



**NATIONAL
CONSERVATION
LANDS**

Kasha-Katuwe Tent Rocks

National Monument

New Mexico Science Plan



U.S. Department of the Interior
Bureau of Land Management

Kasha-Katuwe Tent Rocks National Monument

Science Plan

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1: INTRODUCTION AND SCIENTIFIC MISSION

1.1: Purpose of NCL 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). It was subsequently renamed National Conservation Lands (NCL). The system encompasses nearly 900 units spread across approximately 27 million acres of public lands managed by the Bureau of Land Management (BLM) in the US Department of the Interior (USDI). The BLM is mandated to conserve, protect, and restore the outstanding cultural, ecological, and scientific values of NCL units. Scientific investigation can aid in the conservation, protection, and restoration of these lands; and therefore, science is strategically planned and organized within NCL units (USDI, BLM 2007a).

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, 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 NCL units are considered “living” documents and should be revised and updated frequently. Scientific needs that emerge during the course of implementing a science plan may be added to the plan on an as-needed basis to meet the unit's scientific mission. This science plan will be used as the basis for conducting science in BLM's Kasha-Katuwe Tent Rocks National Monument (KKTR; “The Monument”), one of the units in the national NCL network.

1.2: Unit and geographic area description

Located in north-central New Mexico in the foothills of the Jemez Mountains on the southwestern edge of the Pajarito Plateau, Kasha-Katuwe Tent Rocks National Monument (KKTR; "The Monument") is in Sandoval County about 5 miles west of the Rio Grande (see Figure 1). It lies about 35 miles southwest of Santa Fe and 52 miles northeast of Albuquerque. Access to the area from these cities is by State Road (SR) 16 or SR 22 from Interstate Highway 25 (I-25), then by Tribal Route 92 which connects to BLM Road 1011 (also referred to locally as Forest Service Road 266). Adjacent to the Monument are the Pueblo de Cochiti on the east and south; Santo Domingo (Kewa) Pueblo, Jemez Pueblo and the Santa Fe National Forest on the west; and State lands to the north. The Monument is located within New Mexico Congressional District 3. The Pueblo de Cochiti is the gateway community to the Monument.

The BLM manages The Monument in "close cooperation" and partnership with the Pueblo de Cochiti (the Pueblo) as stated in the statutory proclamation. Together, the BLM and the Pueblo coordinate to protect the Monument's natural and cultural resources.

Kasha-Katuwe Tent Rocks National Monument offers an opportunity to observe, study, and experience the geologic processes and cultures that shaped the NM landscapes for thousands of years. The Monument includes a national recreation trail and ranges from 5,570 feet to 6,760 feet above sea level. The cone-shaped rock formations are the products of volcanic eruptions that occurred 6 to 7 million years ago and left pumice, ash, and tuff deposits over 1,000 feet thick. While fairly uniform in shape, the "tent-like" rock formations vary in height from a few feet up to 90 feet. The BLM acknowledges the area as the traditional, and ancestral lands of the Puebloan people. The land is, and always will be considered sacred to the nearby Pueblo de Cochiti community.

The monument is approximately 5,402 acres (USDI BLM, 2007b). The BLM manages 4,124 surface acres and 4,565 acres of minerals, the State of New Mexico owns approximately 521 acres (both surface and mineral), and the balance (approximately 757 surface acres and 316 acres of minerals) is privately owned (Figure 1). Within the 15,635-acre Planning Area, the BLM manages 5,089 surface acres (4,124 in the Monument and the 956-acre Southwest Acquisition), the State owns 9,789 acres, and 757 acres are privately owned. The BLM manages 5,530 acres of minerals (all) within the Planning Area and 9,268 acres of minerals (gold, silver, and

quicksilver only). The State of New Mexico owns 521 acres of minerals. There are 316 acres of private minerals (all) and 9,268 acres of private minerals (all minerals except gold, silver, and quicksilver). For the purposes of this Science Plan, “KKTR” will be used to refer to the BLM-operated Kasha-Katuwe Tent Rocks National Monument specifically.

