; archeological remains (including split-twig figurines); and unique biological systems. Many caves also play a major role in regional hydrology. Substantial underground streams emerge from Vaseys Paradise, Cheyava Falls, and Roaring, Thunder, and Tapeats springs.

Paleontological Resources

Fossils found within the Grand Canyon encompass virtually the entire spectra of type and preservation. They include algal mats and bacterial spores over a billion years old, mummified dung and hair 11,000 years old, and a multitude of body and trace fossils from the Paleozoic Era, 550-250 million years ago. Fossils tell a great deal about the origin of their host rocks, including the rock’s age and its depositional environment. Nineteenth-century geologists responsible for the earliest geologic mapping at Grand Canyon relied heavily on fossils to determine rock age and their equivalence to known strata.

The older Proterozoic rocks in the inner gorge (schist, gneiss, and granite) are not fossil-bearing. Younger Proterozoic rocks of the Grand Canyon Supergroup (specifically the Bass limestone) contain the oldest fossils in the region (1.2 billion years old). These are “stromatolites,” primitive algal remains very similar to modern algal domes found in marine environments. The 750 million-year-old Kwagunt Formation contains abundant bacterial cysts and spores.

The paleontological record is richer for Paleozoic rocks, including all of the horizontal layers visible from the Canyon rim. Most of these fossils are remains of marine invertebrates. Along the rim, the Kaibab Limestone contains many fossil localities easily accessible to the public, and easily destroyed by development. Evidence of ancient life can be found in the non-marine rocks as well; windblown Coconino Sandstone contains footprints left by ancient reptiles and amphibians. The Supai Group and the Hermit Shale also contain footprints, as well as plant and invertebrate fossils.

Dry caves in the Park contain a wealth of information regarding Grand Canyon’s plant and animal communities since the Ice Age. Deposits in the caves contain dung (and guano), bone, hair, pollen, and other perishable remains from late Pleistocene fauna including ground sloths, condors, teratorns, Harringtons mountain goat, and others. Plant remains record fluctuating climatic conditions as the modern regime became established.

Water Resources

Most of the water flowing in the Colorado River through the Grand Canyon originates in the high mountain areas that rim the upper Colorado drainage basin. The estimated

runoff in the Colorado River at Lees Ferry, Arizona (the head of the Grand Canyon), has ranged from 5.6 to 24.0 million acre-feet per year. Ten-year averages ranged from 11.6 to 18.8 million acre-feet. The significance of this variability is acute in modern River management. A 25-year period (1906-1930) of predominantly above-average runoff was used to allocate water in the Colorado River to seven western states and Mexico (the 1922 Colorado River Compact and 1944 Mexican Water Treaty). The following 40 years (1931-1970) had predominantly below-average runoff. Current allocation accounts for nearly complete use of the Colorado River's flow. Springs and tributaries entering the Colorado in Grand Canyon contribute about 0.5 million acre-feet of water to the River annually.

Historic Water Use

Despite the tremendous quantity of water flowing through the mile-deep Canyon, the water supply history at Grand Canyon has been one of scarcity. As the River cut a canyon through the rock layers, ground water drained into the Canyon. Precipitation is quickly absorbed by the porous rock on the rims, making surface water rare and temporary.

Before 1900, mules carried some water to the South Rim developments from the springs at Indian Garden, 3,200 feet below Grand Canyon Village. Water was also collected in natural or dug "tanks" and cistern catchments. After completion of the railroad to Grand Canyon in 1901, water was hauled to the South Rim in tank cars.

A sewage disposal plant was completed on May 28, 1926, making reclaimed effluent available for non-potable uses. On August 26, 1932, the Santa Fe Railroad completed a pipeline to Indian Garden. Pumps were installed with a capacity of 278,000 gallons per day.

