



Sonoran Desert National Monument Science Plan

November 14, 2019

Bureau of Land Management
Sonoran Desert National Monument



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Purpose of NCL Science Plan

The Bureau of Land Management (BLM) National Conservation Lands (NCL) (formerly known as the National Landscape Conservation System) was administratively established in 2000 and legislatively codified in the Omnibus Public Land Management Act of 2009 (PL 111-11). This system encompasses nearly 900 units spread across approximately 27 million acres of public lands managed by the BLM. The BLM is mandated to conserve, protect, and restore the outstanding cultural, ecological, and scientific values of NCL units.

A key aspect of the NCL is scientific research. Scientific research can aid in the conservation, protection, and restoration of these lands. Therefore, science is strategically planned and organized within NCL units.

The objectives of NCL 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 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 NCL 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 scientific mission of the unit.

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" (BLM 2007). Science has been defined within the BLM several times (BLM 2007; BLM 2008). For this plan, science is defined as the study of natural and social phenomena using repeatable observations or experiments. In the context of land management, scientific data are collected, analyzed, or synthesized to increase knowledge and support decision-making.

This science plan will be used as the basis for conducting science related activities in the Sonoran Desert National Monument (Monument).



Unit Description

President William J. Clinton issued Presidential Proclamation 7397 on January 17, 2001 (see Appendix A) designating the Monument. The Monument was created to protect an array of scientific, biological, archaeological, geological, cultural, and historical objects. As stated in Presidential Proclamation 7397, the Monument was designated to protect “a magnificent example of untrammeled Sonoran Desert landscape” with an “extraordinary array of biological, scientific, and historic resources” (Appendix A).

The Monument was specifically designated to protect certain resources, including:

- A large Sonoran Desert landscape that connects to other large natural areas;
- The ecological diversity of the Sonoran Desert, including a diversity of flora and fauna associated with rare woodlands assemblages, palo verde-mixed cacti, creosote-bursage, desert washes, and rare desert grasslands vegetation communities;
- A cultural landscape that appears largely unchanged, with a rich history that spans at least 10,000 years, from the Archaic to modern day.

The Monument includes natural resources that represent the biological diversity of the Sonoran Desert, including ecological communities found in both the Arizona uplands subdivision and the Lower Colorado River subdivision of the Sonoran Desert biome (Brown 1994). The ecological communities include large, high-quality examples of Sonoran Desert vegetation communities such as creosote bursage and palo verde-mixed cacti, which contain expansive saguaro (*Carnegiea gigantea*) cactus forests and provide habitat for a wide variety of wildlife, including cactus ferruginous pygmy-owls (*Glaucidium brasilianum cactorum*), Sonoran Desert tortoise (*Gopherus morafkai*), lesser long-nosed bat (*Leptonycteris yerbabuena*), Sonoran pronghorn (*Antilocapra americana sonoriensis*), and desert bighorn sheep (*Ovis canadensis nelsoni*). Less common communities include rare woodland assemblages typically found in wetter climates, desert grasslands, and other habitats that are important for wildlife foraging, nesting birds, and amphibians.

Cutting through these communities are desert washes which include increased density of vegetation. These natural desert features provide important wildlife cover, movement corridors, and forage, especially in hot summer months. Desert washes also provide habitat for animals and plants to complete their life cycles and survive drought.

The Monument is a large area of Sonoran Desert that supports large-scale ecological processes. The Monument features 486,400 acres of Sonoran Desert landscape - the most biologically diverse of the North American deserts. The most striking aspect of the plant community within the Monument is the extensive saguaro cactus forest. Individual saguaro cacti are magnificent,



but a forest of these cacti, together with the wide variety of trees, shrubs and herbaceous plants that make up the forest community in the Monument, is impressive.

Scientific analysis shows that the area received far more precipitation 20,000 years ago, and slowly became more arid. Vegetation for the area changed from juniper-oak-pinion pine woodland to the vegetation found today in the Sonoran Desert, although a few plants from the more mesic period, including the Kofa Mountain barberry (*Berberis harrisoniana*), Arizona rosewood (*Vauquelinia californica*), and junipers (*Juniperus spp.*), remain on higher elevations and north-facing slopes.

