NATIONAL CONSERVATION LANDS

Grand Canyon-Parashant

National Monument

Arizona

Science Plan

U.S. Department of the Interior
Bureau of Land Management
National Park Service

Contents

Section 1: Introduction and Scientific Mission

1.1 Purpose of National Conservation Lands Science Plans

The National Landscape Conservation System (NLCS) was administratively established in 2000 and legislatively codified in the Omnibus Public Land Management Act of 2009 (PL 111-11). The system was subsequently renamed National Conservation Lands (NCL). This system encompasses over 900 units spread across approximately 36 million acres of public lands managed by the Bureau of Land Management (BLM). The BLM is mandated to conserve, protect, and restore the outstanding cultural, ecological, and scientific values of NLCS units.

Scientific investigation can aid in the conservation, protection, and restoration of these lands, and therefore, science is strategically planned and organized within National Conservation Lands units. Within National Conservation Lands units there is an expectation for "identifying science needed to address management issues, communicating those needs to science providers, and incorporating the results into the decision making process" (BLM 2007).

The objectives of National Conservation Lands units' science plans are to:

- Identify the scientific mission of the unit;
- Summarize past scientific efforts in the unit, i.e., the scientific background of the unit;
- Identify the priority needs and management issues within the unit that can be addressed by scientific inquiry;
- Define a strategy for accomplishing the scientific goals of the unit;
- Develop science protocols to, for example, ensure that scientific inquiry does not negatively impact the long-term sustainability of the unit and its resources;
- Create a system to organize scientific reports; and,
- Help and promote the integration of science into management.

The science plans of National Conservation Lands units are considered 'living' documents and should be revised and updated frequently (e.g., 3-5 years). Scientific needs that emerge while implementing a science plan may be added to the plan on an as-needed basis to meet the unit's scientific mission.

1.2 Unit and Geographic Area Description

Grand Canyon – Parashant National Monument (Parashant or Monument) was designated by Presidential Proclamation 7265 January 11, 2000. The Monument is cooperatively managed by the Bureau of Land Management and the National Park Service (NPS) under a Service First agreement. It encompasses 1,048,321 acres: 208,449 acres administered by the NPS;

810,661 acres administered by the BLM; 23,206 acres administered by the Arizona State Trust; and 6,005 acres of private land. The federally administered lands lie within the BLM Arizona Strip District and the Lake Mead National Recreation Area (see Map 1).

The Monument is located in Mohave County, Arizona, immediately north of Grand Canyon National Park and the Colorado River and east of the state of Nevada. The area includes vast landscapes identified in the proclamation, including the ponderosa pine forested areas of Mt. Trumbull, Mt. Logan, and Mt. Dellenbaugh; the Mojave Desert in the Grand Wash and Pakoon areas; Kelly and Twin Points overlooking the Grand Canyon; and the Shivwits and Uinkaret Plateaus. Nearly 300,000 acres of the Monument are designated or eligible for designation as wilderness areas. Approximately 791,017 acres are allotted and/or leased for livestock grazing, and more than 14,000 head of cattle roam Monument lands. (NPS 2016)

Most visitors and Monument staff refer to the Monument as "Parashant National Monument", omitting the Grand Canyon reference to avoid confusion with the adjoining Grand Canyon National Park to the south and east.

The jointly created NPS General Management Plan and BLM Resource Management Plan (GMP/RMP) for the Monument represent one section of the 2008 Record of Decision from the Arizona Strip District-wide Environmental Impact Statement (BLM 2008). The GMP/RMP provided a management framework for the cultural, geologic, paleontological and biological objects in the proclamation.

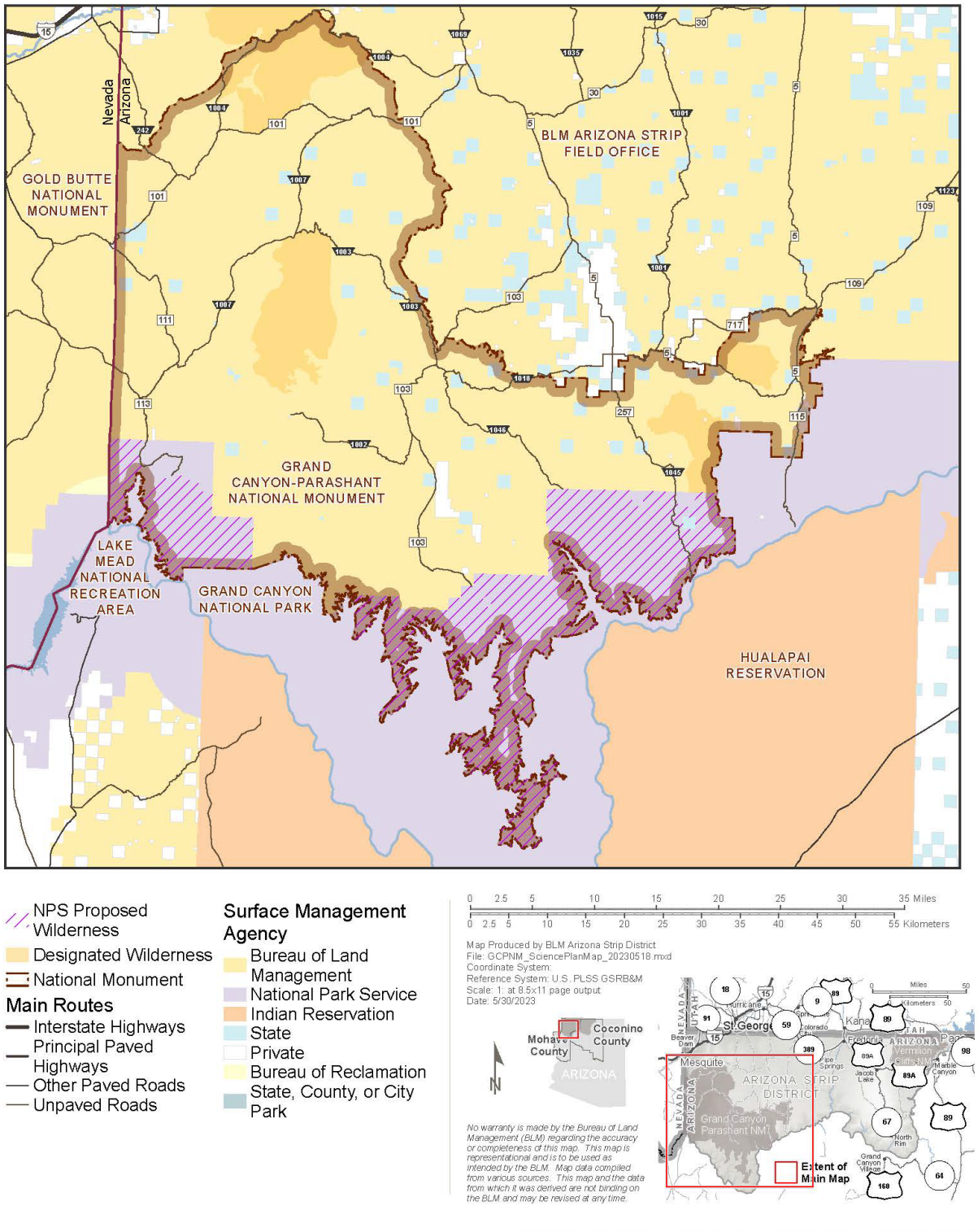
1.3 Scientific Mission

Science in BLM's NCL units is defined broadly as "including basic and applied research in natural and social science, as well as inventory and monitoring initiatives" (USDI, BLM 2007a). In addition, within NCL units there is an expectation for "identifying science needed to address management issues, communicating those needs to science providers, and incorporating the results into the decision making process" (USDI, BLM 2007a).

This Science Plan will be used as the basis for conducting science on Parashant. Scientific efforts within the Monument should support the objects and resources identified in the designating language and clarified in the GMP/RMP including geological, biological, cultural, recreation, scientific, and wilderness resources of the public lands within the Monument boundary while allowing for the historical uses of livestock grazing, and hunting in accordance with applicable laws and regulations of the United States and the State of Arizona. Parashant is a special designation area to be managed in accordance with NCL guidance. Scientific studies in the Monument can provide information to managers and help ensure that the authorized uses do not negatively impact the Monument's conservation mission or other objects of value.