The water lifted from Indian Garden proved sufficient to meet the needs of the large influx of Park visitors following World War II. Additional reservoirs on the South Rim provided storage for water pumped during the slack winter season. Water storage capacity grew from about four million gallons in 1958 to thirteen million gallons in 1968. Water consumption in that year reached 96 million gallons, virtually the entire flow from the springs at Indian Garden.

The earliest developments on the North Rim obtained water from a small spring on Bright Angel Point. A pipeline from Roaring Springs, 3,000 feet below the North Rim, began delivering water in 1928. A dam and hydropower plant on Bright Angel Creek supplied power.

In August 1970, a 13-mile-long transcanyon pipeline was completed, connecting Roaring Springs below the North Rim with the pumping facilities at Indian Garden below the South. The pipeline operates continuously, delivering approximately 720 gallons per minute (378.4 million gallons per year) to the Indian Garden pumping station. Two new pumps at Indian Garden were also installed in 1970. The system

could deliver 420 gallons per minute from Indian Garden to the South Rim, through the 1932 pipeline installed by the Santa Fe Railroad. The springs at Indian Garden now flow freely into Garden Creek, but are supplemented by surges of excess water from the transcanyon pipeline. These surges have very different water quality from the natural flow from Indian Garden springs.

Between 1985 and 1988 major improvements were made to the transcanyon pipeline and pumping facilities at Indian Garden. A new eight-inch-diameter steel pipeline was installed from the South Rim to Indian Garden inside a directional drill hole. A new, 750-horsepower pumping system replaced the original pumps in the renovated 1932 pump house. A section of the transcanyon waterline from Plateau Point to the Colorado River was replaced with steel pipe and rerouted to avoid rock slides. A pipeline from Grand Canyon Village to Desert View, initiated in the 1960s, was completed. A new million-gallon reservoir replaced the 325,000-gallon tank to serve higher elevation facilities in Grand Canyon Village. These improvements allow up to 680 gallons of water per minute to be pumped from Indian Garden, provide additional water storage on the South Rim, and allow water to be pumped the twenty-eight miles to Desert View instead of being hauled by tanker truck.

By the early 1990s, the transcanyon pipeline had exceeded its material lifetime. As the pipeline continues to age, repairs are needed more frequently, and become more costly. It will cost approximately \$40 million to upgrade the pipeline and extend its life. This project's environmental consequences will be determined through the National Environmental Protection Act and the National Historic Preservation Act compliance processes.

Water Rights

Water is a vital natural resource, especially in the arid southwestern United States, where legal and institutional systems are organized to control water use. In the Grand Canyon region, water use is subject to treaty obligations, Federal and State laws, and interstate compacts and agreements. Water rights are generally based on the appropriation doctrine in which first-in-time is first-in-right. Most surface water has already been assigned to specific applicants or users. The remaining supply is desired, and actively pursued, by many State and interstate groups, as well as private individuals.

The Federal government has asserted, and the courts have affirmed, that it has the right to enough water to develop Federal "reserved" land, provided the water is used for purposes of the reservation. National Parks are examples of such reservations. The right is effective as of the date of the reservation action. The Federal government thus has the right to use all waters originating in, or flowing through, Grand Canyon National Park for Park purposes that was not already claimed before the reserve's establishment. Federal reserved water rights for Park purposes have been asserted, and must be quantified for Park areas in the Little Colorado River Basin.

The complex nature of water development projects makes cooperation among water users essential in making projects possible. In 1922 the Colorado River states drafted the Colorado River Compact to apportion the River's waters. Congress approved the Compact in the Boulder Canyon Project Act of December 21, 1928, and President Hoover declared it in effect on June 25, 1929. The Compact divided the Colorado River into two drainage basins, Upper and Lower, with Lees Ferry, Arizona, the dividing line between them.