The lower, flatter areas of the Monument contain the creosote-bursage plant community. This plant community occurs over the open expanses between the mountain ranges and connects the other plant communities together. Rare patches of desert grassland also occur in the Sand Tank Mountains area. The washes in the area support a much denser vegetation community than the surrounding desert, including mesquite (*Prosopis spp.*), ironwood (*Olneya tesota*), palo verde (*Parkinsonia spp.*), desert honeysuckle (*Anisacanthus thurberi*), chuperosa (*Justicia californica*), and desert willow (*Chilopsis linearis*), as well as a variety of herbaceous plants. This vegetation offers the dense cover bird species need for successful nesting, foraging, and escape, and birds heavily use this plant community during migration.

These diverse plant communities of the Monument support a wide variety of wildlife, a robust population of desert bighorn sheep, especially in the Maricopa Mountains area, and other mammalian species such as mule deer (*Odocoileus hemionus*), javelina (*Tayassu tajacu*), mountain lion (*Puma concolor*), gray fox (*Urocyon cinereoargenteus*), and bobcat (*Lynx rufus*). Bat species within the Monument include the lesser long nosed bat, the California leaf-nosed bat (*Macrotus californicus*), and the cave myotis (*Myotis velifer*). Over 200 species of birds are found in the Monument. Numerous species of raptors and owls inhabit the Monument including the elf owl (*Micrathene whitneyi*) and the western screech owl (*Megascops kennicottii*). The Monument also supports a diverse array of reptiles and amphibians, including the Sonoran Desert tortoise, red-backed whiptail (*Aspidoscelis xanthonota*) and the Sonoran green toad (*Bufo retiformis*).

The Monument contains three distinct mountain ranges, the Maricopa, Sand Tank, and Table Top Mountains, as well as the Booth and White Hills, all separated by wide valleys. The Monument is also home to three congressionally designated wilderness areas: the North Maricopa Mountains Wilderness, the South Maricopa Mountains Wilderness, and the Table Top Wilderness, many significant archaeological and historic sites, and remnants of several important historic trails.

This largely undeveloped area provides important open space, wilderness opportunities, and a valuable visual landscape amid a rapidly urbanizing area. The North Maricopa Mountains



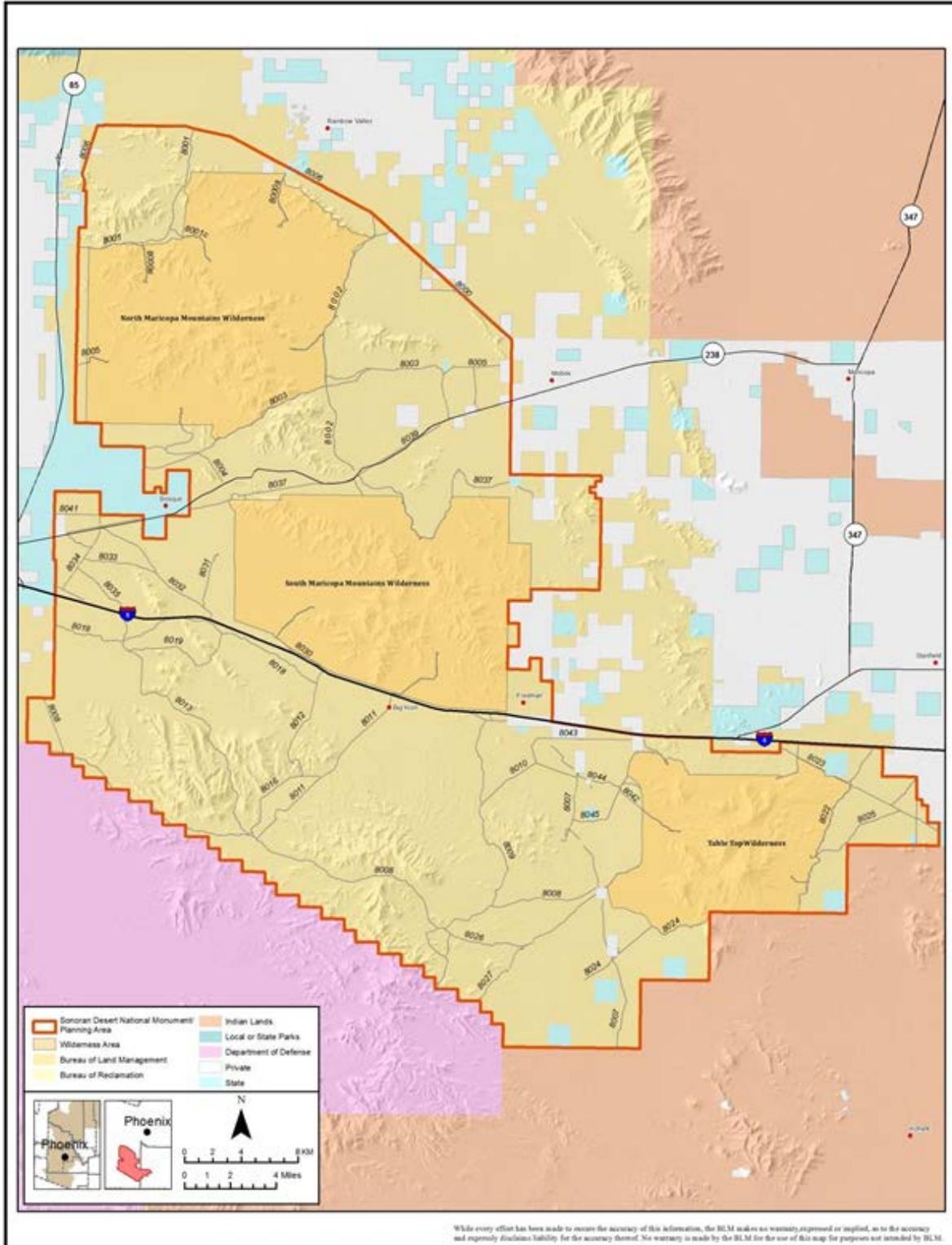
Wilderness has two hiking and equestrian trails, the 9-mile Margie's Cove Trail and the 6-mile Brittlebush Trail. The Table Top Wilderness also has two hiking and equestrian trails, the 7-mile Lava Flow Trail and the 3-mile Table Top Trail. A section of the Juan Bautista de Anza National Historic Trail crosses the Monument. This congressionally designated trail parallels the Butterfield Overland Stage Route, the Mormon Battalion Trail, and the Gila Trail.