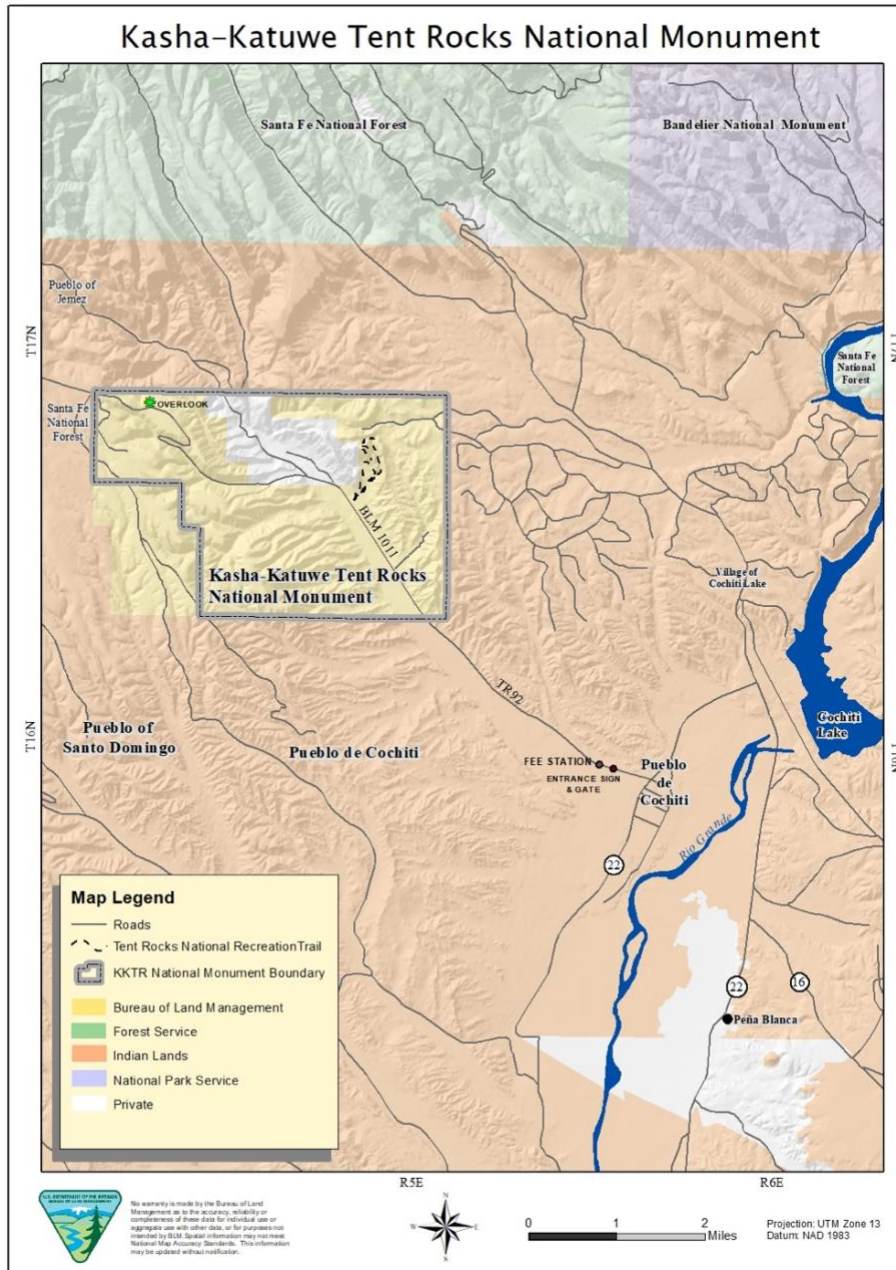


Figure 1: Map of the Kasha-Katuwe Tent Rocks NM and surrounding lands.

1.3: Scientific mission of the unit

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, 2008). 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).

As stated in Presidential Proclamation 7394, KKTR is to be managed "to protect the resources that make the Monument 'a remarkable outdoor laboratory, offering an opportunity to observe, study, and experience the geologic processes that shape natural landscapes, as well as other cultural and biological objects of interest' while allowing as many visitors as possible to enjoy these resources without degrading them."

Specifically, it is the scientific mission of KKTR to:

- Allow and encourage pertinent science that can:
 - inform management decisions and evaluate management methods within KKTR;
 - improve and maintain ecosystem resiliency, function, and land health;
 - maintain diversity and viability of plant and animal populations;
 - use multiple lines of evidence 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 KKTR.
- Serve as a model system for surrounding areas, so that scientific findings can be exported to other federal and non-federal lands.

2: SCIENTIFIC BACKGROUND OF THE NATIONAL CONSERVATION LANDS UNIT

2.1: Completed research and science available for KKTR

Research is considered for the following Science Areas: American Indian Uses and Traditional Practices, Cultural Resources, Air Quality, Soil and Water Resources, Riparian Areas, Upland Vegetation and Woodlands, Fire Management, Livestock Grazing, Noxious Weeds, Special Status Plants and Animals, Wildlife Habitat, Geologic Resources, Paleontology, Visual Resources, Recreation, Socioeconomics, and Environmental Justice. These categorizations roughly follow the Resource Management Plan (RMP; USDI BLM 2007b).

2.1.1: American Indian Uses and Traditional Practices

BLM Point of Contact (POC): Sean Daugherty

American Indian Uses and Traditional Cultural Values will be protected in the Monument and remain available for American Indian use. Developments and recreation management policies will be oriented, in part, toward discouraging visitor use in sensitive areas identified by American Indians. With appropriate advance notice, the BLM will consider brief, temporary closures of all or portions of the Monument and Southwest Acquisition to ensure privacy for traditional uses. Roads and trails will be minimized in traditional use areas by road and trail closures and relocations.