Air Resources

Grand Canyon National Park enjoys some of the cleanest air left in the United States. This clean air is a fragile resource, and existing levels of human-caused pollution create clearly visible hazes. Many studies have been conducted to characterize this haze, its composition and origin. In addition to visibility studies, monitoring programs in the Park measure acid deposition (both wet and dry), ozone concentrations, ultraviolet radiation, and meteorological data. Special studies have supplemented this information with other data.

Class I Area

Grand Canyon National Park was designated a Class I area by the Clean Air Act as amended in 1977 (Public Law 95-217). The Act limits deterioration in air quality and gives added protection to uniquely scenic areas. Amendments to the Act in 1990 called for the creation of the Grand Canyon Visibility Transport Commission to study the interstate transport of air pollutants into the Grand Canyon area. The Commission made its recommendations to the Environmental Protection Agency June 10, 1996. The recommendations address reducing air pollution emissions from industry and vehicles. They also address smoke from forest and agricultural burning and other visibility-related issues. A successor to the Commission will continue its regional coordination role, and monitor recommendation implementation.

Monitoring

Air quality monitoring at Grand Canyon began in 1958. Since then, many techniques have been used to measure visibility, aerosols, gases and acid deposition. The monitoring program is designed to identify existing air quality and trends, measure sensitivity of Park resources to air quality, establish local and synoptic weather patterns affecting air quality, and identify sources and the nature of existing and potential pollutants.

Air quality at Grand Canyon is generally good, but is increasingly threatened by human sources, including metropolitan areas in Arizona, Nevada and California, and also development in northern Mexico. The net effect is a measurable impact on the visibility that is of paramount importance for visitors to appreciate the Grand Canyon. Visibility is often impaired in Grand Canyon National Park by haze even though

pollutant levels do not exceed National Ambient Air Quality Standards (NAAQS). Very small amounts of light-scattering pollutants can significantly reduce visibility under such clean conditions. Haze results in a reduction in clarity and brilliance in the Park and can eliminate distant views. Visibility at the Grand Canyon averages 80 miles, and can exceed 155 miles on the clearest days. Haze can reduce visibility to less than 50 miles, but visibility is still superior to many sections of the country, and should remain so for the future.

Vegetation Resources

More than 1500 known vascular plant species within an elevation difference of almost 8,000 feet have been documented within the Park. Additional species are to be expected with future botanical inventory, especially within remote and rugged areas of the inner canyon and western Grand Canyon. Approximately eight percent of the Park's flora is exotic. Grand Canyon has over a dozen endemic plants known only from localities within the Park's boundaries. An additional 23 regional endemics are known which have ranges crossing Park boundaries. Also, over 167 species of fungi, 64 moss species and 195 lichen species have been reported. Species composition and distribution are influenced by climate, geomorphology and geology.

The Park contains 129 vegetation communities or formations: riparian woodland and scrub, desertscrub, grassland, woodland, and forest. Sixty-three vegetation associations within these formations have been classified and mapped in Grand Canyon (see: Warren P. L., K. L. Reichhardt, D. A. Mouat, B. T. Brown, and R. R. Johnson. 1982. *Vegetation of Grand Canyon National Park*). A riparian community exists along the Colorado River and its perennial tributaries, characterized by the exotic saltcedar (tamarisk), coyote willow, arrowweed, seep willow, western honey mesquite and catclaw acacia. The Colorado River riparian corridor has been disturbed due to the building and operation of Glen Canyon Dam in 1963. Hanging gardens, seeps and springs contain many rare and unique plant species.

Next to the River corridor is a desertscrub community composed of plant species with affinities to the four North American desert floras. A Mohavean desertscrub extends from the Grand Wash Cliffs in extreme western Grand Canyon to near the Colorado River's confluence with the Little Colorado River. It is typified by warm desert species such as creosote bush and white bursage. Frost-sensitive species more characteristic of the Sonoran Desert such as brittle bush, catclaw acacia, and ocotillo can also be found. Chihuahuan species such as mariola, western honey mesquite, and four-wing saltbush also occur. Upstream of the Little Colorado River in Marble Canyon and on the Tonto Platform, species more characteristic of the Great Basin Desert predominate, such as big sagebrush, blackbrush, and rubber rabbitbrush.