The Monument includes a diverse cultural landscape that appears minimally changed from prehistoric to modern times and provides a rare opportunity to protect a wide diversity of sites, both in time and in place. It contains sites representative of the time periods from the Archaic through the modern day, including villages, camps, Ak-Chin farming sites, rock art, lithic scatters, homesteads, and historic ranches, as well as economically important trade and travel routes. These and other sites are an important connection for contemporary tribal peoples and descendants of those who have traveled through and settled here. The Monument provides significant opportunities to expand knowledge and understanding of aboriginal peoples, Spanish explorers, and Euro-Americans within a landscape that encompassed all aspects of their daily lives.

Scientific Background

In addition to BLM land health evaluations, many other studies have been conducted on the Monument. The BLM has also conducted saguaro studies as a part of a grazing capability analysis on the Monument. The Arizona Game and Fish Department has conducted wildlife surveys, including studies on mountain lions and other species, as well as maintaining a long-term desert tortoise monitoring plot. Various prehistoric archaeological surveys have been completed and there have been numerous historic surveys of the Juan Bautista de Anza National Historic Trail, the Mormon Battalion Trail, and the Butterfield Overland Stage Route. There have been studies conducted by students and non-government organizations including studies on plant-insect interactions, DNA analyses of acuña cactus (*Echinomastus erectocentrus* var. *acunensis*), DNA analyses of Rio Grande leopard frogs (*Rana berlandieri*) and studies on migratory and nesting birds in xeric washes.

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The scientific mission of the Monument is to:

1. Support the conservation, protection, and interpretation of Monument values and objects identified in the Presidential Proclamation and the 2012 Sonoran Desert National Monument Resource Management Plan (RMP).
2. Allow and encourage pertinent science across diverse disciplines and timescales that can:
 - Inform and evaluate management decisions;
 - Improve and maintain ecosystem resiliency and function;
 - Maintain diversity and viability of plant and animal populations; and,
 - Preserve and understand cultural and historical resources.
3. Support investigations into the level of impact of stressors on the integrity of Monument objects, including how landscape level compounding stressors such as climate change affect Monument objects.
4. Be responsive to the BLM National Conservation Lands 15-year Strategy and the BLM Arizona National Conservation Lands 3-year Strategy.
5. Serve as a model system for surrounding areas so that scientific findings can be exported to other landscapes on both federal and non-federal lands.
6. Serve as an outdoor laboratory for studies and scientific investigations. Serve as an outdoor science classroom to educate and inspire the next generation.