Specifically, it is the scientific mission of Parashant to:

- Allow and encourage pertinent science that can:
  - inform management decisions and evaluate management methods within the Monument;
  - improve and maintain ecosystem resiliency, function, and land health;
  - maintain integrity of non-biotic resources such as soils, geology, caves, water and air quality;
  - maintain diversity and viability of plant and animal populations;
  - use multiple lines of evidence, including Indigenous Knowledge, to understand the impacts of human utilization of the landscape; and
  - preserve and understand historically significant resources, including archaeological and paleontological sites.
- Allow and encourage long-term and short-term investigations.
- Allow scientific inquiry across diverse disciplines, as appropriate within the Monument.
- Serve as a model system for surrounding areas, so that scientific findings can be exported to other federal and non-federal lands.



Map 1. Grand Canyon-Parashant National Monument and vicinity.

Section 2: Scientific Background of the National Conservation Lands Unit

2.1 BLM, NPS and AGFD science nexus

The Monument presents an unusual overlapping of scientific priorities and research. Not only do various federal agencies beyond BLM and NPS conduct research on Parashant, a state agency does as well (See Section 4.2). BLM and NPS research and long-term monitoring occur across the internal management boundary in part to fulfill both agencies' science missions. The Monument, located in Arizona, also has long-term monitoring conducted by the Arizona Game and Fish Department (AGFD). The State of Arizona focuses on wildlife populations, concentrating on game animals and their predators, and rare or threatened species. This has led to collaborations on projects ranging from research on bat, mule deer, and turkey habitat in the Mount Trumbull region to long-term monitoring of introduced relict leopard frog at Tassi Ranch and Pakoon Spring.

2.2 Inventory, Research and Long-term Monitoring

Completed and ongoing inventory, research, and long-term monitoring (Tables 1 and 2) on Parashant covers a diverse array of topics. Research in the area predates the creation of the Monument. In some cases, this research provides the only data on certain aspects of the Monument. Studies include site or species-specific analyses to landscape-scale analyses. The following is a brief review of subjects, topics, and areas of research that pertain to the Monument. A selected bibliography of research and datasets, including those discussed below, maintained through the NPS Integrated Resource Management System (IRMA) portal, are included in Section 13.

Table 1: Current and planned permitted research (R), inventory (I) and long-term monitoring (LTM) on Parashant.

Project Title	Researcher Institution	Type
American bullfrog and salamander eDNA survey	Parashant/Arizona Game and Fish Department	R
An inventory of adaptive genomic diversity of Joshua tree (*Yucca brevifolia sensu lato*)	California State University Northridge	R
Annual Forest Land Inventory of Arizona	US Forest Service	LTM
Arizona Seed Collection for the Bureau of Land Management	Chicago Botanic Garden	I
Aspen Monitoring in Parashant National Monument	Mojave Desert Inventory and Monitoring Network	LTM

Project Title	Researcher Institution	Type
Bird Monitoring in Arizona pinyon-juniper ecosystems within the Integrated Monitoring in Bird Conservation Regions program	Great Basin Bird Observatory	I
Desert Tortoise Population Monitoring Using Line Distance Sampling throughout the Mojave Desert	US Fish and Wildlife Service	LTM
Effective fire perimeter verification – determining extent of Mojave Desert fire areas conversion to non-native vegetation	Parashant	R
Fire effects monitoring (Home Ranch allotment)	University of Nevada Las Vegas	R
Geologic mapping of Grand Canyon-Parashant National Monument	US Geological Survey	I
Implementation of Conservation Actions for the Relict Leopard Frog	University of Nevada Las Vegas	LTM
Integrated Upland Monitoring of the Mojave Desert Network in Parashant National Monument	Mojave Desert Inventory and Monitoring Network	LTM
Investigating the Distribution of Rare Bearpoppy Species, Las Vegas Bearpoppy (*Arctomecon californica*) in Arizona: Habitat Modelling and Focused Surveys using Traditional and Remote Sensing Methods	Desert Research Institute	I
Microbial sampling for the presence of *Pseudogymnoascus destructans* (white-nose syndrome) on bats during late-hibernation at Grand Canyon - Parashant National Monument.	University of New Mexico	R, I
Monitoring Climate and Fire Resiliency in Forests of Grand Canyon-Parashant National Monument	Northern Arizona University	R
Mt Trumbull archaeological research	California State University Long Beach	R, I
NABat (bat acoustic monitoring)	Mojave Desert Inventory and Monitoring Network	LTM

Project Title	Researcher Institution	Type
Native plant seed, pollinators, and genetic study on the Arizona Strip	Southern Utah University	R
Pakoon Spring relict leopard frog monitoring	University of Nevada Las Vegas	LTM
Riparian Vegetation Monitoring - Protocol Testing	Mojave Desert Inventory and Monitoring Network	LTM
Spring Vegetation Monitoring at Selected Large Springs in Grand Canyon-Parashant National Monument	Mojave Desert Inventory and Monitoring Network	LTM
Springs in the Mojave Desert Network— Surface Water Monitoring at Desert Springs	Mojave Desert Inventory and Monitoring Network	LTM
Springs in the Mojave Desert Network— Water Quality and Quantity Monitoring at Selected Large Springs	Mojave Desert Inventory and Monitoring Network	LTM
Springsnail survey of springs in the Grand Wash area	Arizona Game and Fish Department	I
Tracking of White-Nose Syndrome in the West	Northern Arizona University	LTM
UNM geology research at Parashant National Monument	University of New Mexico	R

Table 2. Ongoing and planned inventory (I) and long-term monitoring (LTM) not requiring a permit on Parashant

Project Title	Type (LTM, I)	Initiation Date
AIM upland vegetation monitoring	LTM	2022
Annual precipitation (Range program)	LTM	1978
RAWS (weather data)	I	1985
Vegetation Trend monitoring	LTM	1980s

2.2.1 Air Resources (including Weather, Climate, Air Quality, Soundscape and Light Pollution)

Inventory

One hundred and twenty viewshed inventory points have been established across the Monument. Approximately 50% of the points have been visited and inventories have been completed. As the inventories are completed through a citizen-science based project, the data is uploaded into NPS IRMA.

Long-term Monitoring

Basic weather data (temperature, wind speed and direction, and rainfall) have been collected at nine Remote Automated Weather Stations (RAWS) scattered across the Monument. Two ink drum style stations collected data starting in 1985, while the majority of the remaining RAWS began collecting data in 1992. All RAWS data is automatically uploaded to the Western Regional Climate Center website.

Thirteen rain cans were established on the Monument in the late 1970s and early 1980s to monitor precipitation amounts. Three of these stations have since been abandoned to eliminate duplication at neighboring RAWS monitoring. Two of the stations were replaced with HOBO stations in 2017. Five stations have been replaced with HOBO stations in the past two years. The HOBO stations, in addition to precipitation amounts, collect duration, intensity, and soil moisture for these sites. The Monument plans to replace the remaining rain can stations with digital (HOBO) stations in the next few years.

Eight HOBO stations have been collecting precipitation and soil moisture since 2014. Six of these also collect wind speed and direction. Three stations, including a snow pillow, have been collecting snowfall data since 2018.

Beginning in 2012, four stations collect soundscape data along the Colorado River air tourism corridor. Air particulate sensors (PurpleAir types) are being added to Parashant, three have been placed since 2021 and one sensor is yet to be placed. Night sky metrics have been collected since 2021 at three locations. Photometers collect night sky quality and cloud cover data, allowing for monitoring of light pollution. Two more addition night sky sites are planned to be installed by 2024.

Research

No current air research is known using datasets collected at Parashant. However, large dataset analysis at the regional, continental or global level likely includes data collected on the Monument. Past research specifically using materials collected at the Monument to model climate change have not provided enough data for analysis at the local level.

Timely Public Service

Combining long-term precipitation datasets with newer soil and air data collection serves the grazing program with needed metrics on rainfall and enhances Land Health Assessment analysis and helps the grazing program manage sustainable cattle grazing on the Monument. Digital datasets, paired with viewshed imagery, increasingly online, are bolstering the Monument's interpretive program as well. The program is using the information to alert visitors on air quality levels and weather conditions before they venture onto the remote Monument.

2.2.2 Cultural Resources (including Archeology and Current Cultural Connections)

Inventory

Inventory and documentation comprise the major focus of the Parashant cultural program. The earliest site documentation occurred in the 1930s and 1940s, though major inventory projects did not begin until the 1970s. The majority of inventory for BLM and NPS has been related to planned land management projects (dominated by fuels reduction) though there has also been considerable inventory conducted for research, primarily in the Mt Trumbull region.