Grassland communities in Grand Canyon are rare and few. Mountain meadows on the North Rim are of two types: montane meadows and upland subalpine grasslands. Both are typified by many grass species, with sedges in the wettest areas and forbs and

grasses along the dry margins. Semi-desert shrub-grasslands occur at Toroweap Valley and above the Grand Wash Cliffs. These areas are characterized by big galleta, blue and black grama, Indian ricegrass, and three-awns.

Above the desert scrub and up to 6,200 feet is a woodland consisting of pinyon pine and one seed and Utah junipers. Other species include big sagebrush, snakeweed, Mormon tea, Utah agave, narrowleaf and banana yucca, snakeweed, winterfat, Indian ricegrass, dropseed, and needlegrass.

Above the woodland between elevations of 6,500 and 8,200 feet on both the North and South rims is a forest characterized by ponderosa pine. Typical plants in this community are Gambel oak, New Mexico locust, mountain mahogany, elderberry, creeping mahonia, and fescue.

Another forest type is found on the North Rim above 8,200 feet. This spruce-fir forest is characterized by Englemann spruce, blue spruce, Douglas fir, white fir, aspen and mountain ash. Typical plants include several species of perennial grasses, groundsel, yarrow, cinquefoil, lupines, sedges and asters.

Fire Effects

Natural fire presence or absence influences the number and distribution of plants and animals in an ecosystem. Fire suppression in the Grand Canyon region during the 55 years before 1978 (when a prescribed fire program was instituted at Grand Canyon) has changed the structure and vegetation composition of the pre-settlement forest and shrub communities. Many communities are fire-dependent for the perpetuation of natural processes. Research conducted on both the North and South rims shows that these forests are adapted to frequent, low-intensity fire. However, the spruce-fir forest of the North Rim, above 8,600 feet, is characterized by both low-intensity and infrequent, high-intensity fires.

In fire's absence, thick stands of young pine, spruce, and fir have closed in upon the once open park-like North Rim forest. Lack of natural burning allows tree crowns to close in and shade many forage plants that support forest animal populations. Dense stands of trees allow the rapid spread of forest infestations such as dwarf mistletoe. The deep accumulation of forest litter improves the habitat for some nuisance insects. Tree crowding contributes to the general slowing of growth rates and lowered resistance to disease and insect infestations. The large quantities of forest fuels accumulated due to previous fire suppression activities. There is a decrease in herbaceous and shrub production, disruption of nutrient cycling, and ecosystem simplification with decreased species and landscape diversity.

The Park's forested areas are now susceptible to holocaust, stand replacing fires. Unburned fuels due to fire suppression have accumulated to unsafe levels so that wildfire threatens entire forest stands and endangers Park developed areas. Since 1978, the Park has accomplished less than 13% of the projected area to be treated by

prescribed fire. The remaining 87% involves significant complexity, much of it without precedent to the National Park Service.

Expanding the prescribed fire zone into some of the wilderness zone on North Rim is important to return to a natural fire regime. Achievement may take decades since several large and complex management ignited prescribed fires must be executed near these areas.

Endangered/Protected Species

Currently there is one Federally listed endangered plant in Grand Canyon: the sentry milk-vetch (*Astragalus cremnophylax* var. *cremnophylax*). In addition, there are seven "species of concern," formally termed Category 2 plants by the U.S. Fish and Wildlife Service under the Endangered Species Act (ESA). There is not enough evidence at this time to support listing these seven species; but should additional information on threats to their populations become available, they may become candidates for listing. (See: U.S. Fish and Wildlife Service. 1996. "Endangered and Threatened Species, Plant and Animal Taxa; Proposed Rule." Wednesday, February 28, 1996, *Federal Register*, Part III).