Integrating Science into Management

Scientific Needs

1. In general, research will:
 - Inform land management decisions in the Monument;
 - Be designed around clearly articulated research/management questions;
 - Be responsive to the National Conservation Lands 15-year Strategy, Arizona BLM's National Conservation Lands Strategy, the BLM and National Conservation Lands Science Strategies, and Monument's Science Plan and RMP.
2. Potential future management decisions will generally be related to the following issues:
 - Livestock grazing management;
 - Updates to route designations (i.e. travel management);
 - Invasive species control;
 - Xero-riparian area management;
 - Adjustments to recreation management (e.g., Business Plans, special recreation permit management, etc.);
 - Management and protection of wilderness characteristics;
 - Other decisions related to the protection, conservation, and interpretation of Monument objects as needed (e.g., projects to improve habitat of wildlife species,



protect archaeological and historical resources, interpreting geologic resources, etc.);

- Identify and document cultural resources; and/or
 - Sustainability.
3. As the management questions in Monument continue to evolve, so do the science needs. Thus, the scientific needs will remain fluid and opportunities for research should remain open and inclusive.

Guidelines for Scientific Research

It is anticipated that three main types of research are most likely to occur within Monument:

1. Assessment, inventory, and monitoring;
2. Solicited research addressing management questions and science needs;
3. Unsolicited contributed scientific studies.

There are numerous topics of research that may be addressed by these three types of inquiries including but not limited to: botany, ecology, hydrology, geology, wildlife studies, paleontology, recreation, and archaeology.

There are some general guidelines that apply to all these types of research:

1. All scientific investigation must comply with relevant laws, regulations, and policies, including any permit requirements.
2. All non-permitted external scientific investigations must be authorized by the Monument manager (or the manager's designee), according to the procedures described below.
3. Science should not impact the long-term health or sustainability of the resources of Monument, especially the resources, objects, and values for which Monument was designated.
 - If impacts are anticipated, appropriate protocols should be followed, and the potential gains should be carefully considered and weighed against potential impacts.
4. A balance must be maintained between research and education, and preservation and protection of Monument resources, objects, and values.
5. Scientists initiating research projects within Monument should be aware of existing data within the BLM and should incorporate these data into projects whenever possible.
6. Proposed research within any of the wilderness areas should comply with appropriate laws and regulations including the Wilderness Act of 1964 and BLM wilderness policy (Manual 6340).
7. Monument staff should use all available monitoring protocols to achieve adequate monitoring of the resources on the Monument (e.g. land health evaluations).



Scientific Authorizations

In addition to the statewide process for permitting paleontological and archaeological research, the process for scientific authorizations within Monument is outlined below. Permits and authorization projects will be shared between appropriate state and field office staff for research taking place within Monument.

All requests should be carefully considered, weighing potential benefits and costs. The following process has been adapted from other NCL units:

1. Scientist submits proposal to Monument science coordinator.
 - Proposals must include:
 - I. Contact information for the principal investigator.
 - II. Summary of proposed research (not to exceed 3 pages) including
 - i. A brief explanation of background information;
 - ii. Rationale for research;
 - iii. Research methods;
 - iv. Timeline for field work; and,
 - v. Outline of public outreach effort, if appropriate.
2. The proposal will be reviewed by the Monument science coordinator to determine if the proposal is:
 - Complete;
 - Conforms to the Monument Science Guidelines (including all relevant laws and regulations);
 - Conforms to the Monument Resource Management Plan;
 - Meets the Monument scientific mission.
3. The science coordinator will brief the Monument manager on the review of the science proposal. Subsequently, the Monument manager (or the manager's designee) will grant or deny authorization to conduct the scientific investigation.
4. If a proposal is denied authorization:

A letter of denial will be provided to the scientist and will include justification for the denial.
5. If a proposal is granted authorization:
 - A determination will be made as to what, if any, National Environmental Policy Act (NEPA) analysis is necessary.
 - A letter of authorization will be provided to the scientist, signed by the Monument manager (or the manager's designee). The authorization may include stipulations such as NEPA analysis requirements, time limits, geographic limits, reporting requirements, and public outreach requirements.