Specific areas where American Indian uses and traditional cultural practices take place are not identified in this document because of the sacred nature of some of these uses. Also, visitors' natural inquisitiveness could lead to higher levels of intrusion. Traditional use areas will be identified through the use of existing data on file and through consultation with tribes as part of the NEPA process and in compliance with NHPA.

The current Point of Contact for the Pueblo de Cochiti is Jacob Pecos, as of August 2020

2.1.2: Cultural Resources

BLM POC: Sean Daugherty and Michael Papirtis

The Planning Area is noted for its cultural resources. Archeological sites in this area span the past 12,000 years and are important for the scientific information they contain. At the same time, many of these same sites figure prominently in the history of several local American Indian tribes and are very important in traditional cultural practices and beliefs. Other more recent sites provide links to the Hispanic and Anglo history of this area, including an active period of homesteading under the Stockraising Homestead Act (<https://gloreCORDS.blm.gov/>). The BLM manages these resources for their information potential, for public values, or for conservation.

Several American Indian groups use KKTR for traditional religious and cultural practices. Pueblo de Cochiti has taken a strong interest in the BLM's management of the area; other tribes such as the Pueblos of Santo Domingo (Kewa), San Felipe, Jemez and Santa Ana may also have concerns. Principal issues include access to sacred places and privacy for religious practices, as well as continued access to areas used for hunting, piñon picking, and gathering of other traditional plants and materials.

Topic: **Cultural Resource Inventories**

Principal Investigators: Sean Daugherty, Michael Papirtis

Management of cultural resources is made more effective by knowledge of their location, nature and extent. While many cultural resource inventories are conducted to satisfy the requirements of Section 106 of the National Historic Preservation Act (54 U.S.C. 306108), Section 110 of the NHPA (54 U.S.C. 306102) also directs federal agencies to proactively manage historic properties, including the identification, evaluation, and nomination of properties to the National Register of Historic Places. Identification and evaluation is most often accomplished through cultural resources inventories as defined in BLM Manual Section 8110 (USDI, BLM 2004), but can include other methods such as oral histories, examination of GLO records, and tribal consultation. Of the 5,084 acres within KKTR, 1,954 acres (38.4%) have been intensively inventoried for archaeological and historical sites. A total of 10 inventories extend into or are contained within the boundaries of the Monument; additionally, the inventories have identified 99 sites extending into or wholly contained within KKTR as of the signing date of this document. The 99 sites represent archaeological sites, not necessarily cultural sites that still need to be identified through an ethnographic study or tribal consultation (see Table 3). One historic period

site (LA 190375) is located along the slot canyon trail and consists of a cavate. Although signs are present directing visitors to stay out of the cavate, many visitors ignore the signs and carve their names into the soft pumice or climb into the cavate to explore.

2.1.3: Air Quality

BLM POC: David Mattern

Air Quality was not an issue identified in the 2007 KKTR RMP (USDI, BLM 2007b). In 2010, the all-weather access road into and through the monument was paved, eliminating the significant dust problem that had existed from ingress and egress of visitor vehicles.

2.1.4: Soil and Water Resources

BLM POC: David Mattern

Topic: **Standards for Public Land Health and Guidelines for Livestock Grazing Management in New Mexico.**

Principal Investigators: BLM interdisciplinary staff.

Standards for Public Land Health apply to all BLM lands in New Mexico. No Land Health assessment(s) have been conducted on KKTR. Per the 2001 Final Decision (USDI BLM, 2001) that amended all RMPs, “Standards of land health are expressions of levels of physical and biological condition or degree of function required for healthy and sustainable lands, and define minimum resource conditions that must be achieved” (USDI BLM, 2001). Factors determining whether the standards are met include analysis of soil and watershed stability, hydrologic processes, vegetation communities, ecological processes, biologic communities (plants and animals), and riparian areas. A Land Health Assessment would be useful to inform potential management actions for various BLM programs including forestry, invasive weeds, fire and fuels, watershed, and wildlife.

Topic: Hydrology of Peralta Creek for Investigation of Riparian Potential

Principal Investigators: BLM staff hydrologist (currently David Mattern)

Per the KKTR RMP (2007), the KKTR Riparian Plan Development Plan/EA (USDI BLM, 2006), and the KKTR Riparian Planting EA (USDI BLM, 2016), we conducted stream reach infiltration measurements (seepage runs) in Peralta Creek in 2005, 2007, 2015 and 2017. These were to investigate water availability for the potential establishment of riparian plant communities. The measurements include pre-fire and post-fire (Las Conchas Fire, 2011) periods of runoff in Peralta Creek. Also, we conducted trial plantings in 2017 with cottonwood and willow seedlings in the upper and lower reaches of Peralta Creek within the Monument; plantings were unsuccessful. We have photo documentation, including ground photos and Google Earth images, of extensive post-fire channel morphology change.