A total of 422 projects on the BLM and at least 66 projects on NPS have accounted for 86,361 acres of cultural inventory. Approximately 8% of the Monument has been inventoried (16% NPS, 7% BLM). While some of the earlier inventories lack complete data, the majority of project documentation is up to current Department of the Interior standards.

Roughly 3,043 archaeological sites have been documented on the Monument. Temporally, 90% of the sites are prehistoric, while historic and protohistoric sites each comprise 5%. The sites are primarily artifact scatters, though large numbers of single- and multiple-room structures have been documented across the Monument.

Through the NPS Historic American Buildings Survey (HABS), Historic American Engineering Record (HAER) and Historic American Landscapes Survey (HALS) programs, four Monument sites have been documented to some extent: Tassi Ranch and Waring Ranch (NPS), and Pine Ranch and the Grand Gulch Mine (BLM). Only Tassi Ranch has completed all the documentation steps and has a completed NPS Cultural Landscape Report and treatment plan.

Long-term Monitoring

Currently, NPS and BLM have different protocols and priorities for the monitoring of cultural resources. Approximately 30 NPS sites are revisited a year by cultural or contract personnel. Condition Assessment Forms, noting any natural or cultural impacts, are completed and site forms updated as necessary. The specific sites visited derive from the

NPS Cultural Resources Inventory System (CRIS) where a "revisit interval" is entered as part of the original site documentation.

The BLM primarily monitors cultural resources using volunteers (Site Steward program), law enforcement officers, and cultural personnel. Approximately 40 sites are monitored annually though some sites are visited more often. The sites monitored derive from a list of sites that are considered "important" or at-risk of vandalism by cultural personnel. Documentation generally only occurs when vandalism is identified.

Research

Four archeological field schools have operated on the Monument since 2001. Dr. Paul Buck, under the aegis of Nevada State College and the Desert Research Institute, ran a summer field school between 2001 and 2008. The field school focused primarily on inventory near Nampaweap and Mt. Trumbull, but also conducted some minimal testing and auguring of sites. No final report was ever completed though annual interim reports exist for each year.

Brigham Young University, under the direction of Dr. James Allison, ran a field school in 2006 in the Hidden Hills area near Poverty Mountain. Again, the focus of the field school was on inventory, but more extensive testing was conducted on a number of sites directly impacted by roads. No final report has ever been completed and documentation, aside from the site forms for newly recorded sites, is nearly non-existent.

The University of Nevada, Las Vegas (UNLV), under Dr. Karen Harry's leadership, began the Shivwits Archeological Research Project in 2006 specifically to try and identify the production source of a unique local pottery ware. Focusing on the NPS lands around Mt. Dellenbaugh, UNLV has focused primarily on the testing, or more extensive excavation, of 10 sites between 2006 and 2014. William Willis, a graduate student of Dr. Harry, has also conducted some small-scale inventory on Kelly Point. Again, no final report has been completed for the research to this point though annual interim reports exist for each year's efforts.

Dr. Sachiko Sakai of California State University, Long Beach (CSU-LB) has conducted a field school in the Mt. Trumbull area since 2010. Her research has focused on examining an intensive trade connection between the Mt Trumbull region and sites near the confluence of the Virgin and Muddy Rivers in Nevada. Though initially focusing on inventory and limited testing, CSU-LB began larger scale excavations of two sites in 2018. No final report has been completed for the research though annual interim reports exist for each year's efforts.

In addition to the research of the archaeological field schools, a number of documents considered essential for NPS units have been completed or attempted: An Ethnographic Overview and Assessment of Grand Canyon-Parashant National Monument and surroundings was completed in 2016, the Administrative History for Parashant was

completed in 2018, and incomplete versions of the Historic Overview and Assessment (2009) and the Archaeological Overview and Assessment (2019) have been attempted.

Finally, a number of oral history projects have been conducted including both American Indian and Euroamerican projects. In 2005, a Paiute Place Names study was conducted on the Arizona Strip District of the BLM that included Monument lands, and a follow-up study related specifically to the Little Springs volcanic fields was completed in 2013. Several works on non-European connections and history of the area have been written. Another oral history project, focusing on Euroamerican 20th century history of the Arizona Strip and southern Utah, has collected and transcribed over 56 interviews with past residents and their descendants.

Mt. Trumbull Archaeological Research
Principal Investigator: Dr. Sachiko Sakai, Department of Anthropology, California State University, Long Beach.

Dr. Sakai's ongoing research is permitted, but not directly funded, by the BLM. Field work is conducted three times each year (spring, summer, and fall) by undergraduate and graduate students. Dr. Sakai's research has brought modern analytical and technological methods to a long-known, but misunderstood, interaction between two large far-flung prehistoric populations that occupy very different environments. The Monument benefits directly from this work in receiving data, as well as interpretative information on the cultural resources located within the Monument.

2.2.3 Paleontology

Inventory

In 2003, an initial literature review was compiled at Northern Arizona University (NAU) for the expected fossil occurrence in the Monument. A second, more focused, bibliography focusing on Pleistocene and Holocene fossils was completed in 2011.

In 2016, a paleontological inventory was completed by the NPS Mojave Desert Inventory and Monitoring Network (MOJN), which encompassed both the BLM and NPS portions of the Monument. This inventory was mostly based on literature reviews with an emphasis on expected fossil occurrence with the given geologic strata available on the Monument.

In 2021, a formal paleontological inventory and literature review was conducted by NPS Geologic Resource Division (GRD) paleontological resource director Vince Santucci. This inventory conducted field studies at selected 22 sites highlighting the best examples of the available strata.

Long-term Monitoring

No systematic long-term monitoring of paleontological resources has taken place. Some limited incidental monitoring of specific locations, typically caves, occurs during other projects.

Research

Recent research into the paleontology of the Monument has focused on carnivore dens and packrat middens located in cave resources, along with ample marine fossils found in limestone outcrops. Pleistocene and early Holocene era paleontology has verified various rodents, Pleistocene horse, camel, goat, raptors, felines and canines all once occurred on Parashant.

Past research, as early as 1914, documented and occasionally collected vertebrate and marine invertebrate fossils. New Pleistocene fossil discoveries in 2009, found in a newly discovered cave system, are currently being identified and cataloged.

New Views of the Ancient Past
Principal Investigator: Justin Tweet, National Park Service

Highlights from the 2021 paleontological inventory included newly located examples of echinoderms, anthozoas, bioturbations, and trilobite trackways. The inventory also revealed that the locations of unmapped geologic strata which commonly occurs on the western portion, were also found in small incidences in the eastern portion. Results of this paleontological inventory were documented in a formal report.

2.2.4 Recreation (including Wilderness Characteristics)

Inventory

No systematic inventories of recreation use or wilderness characteristics have occurred since the determination of the categories of Lands with Wilderness Characteristics during the GMP/RMP process.

Long-term Monitoring

Visitation rates to the Monument are primarily captured via road counters in roadways. While the data has many gaps, data is available for portions of Parashant from 2016 onward. This data captures all roadway use including staff, partners, commercial use groups and grazing permittees.

Research

Visitor surveys have been conducted by university researchers in 2001, 2002-2003 and 2012. Analysis of the public's perception of work done in wilderness to restore the "natural" wilderness character was carried out while the restoration project was underway.

2.2.5 Soils/Geology/Cave and Karst

Inventory

A soils survey for the entire Monument, conducted by US Department of Agriculture Natural Resources Conservation Service (USDA NRCS) on behalf of MOJN, was completed in 2010. Updates to the soil survey and the accompanying Ecological Site Descriptions are ongoing and are housed on the NRCS Web Soil Survey (https://websoilsurvey.sc.egov.usda.gov). Geologic maps have been produced for the entire Monument at various scales by the US Geological Survey (USGS) (1928, 1981-current) and are housed within their system. Updated geologic maps are being produced as part of the USGS Colorado River corridor geologic mapping project.

Cave and karst resources across Parashant have been partially inventoried through internal investigations. Cave inventories began in earnest in 2002 through 2014, with Monument staff identifying 66 caves, 38 shelters, and approximately 30,000 acres of areas with karst potential. While some cave-specific geologic and ecosystem information is available, the focus has been on the living components of caves (microbes and bats).

An abandoned mineral mine inventory using X-ray fluorescence (XRF) analysis has been completed. Potential safety and wildlife issues were examined related to surface-bound heavy metals.