- The proposal will be added to an internal tracking document of on-going scientific investigations in Monument, accessible by all Monument staff.
 - The authorization is routed to Monument and Lower Sonoran Field Office staff.
 - Copies of the authorization will be made available to BLM staff, for example on the shared drive.
 - Short descriptions of ongoing research will be made available to the general public, for example on the Monument webpage.
 - Sensitive topics, for example location of specific cultural or paleontological sites, should be excluded from public information for protection of resources.
6. Research is initiated.
- Research must be conducted according to the stipulations outlined in the authorization.
7. Minimum reporting requirements for all scientific investigations will include:
- Progress reports (frequency as established in the permit), filed with the science coordinator.
 - Progress reports should include status of the investigation, areas studied, approximate dates of fieldwork, partners involved, and preliminary findings when possible.
 - Final reports, filed with the science coordinator.
 - I. Final reports should include:
 - i. Research background and results;
 - ii. Discussion of the results including how the results are relevant to the NCL unit and potential management decisions;
 - iii. A summary of the public outreach effort if appropriate;
 - Raw data where appropriate; and,
 - Electronic copies of any published papers resulting from the scientific investigation.
 - Manager's summary report
 - I. Manager's summary reports are brief presentations (in any appropriate format) of research results to BLM managers, which ensure that:
 - i. Management questions are answered;
 - ii. Managers have a full understanding of scientific findings; and,
 - iii. Managers can incorporate these findings into their management decisions.
8. Research is completed, and final report is filed with the science coordinator.



Future Studies

There are many areas within the Monument that would benefit from additional studies. Some examples of topics of study would be:

- The saguaro cactus forest is listed as a reason why the Monument was designated and more information about saguaros and their interactions with other plants and animals is needed. The proclamation creating the Monument discusses the “excellent habitat for a wide range of wildlife species”;
- More research is also needed on how to improve the habitat for wildlife. Further investigation of the impacts of livestock grazing on both the habitat and wildlife are necessary;
- There are many Endangered Species Act listed species and BLM sensitive species within the Monument. These species and their habitat needs should be a priority for future research. Another area of deep concern is invasive and/or introduced plant and animal species within the Monument;
- The presidential proclamation creating the Monument states, “archaeological and historic sites, including rock art sites, lithic quarries, and scattered artifacts”. Additional exploration of the nature and characteristics of these fragile resources are needed to help us better develop our understanding of the distinct history of this area.



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Appendix A

Proclamation 7397—Establishment of the Sonoran Desert National Monument

January 17, 2001

By the President of the United States of America

A Proclamation

The Sonoran Desert National Monument is a magnificent example of untrammeled Sonoran Desert landscape. The area encompasses a functioning desert ecosystem with an extraordinary array of biological, scientific, and historic resources. The most biologically diverse of the North American deserts, the Monument consists of distinct mountain ranges separated by wide valleys and includes large saguaro cactus forest communities that provide excellent habitat for a wide range of wildlife species.

The Monument's biological resources include a spectacular diversity of plant and animal species. The higher peaks include unique woodland assemblages, while the lower elevation lands offer one of the most structurally complex examples of palo verde/mixed cacti association in the Sonoran Desert. The dense stands of leguminous trees and cacti are dominated by saguaros, palo verde trees, ironwood, prickly pear, and cholla. Important natural water holes, known as tinajas, exist throughout the Monument. The endangered acuna pineapple cactus is also found in the Monument.

The most striking aspect of the plant communities within the Monument are the abundant saguaro cactus forests. The saguaro is a signature plant of the Sonoran Desert. Individual saguaro plants are indeed magnificent, but a forest of these plants, together with the wide variety of trees, shrubs, and herbaceous plants that make up the forest community, is an impressive site to behold. The saguaro cactus forests within the Monument are a national treasure, rivaling those within the Saguaro National Park.

The rich diversity, density, and distribution of plants in the Sand Tank Mountains area of the Monument is especially striking and can be attributed to the management regime in place since the area was withdrawn for military purposes in 1941. While some public access to the area is allowed, no livestock grazing has occurred for nearly 50 years. To extend the extraordinary diversity and overall ecological health of the Sand Tanks Mountains area, land adjacent and with biological resources like the area withdrawn for military purposes should be subject to a similar management regime if possible.

The Monument contains an abundance of packrat middens, allowing for scientific analysis of plant species and climates in past eras. Scientific analysis of the midden shows that the area received far more precipitation 20,000 years ago, and slowly became more arid. Vegetation for



the area changed from juniper-oak-pine woodland to the vegetation found today in the Sonoran Desert, although a few plants from the more mesic period, including the Kofa Mountain barberry, Arizona rosewood, and junipers, remain on higher elevations of north-facing slopes.