2.1.5: Riparian Areas

BLM POC: Joshua Freeman; David Mattern, or current staff hydrologist

Topic: Post-Wildfire Effects on Peralta Creek and Potential Riparian Area

Principal Investigators: Lauren Victoria Jaramillo, M.S. University of New Mexico, Dr. Mark Stone, P.E., D.WRE, University of New Mexico

A five-year study to determine riparian development potential was conducted as a result of questions about changes in the hydrologic regime caused by the 2011 Las Conchas Fire in the upper Peralta Creek watershed (Jaramillo and Stone, unpublished). The study found low-density, sandy soils within the canyon that were highly subject to both erosion and seepage (water infiltration). This was inferred to be a possible reason for the magnitude of channel morphology changes following the Las Conchas Fire and subsequent flooding in 2011. The study was extremely lacking in investigating or discussing the movement, depth, and availability of water within the vadose zone (the unsaturated zone from the ground surface to the water table) even with the clear evidence of significant seepage into the channel bed. The conclusions of low probability of riparian development potential were not supported by their analysis, or more accurately, lack of focus on vadose zone hydrology (UNM, Department of Civil Engineering 2017).

Topic: Trial Riparian Vegetation Planting

Principal Investigators: Dave Mattern, Staff Hydrologist, Rio Puerco Field Office, Jack River, Forester, Rio Puerco Field Office

The 2007 KKTR RMP states that, “if riparian conditions develop [in Peralta Creek], cottonwood, willow, and other riparian species will be planted” (USDI, BLM 2007b). In 2015, an EA was written to allow for the planting of ponderosa pine seedlings, willow, cottonwood, and other appropriate riparian species along 2.05 miles of Peralta Canyon. Subsequently, in spring and early summer 2017, containerized seedlings and saplings were planted to a maximum depth of two (2) feet, but none of the plantings were successful. For this experiment to be conclusive the investigators now believe pole plantings at 6-8 feet of depth should occur in a year with average or greater snowfall; the NRCS collects snowfall data at a SNOTEL station in the Jemez Mountains which can help inform expected snowmelt runoff conditions in Peralta Creek. These modifications in experimental design and procedures could take advantage of ample vadose zone water occurring from channel bed infiltration during the spring snowmelt runoff season.

Topic: Stream Reach Infiltration Measurements and Seepage Runs

Principal Investigators: Dave Mattern, Staff Hydrologist, Rio Puerco Field Office

The 2006 KKTR Riparian Restoration EA was written to place two stream gauges at the upper and lower reaches of Peralta Creek and three alluvial water table wells along the canyon (USDI, BLM 2006). These improvements were in accordance with the monitoring prescription described by the KKTR RMP in 2007. However, the stream gauges were never implemented due to the changing stream morphology, which would require constant maintenance and recalibrations of the gauges. Instead, the staff hydrologist and interns conducted studies in 2005, 2007, 2015, 2017 to determine seepage or the rate of infiltration into the Peralta Creek channel bed. These studies collected near-simultaneous stream discharge data at both the upper and lower reaches of the creek, meaning measurements were taken with as little time delay as possible between the upstream and downstream sampling points. This allowed the investigators to determine the loss in surface water to ground water throughout the 2.05 miles of BLM-managed Peralta Creek. Before the 2011 Las Conchas Fire, about 50% of the water was seeping into the channel bed when flow was 2-3 cfs in the upper reach. In the 2015 and 2017 studies, the data showed that at the same upper reach discharge rates, 95% of the flow was seeping into the channel bed before the observation point in the lower reach 2.05 miles downstream.

2.1.6: Upland Vegetation and Woodlands

BLM POC: Jack River

Topic: **Determination of Forest Pests and Diseases within KKTR**

Principal Investigators: Gregory J. Reynolds, Forest Pathologist, USFS Region 3; Andrew Egan, Forest Entomologist, USFS Region 3; Jack N. River, Forester, BLM Rio Puerco Field Office

An assessment was conducted in 2019 by the USFS Region 3 Forest Pathologist Gregory Reynolds. He determined that *Gymnosporangium speciosum* was present at Tent Rocks and that *P. microphyllus* was presumably somewhere in the area as well. He also identified the presence of the juniper urn gall midge, *Walshomyia juniperina*. (Reynolds, Gregory J., personal communication email, April 30, 2019).



Figure 2: Morphology of *Gymnosporangium speciosum*, a pathogen observed on The Monument

Topic: **Climate-induced patterns and mechanisms of juniper die-off**

Principal Investigators: Michael J. Clifford and Tiffany Pereira, Desert Research Institute