Long-term Monitoring

Ten caves (two wet, eight dry) are monitored for microclimate, wildlife usage, visitor impacts, and bat hibernacula. Other cave locations are assessed by site visits.

Research

Limited research has been conducted on the volcanics, minerals and localized soils within the Monument. However, cave resources have attracted a number of external research pursuits. In 2006-2012, a graduate level study from NAU studied 7 select caves, mostly identifying troglophile invertebrates, including an endemic species of cave cricket, and bat habitat. Following this study, cave researchers from UNM-Albuquerque, focused on cave microbes and the resulting mineralization on cave surfaces, from 2012-2017. In 2015, a UNLV researcher collected a stalagmite from one of the Monument's two wet caves. Ageing of the composition of the interior growth patterns reveal a climate record of temperatures and

precipitation. Another climate research project involving cave resources was attempted in 2010-2013 by a researcher from USGS. The project sought to capture a remnant thermocline horizon left over from the Pleistocene that would be evident to sensors placed throughout the interior of the cave. The research agenda was abandoned when it was determined the sensors would not be sensitive enough to capture this latent thermal signal.

Past Climate as a Key to the Future
Principal Investigator: Dr. Matthew Lachniet, University of Nevada, Las Vegas

Radiometric dating of cave stalagmites revealed a 980,000-year climate record. The temperature and precipitation trends mirrored other cave sites located in the Southwest, becoming a valuable dataset as the regional paleoclimate becomes better defined.

2.2.6 Vegetation

Inventory

Multiple researchers have conducted field collections of the plants of Parashant. Researchers have primarily focused on vascular plants. A field collection, literature search and specimen verification project, completed in 2012, found the earliest plant collections were made in 1877. The project also added 17 new species to the Parashant flora during fieldwork in 2010-2011 and 87 species previously collected from the Monument but not properly linked to the area, bring the total number of vascular plants species, subspecies or varieties known on Parashant to 1120. The majority of historic and current plant collection locations have been confined to major travel corridors.

Smaller scale inventories, in conjunction with ecosystem and water characteristic investigations occurred at 34 springs 2000-2002, 206 springs in 2005, and at least 20 springs since 2017. Inventories were conducted during the rangeland health evaluation on the NPS portion of the Monument in the early 2010s.

Targeted inventories have focused on the bryophytes and lichens of the Mojave Desert and Lone Mountain areas, specific locations such as the Gyp Hills, or invasive plants (multiple surveys 2014-present).

Long-term Monitoring

Vegetative long-term monitoring has primarily been carried out by the Range Program. Trend monitoring (all species identification) at key areas of the Monument began in the 1980s and has expanded to 157 key areas monitored at 5-year intervals as of 2019. Other long-term monitoring has begun in the last few years. MOJN has begun monitoring the health and stand characteristics of the eight stands of aspen (*Populus tremuloides*) in 2018. Riparian vegetation characteristic monitoring at Pakoon and Tassi spring began in 2022.

Integrated Upland (sagebrush community) monitoring has begun on 35 plots established across the Monument in 2023. AIM monitoring for upland vegetation began in 2022.

Research

The single largest body of research on the Monument is that of the Mount Trumbull Ecosystem Restoration Project (1995-present). Multiple vegetation manipulation projects, primarily in second growth ponderosa pine woodlands, researched the role of fire in altered ponderosa pine and pinyon-juniper ecosystems. This research, primarily led by the Ecological Restoration Institute, has been used to inform other forest health planning in ponderosa pine forests in North America.

Similarly, other research on Parashant has looked at the role of fire, including historic fire patterns and reintroducing fire, in ecosystems where multi-plant fire is expected, i.e., pinyon-juniper woodlands, and unexpected, i.e., Mojave Desert. Post-fire rehabilitation research was conducted in the Mojave Desert following the 2005-2008 fires on Parashant.

Invasive plant research has included Mojave Desert post-fire rehabilitation experimental plots as well as on-going work since 2014 to determine the penetration of invasive plants into the Monument's landscape at a distance from major travel corridors.

"Tremendous Species Richness"

Principle Investigator: Dr. Terri Hildebrand, Southern Utah University

Between 2010 and 2012, Dr. Hildebrand, her colleague Walt Fertig, and her students undertook a comprehensive review of the vascular plants of the Monument. Pairing fieldwork and regional herbaria review, her work documented 104 new taxa (species, subspecies and varieties) for the Monument, bringing the total voucher-confirmed taxa to 1107 and 13 literature-reported taxa. To put this in context, as of 2012,

> "The confirmed and reported flora of P[arashant] represents 26% of the 4,241 native and naturalized vascular plant taxa documented for Arizona…. Within Mohave County, the monument flora captures 71% of the 1,588 reported plant taxa …. P[arashant] contains 44% of the 2517 species of seed plants and ferns cited for the Arizona Strip by Atwood…, McDougall…and Flora of North America Editorial Committee..."

2.2.7 Water Resources

Inventory

Springs have been enumerated and sampled across the Monument in studies conducted on behalf of the NPS and BLM in 2002 and 2008. A total of 206 distinct spring heads, some clustering in groups of up to six, have been reported. Starting in 2017, inventories of spring

water chemistry and flow rates, as a citizen science project, was initiated. Water quality in one cave has been inventoried during a microbial research investigation.

Long-term Monitoring

Ten springs are monitored using water presence/absence dataloggers by MOJN. Two springs, Pakoon and Tassi, are monitored quarterly for discharge rates, chemistry, quality and benthic macroinvertebrates. Six wells in the Pakoon Spring area are monitored via water level sensors to understand the subsurface water patterns in the Mojave Desert area of Parashant. Water quality monitoring of these 10 springs, which are selected as representative of the underlying aquifers, involves basic anions and cations, along with targeted heavy metals.

Research

A preliminary hydrogeology assessment was carried out in the Mojave Desert area of Parashant by USGS on behalf of NPS.

Don't Drink the Water!

In 2018, a one-time test for coliforms was included in the annual sampling of 10 springs. The test revealed all were positive for elevated levels beyond US Environmental Protection Agency (EPA) drinking water standards. In subsequent years, tests for heavy metals and other water chemistry have found some springs show evidence of lead contamination, likely due to target shooting, while others had sulphate levels beyond the capacity of cattle consumption. Encouragingly, no mercury, nor uranium has been detected.

2.2.8 Wildlife

Inventory

Periodic, or non-repeating surveys, for wildlife have included most vertebrate and a few invertebrate groups. AGFD has surveyed the Monument for peregrine falcon (*Falco peregrinus*) as part of larger surveys across the BLM Arizona Strip District. Others have surveyed for Mexican spotted owl (*Strix occidentalis*), goshawk (*Accipiter gentilis*) and southwestern willow flycatcher (*Empidonax trailii extimus*). Targeted bat inventory work has been done near water sources, forested areas near Mount Trumbull and cave openings throughout Parashant. Birds have been surveyed for in primarily forested regions of the Monument, however, even these areas remain poorly surveyed for avifauna. Small mammal surveys have been limited to the Mojave Desert areas of Parashant and are incomplete.

Periodic inventories are conducted by the BLM for wild burros on the Tassi-Gold Butte Herd Management Area (HMA). The last inventory was conducted in 2017 using Aerial Surveys with the Simultaneous Double-observer Method. It was estimated that there were 98 adult

animals and 7 foals within the Tassi-Gold Butte HMA. Additionally, there were an estimated 55 wild burros outside of the HMA, within the Pakoon Basin in Arizona. The Appropriate Management Level (AML) is set at zero for both the BLM and NPS portions of the HMA in the GMP/RMP.

Long-term Monitoring

Long-term monitoring of wildlife, other than by AGFD, focuses on special status species with limited exceptions. Mojave desert tortoise (*Gopherus agassizii*) are annually surveyed as part of the Gold Butte-Pakoon critical habitat unit surveillance. Relict leopard frog (*Lithobates onca*) populations are monitored annually at Tassi and Pakoon springs. As part of the MOJN quarterly monitoring of Pakoon and Tassi springs, benthic macroinvertebrates are sampled and Grand Wash springsnail (*Pyrgulopsis bacchus*) are counted and mapped for distribution in their limited habitat. Bats on Parashant have been acoustically monitored through the NABat program since 2017.