Outside Park boundaries are three Federally listed plants: the Brady pincushion cactus is endangered, and the Welsh milkweed and Jones cycladenia are threatened. There are three proposed candidate plants and nine "species of concern." No populations of these species are presently known within the Park. But in some cases suitable habitat does exist, and populations may be discovered in the future.

Additional protection is afforded many native plants by the Native Plant Law developed by the Arizona Commission of Agriculture and Horticulture. Unauthorized collection of these plants is illegal without a permit. Also, Federal agencies with lands next to the Park have assigned special status designations to many species.

Wildlife and Fisheries

Its large size, relatively unfragmented and diverse habitat, and range of elevations and associated climates have made Grand Canyon National Park a valuable wildlife preserve. The current Park wildlife species database includes 315 birds, 88 mammals, 50 reptiles, 8 amphibians, 21 fishes (including five native species), and thousands of aquatic and terrestrial invertebrate species.

The Park spans nearly 8,000 ft. in elevation, from the Mohave desertscrub regions along the Colorado River in the Park's western end to the Kaibab Plateau's subalpine conifer forests on the North Rim. Three broad habitat types will be used to group Park wildlife: the River corridor and inner canyon riparian areas, inner canyon desert uplands, and the coniferous forests.

River Corridor and Inner Canyon Riparian Areas

The riparian habitat along the Colorado River corridor has developed since 1963 in response to controlled releases from Glen Canyon Dam, making Grand Canyon the only place in the Southwest where large riparian habitats have been created rather than degraded or destroyed.

Patchily distributed, naturalized riparian habitat along the main Colorado River channel and tributaries supports diverse and abundant wildlife assemblages, and provides critical habitat for riparian-dependent species. Most animal species that inhabit the inner canyon depend on these riparian areas directly or indirectly for food and cover during at least part of their annual cycles. The densities of some lizards and birds along the River have been found to be the highest recorded anywhere.

Until Glen Canyon Dam was completed in 1963, the Colorado River's aquatic system was dominated by **native fish**. These native species were specifically adapted to highly variable seasonal fluctuations in sediment load, flow, and temperature, and were severely impacted by dramatic changes resulting from the dam. The introduction of non-native fish contributed to competition and direct mortality. Of the eight native species found in the River before 1963, three species are now extirpated in the Grand Canyon (the Colorado squawfish, and the bonytail and roundtail chubs), two are barely holding on (humpback chub and razorback sucker), and three are still considered common (speckled dace, flannelmouth and bluehead suckers).

Programs to introduce **non-native species** for sport and food began at the turn of the century. Most releases were warm-water fish from the eastern U.S., although carp and brown trout were also stocked. Several trout species were introduced for sport purposes by the NPS, Arizona Game and Fish Department (AGFD), and the USFS in the 1920s. While the NPS ceased stocking in 1964, AGFD continues to plant rainbow trout near Lees Ferry. At least 16 species of non-native fish can now be found in the Grand Canyon stretch of the Colorado. This number may increase, as fish stocked in lakes Mead and Powell could move into the Canyon.

Due to previous fish-stocking programs, a popular sport fishery now exists in Grand Canyon. The stretch below Glen Canyon Dam is the most favored, but some tributaries also receive moderate to heavy fishing pressure. The presence of rainbow trout spawning in tributaries also provides a food source for overwintering bald eagles. Some concern has been expressed about potential eagle disturbance by anglers at Nankoweap Creek.

Another impact of recreational fishing in the Grand Canyon is the accidental catch of endangered native species. This is of particular concern outside the no-fishing zone (within one-half mile of the Little Colorado River confluence) since the remaining humpback chub population exists ten miles above and below the Little Colorado confluence.

Plant species' diversity and lush growth along the newly created riparian zone provides many bird habitats in a relatively small area. River corridor bird use illustrates this habitats' importance. Of the 315 bird species recorded in the greater Grand Canyon region, 250 (79%) were found in the River corridor. Only 48 bird species regularly nest along the River; others use the River as a corridor through the desert or as overwintering habitat.