This is ongoing research, identified in Table 2 and highlighted here. Recent and current climate-induced die-off of the highly drought-tolerant juniper (*Juniperus monosperma*) in northern New Mexico have received little scientific attention but may have dramatic land management implications in the form of altered fuel loads and increased invasive species colonizing newly opened canopy gaps. Persistent drought and warm temperatures in the Southwest have caused extensive die-off among the dominant tree species of the region. In 2002 and 2003, extreme drought was responsible for high levels (e.g., >50%) of pinyon pine (*Pinus edulis*) mortality in northern New Mexico, a co-dominant species of the pinyon-juniper woodlands. During the pinyon die-off event, juniper, a highly drought-tolerant species incurred little mortality. However,

due to continued drought over the past decade, combined with extreme drought and high temperatures in 2012 and 2013, juniper have begun to experience high levels of mortality. While extensive research has been conducted to understand the patterns and mechanisms of the pinyon mortality event of 2002-2003, no intensive or targeted research has been conducted on the current juniper mortality event – nor have studies assessed the vegetation management consequences of an additional tree die-off event in a region that has now experienced two such events within a decade. Here, we propose to 1) quantify the patterns and processes of juniper die-off and tree recruitment, 2) measure the fuel loads throughout the KKTR in an effort to understand how fuel dynamics have changed with the two tree die-off events, and 3) monitor the response of understory plants and invasive species. By quantifying the patterns and processes of tree die-off and the change in woody fuels and understory vegetation in response to this die-off, managers will have better knowledge of where and if resources are needed to remove dead woody fuels and/or understory vegetation from the landscape and if monitoring of invasive species are warranted.

2.1.7: Fire Management

BLM POC: Todd Richards

Topic: Fire Regime and Condition Class Assessment

Principal Investigators: Dave Borland, Forester and Fire Ecologist, New Mexico State Office (Retired), Jerry Wall, Hydrologist, Rio Puerco Field Office (Retired), Todd Richards, Fuels Specialist, Rio Puerco Field Office

An assessment to determine the level of departure from the estimated historical ranges of fire regimes and vegetation conditions was conducted on lands within the Monument in 2004 and is provided in Appendix A. Analysis included the use of tools such as the Fire Regime Condition Class (which has been abandoned and replaced with Vegetation Condition Class [VCC]) and Ecological Site Descriptions. The information in Appendix A could be updated to the contemporary VCC classification system.

Additional information on fuels management in the Monument is provided in Appendix B of this Science Plan. Specific research data or science available for fire and fuels management decisions within KKTR are also currently covered within the Science Plan sections on Vegetation, Forests, and Soil and Water Resources.

2.1.8: Livestock Grazing

BLM POC: Joseph Pruitt

Grazing is not authorized within the KKTR. See section 2.1.4 for Standards for Public Land Health in New Mexico that are related to but not limited to grazing effects.

2.1.9: Noxious Weeds

BLM POC: Joseph Pruitt

Topic: **Monitoring noxious weeds**

Principal Investigators: Joseph Pruitt

No external research on noxious weeds has been conducted specifically on KKTR. Species of concern include Scotch thistle (*Onopordium acanthium*), Salt Cedar (*Tamarix ramosissima*), Siberian Elm (*Ulmus pumila*), and cheatgrass (*Bromus tectorum*). Staff priorities (see Table 3) are to 1) Monitor and treat infestation of Scotch thistle, Salt Cedar and Siberian Elm near riparian areas where present. 2) Monitor rate of spread of cheatgrass and any noxious and invasive species that may develop over time. Cheatgrass can reduce the presence of native grasses, altering the fire regime in a way that is out of land managers' control. Currently no spatial data exists for cheatgrass treatment and monitoring. This is primarily due to the fact that, as of August 2020, cheatgrass has only been identified within the last two or three years. A majority of the cheatgrass has been identified along the main trail located within the monument which serves as limiting factor for recording spatial data. Monitoring practices that evaluate the rate of spread should be considered moving forward.

2.1.10: Special Status Plants and Animals

BLM POC: Josh Freeman

Topic: **Special Status Plants**

Principal Investigators: Zoe Davidson, State Botanist

KKTR possesses no documented or known special status plants as of 2020. This information has been confirmed with New Mexico State Botanist, Zoe Davidson. However, this does not exclude the possibility that special status plants may be found in KKTR in the future. The 2007 KKTR RMP also notes that, "No special status plant species have been identified within the Monument or Southwest Acquisition. Any plants located will be managed on a case-by-case basis" (USDI, BLM 2007b).

Topic: **Special Status Animals**

Principal Investigators: Joshua Freeman, Wildlife Biologist

Canyon-effect ponderosa pine and tent rock formations provide habitat for eight (8) BLM sensitive species. Sensitive species whose presence has either been documented or have suitable habitat within the KKTR National Monument include Townsend's big eared bat (*Corynorhinus townsendii*), Spotted bat (*Euderma maculatum*), Mexican Whip-poor-will (*Antrostomus arizonae*), Pinyon Jay (*Gymnorhinus cyanocephalus*), Bendire's Thrasher (*Toxostoma bendirei*), Virginia Warbler (*Leiothlypis virginiae*), Monarch Butterfly (*Danaus plexippus*) and Western Bumble Bee (*Bombus occidentalis*). The KKTR RMP states that, "the BLM is to... Determine the distribution, abundance, and reason for the current status and habitat needs for the candidate (and special status) species... and Monitor populations and habitats of candidate (and sensitive) species to determine whether management objectives are being met" (USDI, BLM 2007b).