AGFD long-term monitoring focuses on population dynamics of desert bighorn sheep (*Ovis canadensis*), mule deer (*Odocoileus hemionus*), and Merriam's turkey (*Meleagris gallopavo*).

Research

Several projects, linked to the Mount Trumbull ecosystem restoration project, dealt with wildlife responses to the restoration work. Studies included birds, deer, bats, lizards and butterflies. Other researchers, either collecting on Parashant or using specimens collected by others, have used Parashant materials to better describe the ranges and variations within species found beyond the Monument. Work with the cave-based microbiota has yielded species and new genetic variations of microbial ecosystems. On-going research into bat distribution across the Monument, their microbiota, and White Nose Syndrome (WNS) surveillance of bat populations have found over 16 species of bats on Parashant, multiple maternity roosts and a low detect of WNS in three bats.

Restoring a Rare Species

In 2022 relict leopard frogs were introduced into Pakoon Springs, a spring system within the historic range of the species. The introduction was planned for many years but was not possible because the site was infested with American bullfrogs. The bullfrog eradication was a cooperative effort led by the Relict Leopard Frog Conservation Team and finished primarily by the diligent effort of the AGFD. A site visit in April 2023 observed encouraging signs the introduced population is persisting at Pakoon Springs including adult frogs and tadpoles.

Section 3: Management Decisions and Science Needs

3.1 Alignment with GMP/RMP

The Parashant GMP/RMP includes various science and research desired future conditions and management actions to fulfill the goals of the Monument. Nearly all the goals include data needs that can be addressed through long-term monitoring, inventory and/or research.

Explicit recognition and direction for science on Parashant is as follows:

DFC-GL-01 (in part): Paleontological resources will be managed for their scientific, educational, and recreational values…

DFC-SR-01: Approved scientific research will contribute to management of natural and cultural resources and achieving DFCs.

MA-LR-05 (in part): No new ROWs or ancillary public facilities should be processed within the Monument except for a) ROWs pursuant to existing policies and practices such as, but not limited to, scientific monitoring stations, repeaters…

MA-GL-01: BLM and NPS will identify and protect significant fossils and allow for scientific research at paleontological sites, in accordance with permitting procedures.

MA-GL-03: The collection of any objects in the Monument, including paleontological resources (such as fossils or track ways) or rock specimens will not be authorized, except by permit for scientific research or use.

MA-SR-01: Permits will be required for approved scientific research to insure compatibility and reporting of results.

MA-SR-02: The collection of any objects in the Monument will not be authorized except by permit for scientific research or use.

MA-TE-04 (in part): Reintroductions, transplants, and supplemental stockings (augmentations) of special status species populations will be carried out in collaboration with the AGFD and or the USFWS for the following purposes:
To maintain current populations, distributions, and genetic diversity;
To conserve or recover threatened or endangered species; and/or
To restore or enhance native populations, diversity, or distribution of special status species…. These actions will be based on the best available scientific information.

MA-VM-10 (in part): The Monument will be closed to the general commercial sale of vegetative products, except for the following situations:

On BLM-administered lands, the sale, collection, or use of vegetative materials (e.g., native seed, medicinals, landscape mulch, posts, fuel wood, etc.) will require a permit and may be authorized if tied to a clearly defined science-based research or restoration project, and the use will be consistent with achieving the DFCs and protecting Monument objects

On NPS-administered lands, the collection or use of vegetative materials will only be authorized in conjunction with documented research or restoration programs in accordance with NPS regulations and policy.

MA-VM-27: Up to 70,000 BLM acres of Mojave Desert Ecological Zone will be treated over the life of this Approved Plan. Up to 100 acres may be treated with prescribed fire on BLM-administered lands if associated with scientific research.

MA-VM-31: Up to 150,000 BLM acres of Mojave-Great Basin Transition Ecological Zone can be treated over the life of this Approved Plan. Up to 100 acres may be treated with prescribed fire on BLM-administered lands if associated with scientific research.

3.2 Identified Science Needs (Foundation Document)

During the NPS Foundation Document (2016) process, several science and data needs were identified and prioritized for Parashant. Those that have not been addressed to date or in process are described below.

3.2.1 High Priority

- Watershed data: Includes watershed precipitation analysis, water chemistry analysis, extent of riparian access/survey, hydrologic budget data, spring inventory/GIS data, and protocols for riparian and spring protection.
- Acoustic data: Includes baseline levels for soundscapes, and quantify both anthropogenic and natural sounds.
- Rights-of-way data
- Visitor use study and survey

3.2.2 Medium Priority

- Air quality monitoring (Air pollution effects on Monument ecosystem, including excess nitrogen, sulfur, mercury/toxics deposition, and ground-level ozone)
- Archeological inventory (uninventoried areas)
- Avian inventory
- Biological soil crust component analysis

- Continued monitoring of (or access to) weather parameters (precipitation temp, storm events), ecological responses, and assessment of projected climate futures (models) for the region
- Cultural landscape report for the Home Ranch Allotment
- Cultural resource overview, assessment, and affiliation study (umbrella document to determine which data or plans need to be updated and where documentation gaps exist)
- Fire history (consolidation and access to information)
- HABS/HAER/HALS for Grand Gulch Mine
- Historic structures report for the Home Ranch Allotment
- Historical visitation numbers analysis
- Invasive plant inventory
- Mammal inventory (especially small)
- Natural resource overview and assessment
- Night sky monitoring/analysis
- Remapping of Pakoon Basin alluvial units (more precise geologic survey)
- Reptile/amphibian inventory
- Study of fluvial erosion on arid lands
- Visual resource inventory (update)

3.2.3 Mapping Needs

- Existing research sites
- Collection sites
- Trail inventory and trail difficulty ratings
- Improved GIS verification of infrastructure and roads

3.3 Identified Science Needs (Other Sources)

As literature reviews and inventories have been completed, additional scientific data needs have emerged, often more specific than those described in the Foundation document.

- Air Resources (Climate) (Monahan 2014)
  - Characterize Park [Parashant] exposure to recent climate change in a vulnerability assessment.
  - Develop plausible and divergent futures for use in a climate-change scenario planning workshop.

- Cultural research
  - Increase inventory on the lower-elevation Esplanade area of the Monument. (Harry and Willis 2019)

    - Standardize and increase in-field artifact analysis during site recording. (Harry and Willis 2019)
    - Study identifying places of enduring importance to tribal members (identify Traditional Cultural Properties (TCPs) or lands that may warrant special consideration under Executive Order 13007 (Sacred sites), AIRFA, and DOI guidance pertaining to sacred sites, such as the [November 2021 *Memorandum of Understanding Regarding Interagency Coordination and Collaboration for the Protection of Indigenous Sacred Sites*.] (Deur 2014)
    - Systematically document the knowledge and perspectives of contemporary tribal members (Traditional Use Studies, or similar studies). (Deur 2014)
    - Traditional Use Study focusing on past and present plant gathering (Deur 2014)

- Paleontological research (Tweet 2021)
    - Dating of cave samples procured during the recent inventory
    - Inventories of packrat midden sites and description of midden contents (Quaternary climate and ecological change at Parashant)
    - Surveys of the Moenkopi Formation
    - Analysis of the color replacement of remineralized Kaibab Formation fossils
    - Further surveys of lower Supai Group formations (including investigation for additional invertebrate trace fossil sites)
    - Further investigation of Surprise Canyon Formation outcrops (including investigation for vertebrate fossils)

- Vegetation research (Hildebrand 2012)
    - Vascular plant survey focusing on areas not previously explored – "As many as 300 additional species may still be found on PARA, based on the number of taxa known from comparable habitats in adjacent areas of the Arizona Strip."

- Water research (Truini 2012)
    - Construct a conceptual hydrogeologic-framework model to better understand the relation of the geologic structure, lithology, and groundwater movement between Grand Canyon Parashant National Monument and southern Utah and southeastern Nevada.
        - Questions include:
            - Does water move east to west from the Paleozoic rocks downward into the Grand Wash Trough, and what are the hydrogeologic units?
            - How do the subbasins below the Grand Wash Trough affect the movement of groundwater?
            - Are the Virgin Mountains a barrier to groundwater movement between the towns of Mesquite, Nev., St. George, Utah, and the Monument?