Vegetation occurs in discrete patches rather than continuously along the River. Patch size is an important factor in determining its suitability for a bird species. Patches that may sustain some species for breeding may be too small for other species. Some species avoid nesting in small vegetation patches, presumably due to a lack of suitable nest sites or food, or vulnerability to predators.

Fire, disease, and erosion due to river processes or human use affect these vegetation patches and their use as wildlife habitat. Any changes in the flow regime of Glen Canyon Dam will modify the distribution and species composition of riparian vegetation. These changes will in turn effect the bird communities along the corridor, benefiting some species and thwarting others.

Under post-Dam conditions, large numbers of waterfowl have begun using the stretch below Glen Canyon Dam during winter, peaking in late December and early January. Nineteen species have been regularly reported between Lees Ferry and Soap Creek, at a density of 136 ducks per mile. The diversity and number of waterfowl using this area attests to the abundant food resources in the productive clear, cold aquatic ecosystem. This ecosystem is based on the trophic relationships that exist between filamentous green algae, diatoms, amphipods, and larval insects.

Of the 34 mammal species found along the Colorado River corridor, 15 are rodents and eight are bats. While river otters and muskrats are extremely rare, beavers and other rodents have probably benefited from the Dam's presence, increasing their distribution. By cutting willows, cottonwoods, and shrubs for food, beaver can significantly affect riparian vegetation. Other rodents are mostly omnivorous, using many different vegetation types. While bats typically roost and inhabit desert uplands, the insect abundance along the River and tributaries attracts foraging bats from throughout the inner canyon and conifer forests on both rims.

Coyotes, ringtails and spotted skunks, which are the most numerous riparian predators, prey on invertebrates, rodents and reptiles. Raccoon, weasel, bobcat, gray fox, and mountain lion are also present, but much rarer.

Mule deer and desert bighorn sheep are the ungulates which frequent the River corridor. Observational evidence suggests that since the removal of 500 burros by 1981, the number of bighorn sheep has increased. Mule deer are generally not permanent residents along the River, but travel from the rim when food and water resources become scarce there.

There are 27 known **amphibian and reptile** species that reside in the River corridor. The three most common amphibians (canyon treefrog, red-spotted toad, Woodhouse's toad) need the River corridor, or tributary riparian areas with perennial water, for breeding. However, these species are more tolerant of desiccation than most amphibians, and red-spotted toads have been found as far as one-half mile from a known water source. Leopard frogs are also very rare in the corridor, and are known to exist at only two sites.

Of the remaining 23 reptile species, ten are considered common along the corridor. Reptiles use both upland desert and riparian sites, but higher densities are supported in riparian areas due to the rich invertebrate food source and vegetation, and the per site abundance near water.

Lizard density tends to increase from the upland desert to the water's edge. Within the zone between water's edge and open tamarisk sites, lizard densities are equal to or higher than other Southwestern sites. Gila monsters and chuckwallas are the two largest lizards in the Canyon, with chuckwallas much more common.

Many snake species, which are not directly dependent on surface water, may be found both within the inner gorge and the River corridor. Since many snakes feed on lizards, higher prey densities along the River probably result in higher snake densities as well. Five rattlesnake species have been recorded in the Park. Two are distinct species rarely encountered, the Southwestern speckled rattlesnake and the Northern black-tailed rattlesnake. The other three snakes are subspecies of the Western diamondback rattlesnake complex: the Grand Canyon rattlesnake, Great Basin rattlesnake, and the Hopi rattlesnake. Of these, the grand Canyon Rattlesnake is most commonly encountered in the inner canyon, the Hopi on the South Rim, and the Great Basin on the North Rim.

As the demand for reptiles in the pet trade increases and collectors seek new sources of supply, many national parks are having problems with illegal reptile collection, especially rattlesnakes.