Topic: **Biological Evaluation for KKTR RMP**

Principal Investigators: RPFO Wildlife Biologists

This biological evaluation was completed in 2005 and assessed the Monument's habitat potential for all special status species known to occur in New Mexico. The findings elucidate that grama grass cactus (*Sclerocactus papyracanthus*) is the only special status plant species with suitable habitat at KKTR. The evaluation lists five (5) species of bat as having, "suitable habitats in KKTR-NM," including Big Free-tailed Bat (*Nyctinomops macrotis*), Townsend's Big-eared Bat (*Corynorhinus townsendii*), Yuma Myotis (*Myotis yumanensis*), Long-eared Myotis (*Myotis evotis*), and Western Small-footed Myotis (*Myotis ciliolabrum*). All five of these bat species were listed as US Fish and Wildlife (USFWS) species of concern and BLM sensitive species. The findings conclude that there is suitable habitat for three (3) special status small mammals, including Desert Pocket Gopher (*Geomys arenarius*) {USFWS species of concern}, Ringtail (*Bassariscus astutus*) {New Mexico State sensitive species and Forest Service sensitive}, and Western Spotted Skunk (*Spilogale gracilis*) {New Mexico State sensitive species}. Lastly, the biological evaluation lists seven (7) special status birds with the potential to occur in suitable habitat within the monument; Ferruginous Hawk (*Buteo regalis*) {USFWS species of concern, BLM sensitive, FS sensitive, and Groups 3 on the Navajo Endangered Species List}, American Peregrine Falcon (*Falco peregrinus*) {NM State threatened species, USFWS species of concern, BLM sensitive, and Group 4 of the Navajo Endangered Species List}, Arctic Peregrine Falcon (*Falco peregrinus tundrius*) {NM State threatened species, USFWS species of concern,

BLM sensitive, and Group 3 of the Navajo Endangered Species List}, Gray Vireo (*Vireo vicinior*) {NM state threatened species}, Western Burrowing Owl (*Athene cunicularia hypugaea*) {USFWS species of concern, BLM sensitive, FS sensitive}, Sage Thrasher (*Oreoscoptes montanus*) {BLM sensitive}, and Loggerhead Shrike (*Lanius ludovicianus*) {USFWS species of concern and BLM sensitive}. There are an additional five (5) special status animal species that are listed as having a, “possible, but unlikely,” potential for occurrence in KKTR: Spotted Bat (*Euderma maculatum*), Little Brown Myotis (*Myotis lucifugus*), Occult Little Brown Bat (*Myotis occultus*), Long-legged Myotis (*Myotis volans*), and Red Fox (*Vulpes vulpes*) (USDI, BLM 2005b).

2.1.11: Wildlife Habitat

BLM POC: Josh Freeman

No external research on wildlife habitat has been conducted specifically on KKTR. General habitat types include canyon walls, ponderosa pine forest, pinyon-juniper woodlands, grasslands, and riparian habitat. Canyon walls and trees create a vertical spectrum of wildlife habitat. Ponderosa pines and cliff faces provide habitat for raptors, bats, and other cliff dwelling species. Pinyon-juniper woodlands and point-leaf manzanita are home to many non-game avian species. Native grasses and wildflowers are forage for deer and elk and habitat for insects and arthropods. Crucial winter ranges for deer and elk also exist within the monument due to the presence of year-round forage. Ephemeral rainwater can pool and provide amphibian habitat, but this occurrence is rare, and thus amphibian habitat within the monument is considered very limited.

Three (3) dirt tanks and one (1) rainfall catchment system provide consistent water for wildlife. The dirt tanks are remnant from before grazing was discontinued within the monument. The rainfall catchment and storage system were implemented through a partnership with New Mexico Department of Game and Fish.

Invasive plants within the monument could pose a threat to wildlife habitat (see section 2.1.9).

2.1.12: Geologic Resources

BLM POC: Calvin Parson

What follows is a general description of the known geology on the Monument.

There are two main rock units exposed within monument. The older formation is the Peralta Tuff member of the Bearhead Rhyolite and the younger formation is the Cochiti Formation. The rock types are distinguished in part by their color: the Peralta Tuff member of the Bearhead Rhyolite is a white to orangish-tan, and the Cochiti Formation is gray in color.

Both of these units were formed by deposition and erode relatively easily. The material tends to be somewhat homogenous with smaller grained material; however, the strata contains occasional cobbles and boulders deposited within the matrix. The nature of the material's erosivity, when capped by the occasional cobbles and boulders, allows the cobble or boulder to act as a capstone and armor the erosive material underneath from meteoric precipitation and frost wedging. The material under the stone, historically tends to erode in a conical or "tent" shaped fashion until the capstone is undercut, allowing the feature to continue to erode until it is consumed by the earth's natural processes.