        - What are the ground-water flowpaths, and how old is the water discharging from the springs?
        - Is there a mixture of old and young groundwater, suggesting local and nonlocal recharge?
        - Where are the recharge sites for the regional groundwater system?
        - What is the hydrologic connection between Tassi and Pakoon Springs and (or) other springs and the regional groundwater system?
        - How old is the water from wells developed in Mesquite, Nev., and St. George, Utah, and does it have a similar recharge signature to water in the Monument?
    - Data collection: Additional water-chemical sampling from Tassi and Pakoon Springs and selected springs and wells
        - Resample for major and minor ions and for stable isotopes (18O and 2H) to reduce the uncertainty in seasonal variations and the variation due to discharge points
        - Analysis of 14C to date the older groundwater component
        - Analyses of chlorofluorocarbons (CFCs), noble gases, sulfur hexafluoride (SF6), and tritium (3H) to date the modern component of the groundwater
        - Analysis of groundwater and rocks for strontium-87 (87Sr), to provide geochemical signatures in order to discern groundwater flowpaths and identify the hydrogeologic units
        - Analysis for noble gases from selected springs and wells within Parashant and the cities of Mesquite, Nev., and St. George, Utah, to define recharge elevations
        - Deployment of three to four sets of rain buckets from upper elevations down to lower elevations to collect rainwater in order to measure 18O and 2H to determine the most likely source elevation from the spring water.

- Wildlife Research
    - Investigation of chipmunk population sighted near Middle Spring. Potential Pleistocene era isolated subspecies of Uinta chipmunk (*Tamias umbrinus*). (Boone 2011)
    - Monitoring for bird species response to climate change. Nine species may make Parashant a refugia, while summer or winter climate predictions may extirpate 30 species and 40 species may colonize Parashant. (Schuurman 2018)
    - Bat habitat modeling using individual bat tracking to inventory non-cave roosting sites. (Northup 2015)

3.4 Identified Science Needs (Management)

Emergent issues requiring data for resolution often are found in the time between large scale planning efforts such as the GMP/RMP and Foundation document and before specific issues are illuminated by research. The following are science priorities identified by the Monument Manager and Superintendent that have not been described either in the Foundation document or current published research.

- Inventory feral horse and burro populations to determine numbers and dispersal on Parashant, a Herd Management Area designated with a "zero" population of burros and not designated or adjacent to a Wild Horse Herd Management Area.
- Social science-based surveys of physical and virtual users of the Monument to illuminate changing societal views and uses of the Monument and its virtual presence.
- Integrate indigenous knowledge and co-stewardship, per Secretarial Order 3403, in designing and implementing potential scientific projects.
- Engage descendant communities in future cultural resources research to develop appropriate research questions and historic contexts that includes their views. Interpretation, both academically and with the general public, of cultural resources scientific data should strive to include the views of descendant communities.

Section 4: Meeting Science Needs

4.1 Internal Organization

An effective internal organization is necessary to strategically identify and address science needs in Parashant. The Monument Manager and Superintendent will serve as the overarching managers of scientific inquiries on the Monument. The Monument Ecologist will serve as the Science Coordinator (including the Research Permit Coordinator duties). The Science Coordinator will work directly for the Monument Manager and Superintendent, collaborating with appropriate BLM and NPS staff in the Arizona Strip District Office (ASDO), NPS Regional Office, BLM AZ State Office (ASO), NPS and BLM Washington offices, and science partners.

The roles of the Science Coordinator in relation to scientific inquiries on Parashant are:

- Serving as the point of contact for scientific inquiries, from both internal and external sources. Scientific inquiry proposals will be submitted in writing directly the Science Coordinator. Contact information for the science coordinator is listed in Section 11.
- Coordinating the processing of research permits for the Monument, working with resource specialists as applicable:
  - identify the issues in conducting the research
  - ensure appropriate planning and environmental reviews are in place
  - ensure appropriate mitigation measures and research permit stipulations are implemented
- Preparing the research permit for signature.
- Coordinating internal/external scientific inquiries with the Monument Manager and Superintendent.
- Coordinating internal/external inquiries with the Monument Manager and Superintendent.
- Coordinating the inquiry process with the applicant and other scientific partners, if necessary.
- When appropriate, coordinating the process of requesting, administering, and utilizing BLM and NPS funds for proposed inquiries.

4.2 Collaboration and Partnerships

Collaboration and open communication with existing and potential science partners is critical to the success of implementing of the Science Plan. This collaboration will ensure that research on Parashant is pertinent to the protection of Monument objects and future management decisions.

Current Institutional Scientific Partnerships with Parashant (project ongoing)

- Arizona Game and Fish Department
- California State University, Long Beach
- Chicago Botanic Garden
- Colorado Plateau Cooperative Ecosystem Studies Unit
- Desert Research Institute
- Ecological Restoration Institute
- Great Basin Bird Observatory
- Great Basin Cooperative Ecosystem Studies Unit
- Northern Arizona University
- NPS Mojave Desert Inventory and Monitoring Network
- Relict Leopard Frog Conservation Team
- Southern Utah University
- University of Nevada, Las Vegas
- University of New Mexico, Albuquerque
- US Fish and Wildlife Service
- US Forest Service
- US Geological Survey

Past Institutional Scientific Partnerships with Parashant (no current project)

- Arizona State University
- BLM Las Vegas Field Office
- Brigham Young University
- California State University, Northridge
- Desert Botanic Garden
- Institute for Applied Ecology
- Museum of Northern Arizona
- National Speleological Society
- Nevada State College
- Princeton University
- Southern Arkansas University
- University of Mississippi
- US Geological Survey - Astrogeology Team
- US Geological Survey – BRD Southwest Biological Science Center
- US Geological Survey – BRD Western Ecological Research Center
- Utah Tech University (formerly Dixie State University)

Section 5: Science Protocols

5.1 General Science Guidelines

- Scientific inquiries will comply with current and relevant agency laws and regulations.
- Scientific research should not detrimentally impact the long term health or sustainability of Monument objects or other resources of Parashant.
- Scientists initiating research projects within the Monument must be aware of existing data within the BLM and NPS and should incorporate these data into projects whenever possible.
- Proposed research within the Monument should comply with appropriate laws and regulations.
- Parashant, when applicable, will encourage external science inquiries to adopt BLM and NPS data management strategies.
- Proposed research will follow guidelines in the Department of the Interior's "Integrity of Scientific and Scholarly Activities" policy established in Departmental Manual Part 305 Chapter 3.
- External scientific projects, including Unmanned Aerial System (UAS) data collection, must apply for and receive a research permit from the Research Permit Coordinator in order to proceed (Section 5.2).
- Internal scientific projects must apply for and receive a research permit if new installations or materials collection that may be retained are part of the proposal.
- All scientific inquiries will be presented to the Interdisciplinary Team (ID team) for review once a complete proposal has been received by the Research Permit Coordinator.
- The research permit may require further approvals to be fully valid.

5.2 Authorization and Tracking Process

- Research permits are required for scientific research in accordance with the GMP/RMP (2008)
  - MA-SR-01 Permits will be required for approved scientific research to insure (sic) compatibility and reporting of results.
  - MA-SR-02 The collection of any objects in the Monument will not be authorized except by permit for scientific research or use.
- Proposals will be submitted to Research Permit Coordinator through the NPS Research Permit and Reporting System (RPRS).
- The Research Permit Coordinator will review the proposal for completeness and consult with the appropriate BLM and NPS resource specialists to determine the

scientific validity and integrity of the proposal, and potential impacts to resource and resource uses.

- The Research Permit Coordinator will brief the Superintendent and Monument Manager upon receipt of request to conduct research. Through the National Environmental Policy Act (NEPA) process, the Monument Manager and Superintendent will determine whether the proposal:
  - Is consistent with this Science Plan;
  - Meets Parashant's scientific mission (see Section 1);
  - Conforms with Parashant's GMP/RMP; and
  - Is consistent with other current and relevant agency laws and regulations.
- If the proposal is not accepted, the Research Permit Coordinator will provide written notification and justification to the applicant of the decision as soon as practical.
- If the proposal is accepted:
  - The Research Permit Coordinator will determine what, if any, NEPA analysis is required to carry out inquiry.
  - If a Categorical Exclusion or an Environmental Assessment is needed, the Monument Manager and Superintendent, in consultation with the Research Permit Coordinator and ASDO Planning and Environmental Compliance specialist, will assign an Interdisciplinary Team (including a team lead/project manager) comprised of appropriate resource specialists.
  - Resource specialists will review the proposal to determine what mitigation or stipulations need to be included in the authorization (i.e., research permit).
  - When appropriate, the Research Permit Coordinator will prepare a research permit for the applicant to be approved by the Monument Manager (through signature of a NEPA Decision Memo) and the Superintendent (through signature of the RPRS permit).
  - The research permit will be sent to the applicant for review and signature.
  - Any planned materials collection, retained after analysis, will be coordinated with the Lake Mead National Recreation Area Collections Specialist to ensure proper documentation and cataloging.
- Reporting for all scientific investigations will require:
  - Annual progress reports to be filed through RPRS
  - A final report that includes any documentation related to any materials not destroyed through analysis
- If permit stipulations are not adhered to, the research permit can be canceled, in writing, by the Monument Manager or Superintendent.
- Additional permits
  - Archaeological and Paleontological research will require approval from the appropriate Deputy State Director from the Arizona BLM State Office or the NPS Regional Office and either an Archaeological Resources Protection Act (ARPA)

or Paleontological Resources Preservation Act (PRPA) permit, after completion of coordination with interested Federally recognized Indian tribes and receipt of a Tribal Authorization Form.