The highest abundance of Park **invertebrates** is found in the River corridor. Invertebrates play a major role in food pyramids that link the aquatic and terrestrial systems, and also serve as the basis for the vertebrates in the Canyon.

Kanab Ambersnails (*Oxyloma haydeni kanabensis*), discovered in 1991 at Vaseys Paradise, are known to exist at only one other site in southern Utah. The Vaseys population size is not known definitively, but was estimated in fall 1995 to be ca. 106,000 individuals. Searches at more than seventy other springs and seeps along the Colorado River have failed to locate any other Kanab Ambersnail populations.

Inner Canyon Desert Uplands

The biotic communities of the desertscrub uplands are influenced by the three North American deserts from which they are derived (further described in the *Vegetation Resources* Section). Moving upriver, as the elevation becomes higher and the climate cooler, there are fewer cacti, creosote, and brittlebush, and more widely spaced shrubs such as white bursage and blackbrush. Widespread erosion and rock weathering has created numerous scree slopes and talus fields that provide numerous animal hiding places. The arid conditions of the desertscrub uplands favor a fauna comprised chiefly of reptiles and desert-adapted rodents, although birds also breed in the uplands and cliff areas.

Approximately 30 **bird** species breed primarily in the desert uplands and cliffs of the inner canyon. There are no endemic birds; virtually all species present breed in other suitable habitats throughout the Sonoran and Mohave deserts. It is estimated that at least 100 pairs of peregrine falcons nest along the cliffs of the inner canyon. The abundance of bats, swifts, and riparian birds provides ample food for peregrines, and suitable aerie sites are plentiful along the steep canyons. Unless overwintering survival is a limiting factor in population regulation, the peregrine population is likely to continue to increase.

The **mammalian** fauna includes 50 species, mostly rodents and bats. Three of the five Park woodrat species occur in desertscrub. Many generations of woodrats inhabit the same middens, which can serve as valuable indicators of past climatic conditions and associated vegetation. Numerous caves in the inner canyon provide roost sites for migratory and resident bats. Maternity colonies are especially prone to disturbance from human exploration, and greater efforts are needed to inventory Park caves for bats, and establish protective measures where necessary.

Amphibians are generally absent from upland areas that are more than one mile from water. Except for the desert banded gecko, which seems to be distributed only near water along the Colorado River, all **reptiles** known to inhabit the River corridor also appear in the uplands, albeit in lower densities.

Coniferous Forests

The three forest types are piñon-juniper between 4,000 and 6,200 feet; ponderosa pine with Douglas fir, white fir, and aspen up to 8,200 feet; and subalpine spruce-fir above 8,200 feet. The higher elevation conifer forests of the Kaibab Plateau, and to a lesser extent the Coconino Plateau, provide habitat patches for species usually found much further north. These "sky-islands" result in disjunct distributions of many species in the western U.S.

The conifer forests of the Grand Canyon region have been extensively altered by past practices of cutting, fire suppression, and overgrazing. As mentioned in the *Vegetation* Section, fire suppression has transformed the forests from an open park-

like setting into a thick, dense forest choked with many young trees. These changes have presumably impacted wildlife species that prefer open canopy forests, such as Kaibab squirrels and goshawks. But more species of mammals and breeding birds are found in the conifer forests than either the inner canyon or River corridor habitats.

Of the approximately 90 **bird** species that breed in the coniferous forests, 51 are summer residents and at least 15 of these are known to be neotropical migrants. Impacts to bird populations from Park prescribed-fire activities are poorly known at present, but have the potential to drastically alter species distributions and population levels. Goshawks and spotted owls are threatened elsewhere in the Southwest from logging activities. Goshawks in particular, and to a lesser extent spotted owls, find refuge in the Park primarily in the conifer forests and upper side canyons along the North Rim.