These tents are a source of fascination and attract people to the area to enjoy the beauty and ambiance of the area against a backdrop of the numerous features. Erosion is a natural process, in fact this is how the tents are formed; however, abrasion from people climbing and laying on the tents likely exacerbates the rate of erosion. To a lesser degree, the "tents" may be affected by wind erosion. With a reportedly large population of people visiting the area to view and enjoy the beauty of the "tents", as well as walking on the narrow paths, there is some question whether the amount of visitation is exacerbating the rate of erosion that will lead to the destruction of the features or contribute to the trail and exacerbate the incision of areas like the Slot Canyon (Table 3). If human visitation is exacerbating the rate of erosion, engineering controls such as fencing around the tents or armoring the trail surface may be necessary and appropriate to protect the geologic features and the trail surface.

2.1.13: Paleontology

BLM POC: Sean Daugherty with Michael Papirtis

Topic: Potential Fossil Yield Classifications (PFYC)

Principal Investigators: Sean Daugherty

Within the Monument three of the five Potential Fossil Yield Classifications (PFYC) are present. The PFYC is based on internal BLM guidance describing geological outcroppings cross-referenced to the actual location information.

PFYC 1 within the Monument is identified as Neogene volcanic rock and is unlikely to preserve fossil material. Management Concern for paleontological resources on Class 1 acres is negligible. Ground disturbing activities will not require mitigation except in rare circumstances. PFYC 1 covers almost 1,000 acres, or 20% of the Monument.

PFYC 2 within the Monument is identified as alluvium soils from the upper and middle Quaternary, are less than 10,000 years old and are not likely to contain any fossil material. Management concerns for PFYC is negligible except in rare circumstances. PFYC 2 covers almost 1,000 acres, or 20% of the Monument.

PFYC 4 within the Monument is the last of the groups represented and is identified as Santa Fe Group, undivided, basin fill of Rio Grande rift region. Locally PFYC 4 alluvium fill a wide range of continental environments. Documented material has been found in the Camp Rice, Tesuque, Palomas, Popotosa, Sierra Ladrones, and Zia formations within the Santa Fe Group. Management Concern for paleontological resources on Class 4 acres may extend across the entire range. Ground disturbing activities need to be evaluated on a case-by-case basis for the need to mitigate. Class 4 acres require assessment prior to surface disturbing activities. PFYC 4 covers the remaining 3,000 acres, or 60% of the Monument. There are no know localities within the Monument.

2.1.14: Visual Resources

BLM POC: Jamie Garcia, Outdoor Recreation Planner

Topic: Visual Resource Management (VRM) Classes

Principal Investigators: Jamie Garcia

The Monument is a combination of VRM Classes II and III (Figure 3). BLM Road 1011 as well as parking areas and trails are within VRM Class III (moderate change allowable) while the rest of the dispersed land in the Monument is VRM Class II (low change allowable).

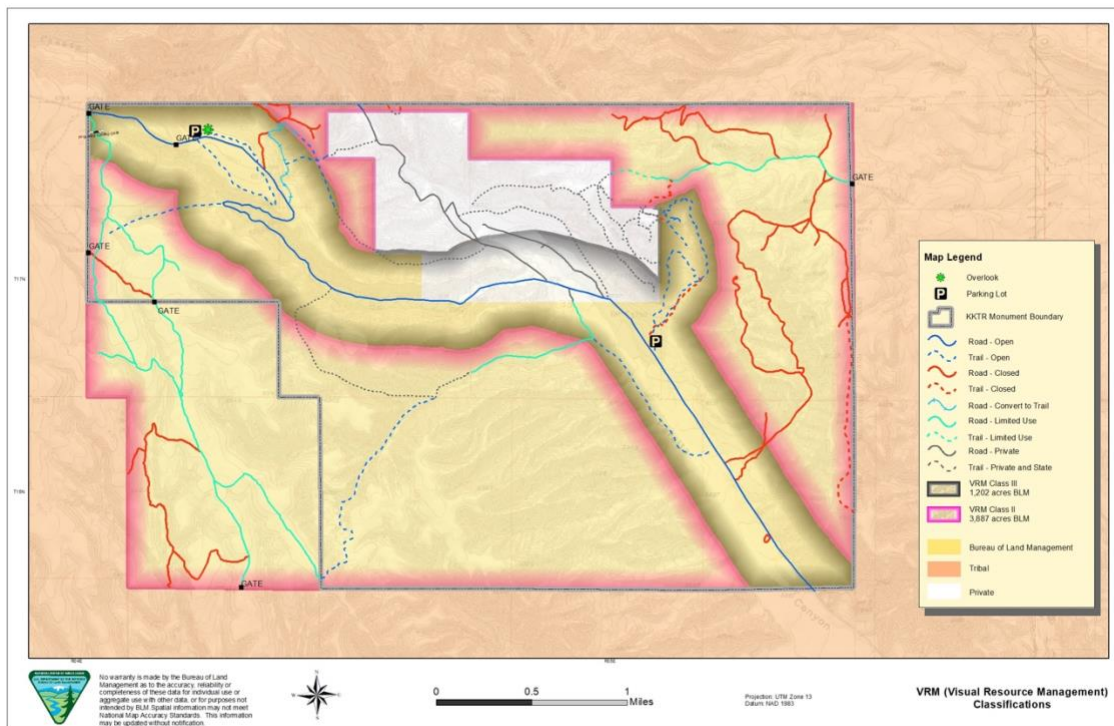


Figure 3: KKTR VRM Class Map

The objective of Class II is to retain the existing character of the landscape. The level of change to the characteristic landscape should be low. Management activities may be seen, but should not attract the attention of the casual observer. Any changes must repeat the basic elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape.