The lower elevations and flatter areas of the Monument contain the creosote-bursage plant community. This plant community thrives in the open expanses between the mountain ranges and connects the other plant communities together. Rare patches of desert grassland can also be found throughout the Monument, especially in the Sand Tank Mountains area. The washes in the area support a much denser vegetation community than the surrounding desert, including mesquite, ironwood, palo verde, desert honeysuckle, chuperosa, and desert willow, as well as a variety of herbaceous plants. This vegetation offers the dense cover bird species need for successful nesting, foraging, and escape, and birds heavily use the washes during migration.

The diverse plant communities present in the Monument support a wide variety of wildlife, including the endangered Sonoran pronghorn, a robust population of desert bighorn sheep, especially in the Maricopa Mountains area, and other mammalian species such as mule deer, javelina, mountain lion, gray fox, and bobcat. Bat species within the Monument include the endangered lesser long-nosed bat, the California leaf-nosed bat, and the cave myotis. Over 200 species of birds are found in the Monument, including 59 species known to nest in the Vekol Valley area. Numerous species of raptors and owls inhabit the Monument, including the elf owl and the western screech owl. The Monument also supports a diverse array of reptiles and amphibians, including the Sonoran Desert tortoise and the red-backed whiptail. The Bureau of Land Management has designated approximately 25,000 acres of land in the Maricopa Mountains area as critical habitat for the desert tortoise. The Vekol Valley and Sand Tank Mountain areas contain especially diverse and robust populations of amphibians. During summer rainfall events, thousands of Sonoran green toads in the Vekol Valley can be heard moving around and calling out.

The Monument also contains many significant archaeological and historic sites, including rock art sites, lithic quarries, and scattered artifacts. Vekol Wash is believed to have been an important prehistoric travel and trade corridor between the Hohokam and tribes located in what is now Mexico. Signs of large villages and permanent habitat sites occur throughout the area, and particularly along the bajadas of the Table Top Mountains. Occupants of these villages were the ancestors of today's O'odham, Quechan, Cocopah, Maricopa, and other tribes. The Monument also contains a frequently used trail corridor 23 miles long in which are found remnants of several important historic trails, including the Juan Bautista de Anza National Historic Trail, the Mormon Battalion Trail, and the Butterfield Overland Stage Route.

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 Sonoran Desert 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 Sonoran Desert National Monument, for the purpose of protecting the objects identified above, all lands and interest in lands owned or controlled by the United States within the boundaries of the area described on the map entitled "Sonoran Desert National Monument" attached to and forming a part of this proclamation. The Federal land and interests in land reserved consist of approximately 486,149 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. Lands and interests in lands within the 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 management 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, pursuant to applicable legal authorities, to implement the purposes of this proclamation. That portion identified as Area A on the map, however, shall be managed under the management arrangement established by section 3 of Public Law No. 99-606, 100 Stat. 3460-61, until November 6, 2001, at which time, pursuant to section 5(a) of Public Law No. 99-606,



100 Stat. 3462-63, the military withdrawal terminates. At that time, the Secretary of the Interior shall assume management responsibility for Area A through the Bureau of Land Management.

The Secretary of the Interior shall prepare a management plan that addresses the actions, including road closures or travel restrictions, necessary to protect the objects identified in this proclamation.

Laws, regulations, and policies followed by the Bureau of Land Management in issuing and administering grazing permits or leases on all lands under its jurisdiction shall continue to apply with regard to the lands in the Monument; provided, however, that grazing permits on Federal lands within the Monument south of Interstate Highway 8 shall not be renewed at the end of their current term; and provided further, that grazing on Federal lands north of Interstate 8 shall be allowed to continue only to the extent that the Bureau of Land Management determines that grazing is compatible with the paramount purpose of protecting the objects identified in this proclamation.

Nothing in this proclamation shall be deemed to revoke any existing withdrawal, reservation, or appropriation; however, the national Monument shall be the dominant reservation.

Nothing in this proclamation shall preclude low level overflights of military aircraft, the designation of new units of special use airspace, or the use or establishment of military flight training routes over the lands included in this proclamation.

In order to protect the public during operations at the adjacent Barry M. Goldwater Range, and to continue management practices that have resulted in an exceptionally well preserved natural resource, the current procedures for public access to the portion of the Monument depicted as Area A on the attached map shall remain in full force and effect, except to the extent that the United States Air Force agrees to different procedures which the Bureau of Land Management determines are compatible with the protection of the objects identified in this proclamation.

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 seventeenth day of January, in the year of our Lord two thousand one, and of the Independence of the United States of America the two hundred and twenty-fifth.

WILLIAM J. CLINTON