The conifer forests provide habitat for 52 **mammal** species. On the Kaibab Plateau are found small mammal species more typical of northern latitudes, including porcupines, shrews, red squirrels, and several bat species.

Human activity during the last century has left its mark on the mammal fauna. Three species are reported to have been hunted to extirpation: the wolf, jaguar, and the grizzly bear. Predators were targeted for removal on the Kaibab from 1906 to 1939, resulting in the destruction of 816 mountain lions, 30 wolves, 7,388 coyotes, and 863 bobcats. Lion densities remain low to this day, attesting to the long-term impacts of these programs.

The 1920s Kaibab mule deer explosion resulting from overambitious predator control and hunting elimination, was classic wildlife mismanagement. The mule deer population increased from 4,000 in 1906 to 100,000 in 1924. The subsequent inevitable starvation left 10,000 deer by 1936. Although livestock grazing was discontinued in 1920 on the Kaibab Plateau, the habitat degradation that resulted from the presence of so many deer is still evident. Timber cutting on Kaibab National Forest lands since 1944 has benefited deer by increasing the early successional stage forest, which contains optimal forage. This is in sharp contrast to fire suppression, which reduces available deer forage. From 1969 to 1984, deer population levels fluctuated between 4,700 and 25,000 animals.

Mule deer on the Kaibab Plateau migrate from lower elevation piñon-juniper forests in the winter to higher elevation mixed-conifer forests in the summer. Included within Park boundaries is five percent of their available overwintering habitat and 25% of their summering habitat.

Arizona's native elk, *Cervus merriami*, were hunted to extinction by the early 1900s. Rocky Mountain elk were subsequently transplanted in Arizona, and populations have become established as far north as the South Rim and as far west as Havasu Canyon. In the Park's vicinity, these elk have so increased in number and size during the last

20 years that they are now considered a trophy population, and managed accordingly by the Arizona Game and Fish Department.

Bear have always been uncommon in this region, and reports remain rare. The last bear known to frequent the Park on the North Rim was killed outside the Park in 1991 after it became a nuisance, feeding on trash. However, bears could disperse into the Park from adjacent Forest Service land, where hunting is now prohibited.

The tiger salamander and the spadefoot toad, two **amphibians** not usually found in the other two habitats, occur in spruce-fir forests. Most **reptiles** are found in the piñon-juniper and ponderosa pine regions, especially the mountain short-horned lizard, which is found chiefly in piñon-juniper forests on the Canyon's rims.

Endangered/Protected Species

Park animals are on the official list of endangered or threatened wildlife that is maintained by the U.S. Fish and Wildlife Service are listed in Figure 2-1. The Park also provides habitat for 12 Federal Candidate Category 2 species.

Figure 2-1. Grand Canyon National Park's Endangered and Threatened Wildlife.

Bald Eagle	<i>Haliaeetus leucocephalus</i>	Endangered
American Peregrine Falcon	<i>Falco peregrinus anatum</i>	Endangered
Mexican Spotted Owl	<i>Strix occidentalis lucida</i>	Threatened
Southwestern Willow Flycatcher	<i>Empidonax trailii extimus</i>	Endangered
Humpback Chub	<i>Gila cypha</i>	Endangered
Razorback Sucker	<i>Xyrauchen texanus</i>	Endangered
Kanab Ambersnail	<i>Oxyloma haydeni kanabensis</i>	Endangered

Due to recovery-plan goals being met, plans in 1996 call for the bald eagle to be downlisted to threatened status, and the American peregrine falcon to be removed entirely from the Endangered Species list.

Monitoring efforts are underway for most remaining Park threatened and endangered species. The *List of Threatened Native Wildlife in Arizona*, developed by the Arizona Game and Fish Commission, includes 21 Park species.

CULTURAL RESOURCES

Grand Canyon National Park is rich in cultural resources; over 3,500 prehistoric and historic sites have been recorded. This inventory is based on a two percent survey of the entire Park.