- Vertebrate research that proposes handling, manipulation or collection of vertebrates will require NPS Institutional Animal Care and Use Committee (IACUC) approval and may require state or university IACUC approval as well.
- Vertebrate research by non-NPS or BLM staff that proposes handling, manipulation or collection of vertebrates may require additional permits such as a scientific collecting permit from the State of Arizona.
- Research involving federally listed endangered or threatened species may require a US Fish and Wildlife Service (USFWS) permit.

Section 6: Organization and Communication of Completed Science

6.1 Scientific Background Needed for Updates

Section 2 of this report provides a brief summary of the scientific background of the unit and provides citations to the relevant reports in the bibliography (Sections 9 and 13) of this science plan. At every revision of the science plan, these sections will be updated.

6.2 Internal Communications

All reports described in Section 5 will be stored, organized, and shared on a share drive or SharePoint site, accessible to all staff at the Monument, except for those reports containing controlled unclassified information (CUI) of a sensitive nature (e.g., threatened and endangered plant locations, cave locations, non-public use cultural locations, etc.). Restricted access reports will be stored and organized on a share drive or SharePoint site accessible to the relevant specialists and managers. The Science Coordinator should strive to organize periodic presentations of scientific results to Monument and ASDO staff, as well as keep ASO updated on current and ongoing efforts.

A separate project file shall be set up for each research proposal received with all associated documents stored in this location.

All internal communications will be shared with the ID team.

6.3 Communication to the Broader BLM and NPS Organization

The Monument Manager and Superintendent will comply, in a timely manner, with all requests for completed scientific investigations (e.g., reports, publications, etc.) from District, State, and Washington offices and NPS Regional and Washington offices.

Ongoing studies will be documented in the Monument annual report. Ongoing long-term data and completed datasets and reports will be uploaded to the relevant BLM and NPS databases.

6.4 Communication of Scientific Results to the Public

The Monument Manager, in coordination with the ASDO and Monument Public Affairs Specialists, and Science Coordinator, will strive to make information on science projects within Parashant accessible to the general public. This could include but is not limited to posting updates on both Parashant websites in formats such as written descriptions of scientific inquiries or citations of published research; uploading data to public-facing BLM, NPS and other federal government databases; press releases; using social media websites like Facebook or Twitter; brown bag lunch presentations; leading field tours; participating in

community outreach events, etc. All public information will be approved by the Monument Manager or Superintendent.

Section 7: Integrating Science into Management

7.1 Communications

Direct communication is critical between the District Manager, Monument Manager, Science Coordinator, scientist, and ID team.

It is the responsibility of the Science Coordinator to ensure that scientific findings are communicated to the Monument Manager, Superintendent, BLM District Manager, BLM State Office and NPS Regional Office via methods outlined in Section 6. Subsequently, the managers will be able to use the scientific information, as appropriate, in management decisions related to Parashant.

7.2 Integration

- Integrating scientific findings into management decisions should not end scientific inquiry into a specific topic.
- Science will be integrated into management decisions, particularly during the NEPA process, contract specifications, and terms and conditions language on permitting, to the best ability while working within existing policy and regulatory guidelines.
- Using science in the decision-making process should provide an opportunity to identify future science needs to adaptively manage for certain objectives.

Section 8: Science Plan Review and Approval

I affirm that I have read, understand and approve the 2023 Science Plan for Grand Canyon – Parashant National Monument.

This plan will be used as the basis for conducting science in Grand Canyon – Parashant National Monument. "Science" is defined in Section 1 of this plan.

As a living document, this plan will be updated as needed. Scientific needs that emerge during the course of implementing this plan may be added to the plan on an as-needed basis to meet the needs of Grand Canyon – Parashant National Monument, the Bureau of Land Management and the National Park Service.

BRANDON BOSHELL
Digitally signed by BRANDON BOSHELL
Date: 2023.07.11 09:00:38 -06'00'

7/11/23

Brandon E. Boshell
Monument Manager
Grand Canyon - Parashant National Monument

Date

BENJAMIN ROBERTS
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7/10/23

Ben Roberts
Superintendent
Grand Canyon - Parashant National Monument

Date

DARREL MONGER
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7/12/23

Darrel W. Monger
District Manager
Arizona Strip District

Date

GEOFFREY WALSH
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Date: 2023.07.12 15:53:05 -07'00'

7/12/23

Geoffrey Walsh
Arizona NCL Lead
Arizona State Office

Date

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Section 10: Unit's Proclamation

Establishment of the Grand Canyon-Parashant National Monument

By the President of the United States of America

A Proclamation

The Grand Canyon-Parashant National Monument is a vast, biologically diverse, impressive landscape encompassing an array of scientific and historic objects. This remote area of open, undeveloped spaces and engaging scenery is located on the edge of one of the most beautiful places on earth, the Grand Canyon. Despite the hardships created by rugged isolation and the lack of natural waters, the monument has a long and rich human history spanning more than 11,000 years, and an equally rich geologic history spanning almost 2 billion years. Full of natural splendor and a sense of solitude, this area remains remote and unspoiled, qualities that are essential to the protection of the scientific and historic resources it contains.

The monument is a geological treasure. Its Paleozoic and Mesozoic sedimentary rock layers are relatively undeformed and unobscured by vegetation, offering a clear view to understanding the geologic history of the Colorado Plateau. Deep canyons, mountains, and lonely buttes testify to the power of geological forces and provide colorful vistas. A variety of formations have been exposed by millennia of erosion by the Colorado River. The Cambrian, Devonian, and Mississippian formations (Muav Limestone, Temple Butte Formation, and the Redwall Limestone) are exposed at the southern end of the lower Grand Wash Cliffs. The Pennsylvanian and Permian formations (Calville Limestone, Esplanade Sandstone, Hermit Shale, Toroweap Formation, and the Kaibab Formation) are well exposed within the Parashant, Andrus, and Whitmore Canyons, and on the Grand Gulch Bench. The Triassic Chinle and Moenkopi Formations are exposed on the Shivwits Plateau, and the purple, pink, and white shale, mudstone, and sandstone of the Triassic Chinle Formation are exposed in Hells Hole.

The monument encompasses the lower portion of the Shivwits Plateau, which forms an important watershed for the Colorado River and the Grand Canyon. The Plateau is bounded on the west by the Grand Wash Cliffs and on the east by the Hurricane Cliffs. These cliffs, formed by large faults that sever the Colorado Plateau slicing north to south through the region, were and are major topographic barriers to travel across the area. The Grand Wash Cliffs juxtapose the colorful, lava-capped Precambrian and Paleozoic strata of the Grand Canyon against the highly faulted terrain, recent lake beds, and desert volcanic peaks of the down-dropped Grand Wash trough. These cliffs, which consist of lower and upper cliffs separated by the Grand Gulch Bench, form a spectacular boundary between the basin and range and the Colorado Plateau geologic provinces. At the south end of the Shivwits Plateau are several important tributaries to the Colorado River, including the rugged and beautiful Parashant, Andrus, and Whitmore canyons. The Plateau here is capped by volcanic rocks with an array of cinder cones and basalt flows, ranging in age from 9 million to only about 1000 years old. Lava from the

Whitmore and Toroweap areas flowed into the Grand Canyon and dammed the river many times over the past several million years. The monument is pocketed with sinkholes and breccia pipes, structures associated with volcanism and the collapse of underlying rock layers through ground water dissolution.

Fossils are abundant in the monument. Among these are large numbers of invertebrate fossils, including bryozoans and brachiopods located in the Calville limestone of the Grand Wash Cliffs, and brachiopods, pelecypods, fenestrate bryozoa, and crinoid ossicles in the Toroweap and Kaibab formations of Whitmore Canyon. There are also sponges in nodules and pectenoid pelecypods throughout the Kaibab formation of Parashant Canyon.

The Grand Canyon-Parashant National Monument contains portions of geologic faults, including the Dellenbaugh fault, which cuts basalt flows dated 6 to 7 million years old, the Toroweap fault, which has been active within the last 30,000 years, the Hurricane fault, which forms the Hurricane Cliffs and extends over 150 miles across northern Arizona and into Utah, and the Grand Wash fault, which bounds the west side of the Shivwits Plateau and has approximately 15,000 feet of displacement across the monument.

Archaeological evidence shows much human use of the area over the past centuries. Because of their remoteness and the lack of easy road access, the sites in this area have experienced relatively little vandalism. Their good condition distinguishes them from many prehistoric resources in other areas. Prehistoric use is documented by irreplaceable rock art images, quarries, villages, watchtowers, agricultural features, burial sites, caves, rockshelters, trails, and camps. Current evidence indicates that the monument was utilized by small numbers of hunter-gatherers during the Archaic Period (7000 B.C. to 300 B.C.). Population and utilization of the monument increased during the Ancestral Puebloan Period from the Basketmaker II Phase through the Pueblo II Phase (300 B.C. to 1150 A.D.), as evidenced by the presence of pit houses, habitation rooms, agricultural features, and pueblo structures. Population size decreased during the Pueblo III Phase (1150 A.D. to 1225 A.D.). Southern Paiute groups replaced the Pueblo groups and were occupying the monument at the time of Euro-American contact. Archeological sites in the monument include large concentrations of ancestral Puebloan (Anasazi or Hitsatsinom) villages, a large, intact Pueblo II village, numerous archaic period archeological sites, ancestral Puebloan sites, and Southern Paiute sites. The monument also contains areas of importance to existing Indian tribes.

In 1776, the Escalante-Dominguez expedition of Spanish explorers passed near Mount Trumbull. In the first half of the 19th century, Jedediah Smith, Antonio Armiijo, and John C. Fremont explored portions of this remote area. Jacob Hamblin, a noted Mormon pioneer, explored portions of the Shivwits Plateau in 1858 and, with John Wesley Powell, in the 1870s. Clarence Dutton completed some of the first geological explorations of this area and provided some of the most stirring written descriptions. Having traversed this area by wagon at the request of the territorial legislature, Sharlot Hall recommended it for inclusion within the State

of Arizona when it gained Statehood in 1912. Early historic sawmills provided timber that was hauled 70 miles along the Temple Trail wagon road from Mt. Trumbull down the Hurricane Cliffs to St. George, Utah. Ranch structures and corrals, fences, water tanks, and the ruins of sawmills are scattered across the monument and tell the stories of the remote family ranches and the lifestyles of early homesteaders. There are several old mining sites dating from the 1870s, showing the history of mining during the late 19th and early 20th centuries. The remote and undeveloped nature of the monument protects these historical sites in nearly their original context.

The monument also contains outstanding biological resources preserved by remoteness and limited travel corridors. The monument is the junction of two physiographic ecoregions: the Mojave Desert and the Colorado Plateau. Individually, these regions contain ecosystems extreme to each other, ranging from stark, arid desert to complex, dramatic higher elevation plateaus, tributaries, and rims of the Grand Canyon. The western margin of the Shivwits Plateau marks the boundary between the Sonoran/Mojave/Great Basin floristic provinces to the west and south, and the Colorado Plateau province to the northeast. This intersection of these biomes is a distinctive and remarkable feature. Riparian corridors link the plateau to the Colorado River corridor below, allowing wildlife movement and plant dispersal. The Shivwits Plateau is in an arid environment with between 14 to 18 inches of precipitation a year. Giant Mojave Yucca cacti proliferate in undisturbed conditions throughout the monument. Diverse wildlife inhabit the monument, including a trophy-quality mule deer herd, Kaibab squirrels, and wild turkey. There are numerous threatened or endangered species as well, including the Mexican spotted owl, the California condor, the desert tortoise, and the southwestern willow flycatcher. There are also candidate or sensitive species, including the spotted bat, the western mastiff bat, the Townsend's big eared bat, and the goshawk, as well as two federally recognized sensitive rare plant species: Penstemon distans and Rosa stellata. The ponderosa pine ecosystem in the Mt. Trumbull area is a biological resource of scientific interest, which has been studied to gain important insights regarding dendroclimatic reconstruction, fire history, forest structure change, and the long-term persistence and stability of presettlement pine groups.

Section 2 of the Act of June 8, 1906 (34 Stat. 225, 16 U.S.C. 431) authorizes the President, in his discretion, to declare by public proclamation historic landmarks, historic and prehistoric structures, and other objects of historic or scientific interest that are situated upon the lands owned or controlled by the Government of the United States to be national monuments, and to reserve as a part thereof parcels of land, the limits of which in all cases shall be confined to the smallest area compatible with the proper care and management of the objects to be protected.

WHEREAS it appears that it would be in the public interest to reserve such lands as a national monument to be known as the Grand Canyon-Parashant National Monument:

NOW, THEREFORE, I, WILLIAM J. CLINTON, President of the United States of America, by the authority vested in me by section 2 of the Act of June 8, 1906 (34 Stat. 225, 16 U.S.C. 431), do proclaim that there are hereby set apart and reserved as the Grand Canyon-Parashant National Monument, for the purpose of protecting the objects identified above, all lands and interests in lands owned or controlled by the United States within the boundaries of the area described on the map entitled "Grand Canyon-Parashant National Monument" attached to and forming a part of this proclamation. The Federal land and interests in land reserved consist of approximately 1,014,000 acres, which is the smallest area compatible with the proper care and management of the objects to be protected.

For the purpose of protecting the objects identified above, all motorized and mechanized vehicle use off road will be prohibited, except for emergency or authorized administrative purposes.

Nothing in this proclamation shall be deemed to enlarge or diminish the jurisdiction of the State of Arizona with respect to fish and wildlife management.

The establishment of this monument is subject to valid existing rights.

All Federal lands and interests in lands within the boundaries of this monument are hereby appropriated and withdrawn from all forms of entry, location, selection, sale, or leasing or other disposition under the public land laws, including but not limited to withdrawal from location, entry, and patent under the mining laws, and from disposition under all laws relating to mineral and geothermal leasing, other than by exchange that furthers the protective purposes of the monument. Sale of vegetative material is permitted only if part of an authorized science-based ecological restoration project. Lands and interests in lands within the proposed monument not owned by the United States shall be reserved as a part of the monument upon acquisition of title thereto by the United States.

This proclamation does not reserve water as a matter of Federal law nor relinquish any water rights held by the Federal Government existing on this date. The Federal land managing agencies shall work with appropriate State authorities to ensure that water resources needed for monument purposes are available.

The Secretary of the Interior shall manage the monument through the Bureau of Land Management and the National Park Service, pursuant to applicable legal authorities, to implement the purposes of this proclamation. The National Park Service and the Bureau of Land Management shall manage the monument cooperatively and shall prepare an agreement to share, consistent with applicable laws, whatever resources are necessary to properly manage the monument; however, the National Park Service shall continue to have primary management authority over the portion of the monument within the Lake Mead National Recreation Area, and the Bureau of Land Management shall have primary management authority over the remaining portion of the monument.

The Bureau of Land Management shall continue to issue and administer grazing leases within the portion of the monument within the Lake Mead National Recreation Area, consistent with the Lake Mead National Recreation Area authorizing legislation. Laws, regulations, and policies followed by the Bureau of Land Management in issuing and administering grazing leases on all lands under its jurisdiction shall continue to apply to the remaining portion of the monument.

Nothing in this proclamation shall be deemed to revoke any existing withdrawal, reservation, or appropriation; however, the national monument shall be the dominant reservation. Warning is hereby given to all unauthorized persons not to appropriate, injure, destroy, or remove any feature of this monument and not to locate or settle upon any of the lands thereof.

IN WITNESS WHEREOF, I have hereunto set my hand this eleventh day of January, in the year of our Lord two thousand, and of the Independence of the United States of America the two hundred and twenty-fourth.

WILLIAM J. CLINTON

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