The objective of Class III is to partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate. Management activities may attract attention but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.

2.1.15: Recreation

BLM POC: Jamie Garcia, Outdoor Recreation Planner

Topic: **Visitor Use Surveys**

Principal Investigators: Jamie Garcia

The Monument has had five Visitor Satisfaction surveys administered in 2000, 2007, 2008, 2015, and 2017. Overall, visitor satisfaction is good. Table 1 shows the data collected in these surveys.

Visitor use has also been monitored through entry data collection since the Monument became a fee area in Fiscal Year 2000. Visitation has increased dramatically throughout the years, beginning in 2007. Again, the monument had significantly larger numbers of visitation in 2015 and has had increased visitation every year since. At the time the existing Resource Management Plan was approved, the Monument trails and facilities were designed to hold capacity at 50,000 visitors annually. The current visitation is nearly three times the originally planned capacity. In most recent years, visitation was less than the estimated numbers due to unforeseen circumstances (e.g. 2019 Government Furlough, weather closures). The table below shows the annual visitation by Fiscal Year.

Table 1. Kasha-Katuwe Tent Rocks Visitation by Fiscal Year

Fiscal Year	Visits
2000	14,674
2001	25,000
2002	45,000
2003	49,500
2004	50,300
2005	71,497
2006	70,690
2007	121,916
2008	43,695
2009	43,690
2010	no data
2011	no data
2012	no data
2013	68,616
2014	62,684 (incomplete data)
2015	103,856
2016	66,599 (incomplete data)
2017	126,966
2018	130,237
2019	117,146

Additionally, a social media study was conducted in 2018 (Wood et al. 2020). The primary finding was that social media data are very useful in predicting visitation patterns at sites where no on-site counts have been collected. However, collecting some on-site data (such as infrared trail counts from existing TrafX counters), substantially improves visitation model estimates. Data collected during this study monitored visitor usage at different points of the trail, indicating which parts of the trail received the most use. Layering this with the geospatial data from social media posts, we can see what our visitors want to see, as well as improvements that can be made to keep visitors from areas they should not be. Continued monitoring and study need to be done to make a more comprehensive report.

2.1.16: Social and Economic Contributions and Opportunities

BLM POC: Carin Farley, Michael Johnson

The Kasha-Katuwe Tent Rocks National Monument (KKTR) provides unique opportunities to gain insights into the social perspectives of both users and local communities to whom the monument is more than simply a beautiful place. Both the monument proclamation and ensuing management have recognized the important role the KKTR plays in perceptions of the natural environment and belief systems of local Pueblos. Other local communities and current inholders also have important perspectives and history in relation to KKTR. As visitation rates have continued to rise, management will continue to implement new strategies to prevent negative impacts to the Monument. There will be ongoing need and opportunity to understand, from a sociocultural perspective, what change is and is not acceptable to different communities. This type of social research can often be best combined with other disciplines, such as recreation management, to gain data that are useful to a broad range of management issues.

Given the importance of the KKTR in Puebloan belief systems, most proposed management changes should have an integral social component. This is vital, both to ensure inclusion of concerned tribal communities, and is necessary to obtain information leading to acceptable management decisions that address ongoing issues.

The social and economic conditions attributable to management of the Planning Area may also include social values associated with environmental education [SE-2] (USDI, BLM 2007b). Lands used for recreational activities can contribute significantly to local economies. Economic values of the Monument include employment for Cochiti tribal members and minimal income to the gateway community of Pueblo de Cochiti at the Cochiti Visitor Center. In 2019 the visitation has tripled with

visitors coming from out of state and internationally. Most visitors travel from and spend their tourism dollars in the surrounding urban areas of Albuquerque and Santa Fe. The size of the local community does not encourage overnight or longer duration stays. Currently tourism income is not being spent locally, and the local community has shown interest in that type of revenue in the future. Identification of the potential for these types of socioeconomic opportunities and contributions would be a beneficial and useful area of inquiry for future research efforts.

The Pueblo de Cochiti will continue to participate in management of the Monument and Planning Area [AIU-6]. Social and economic factors need to be more closely monitored through visitor use data collected as part of the Monument Recreation Management Program (see section 2.1.15). A Business Management Plan is needed in order to address the amenity fee that has not had an increase since its inception in the early 2000. A Business Management plan is slated to begin draft in FY21 in coordination with Pueblo de Cochiti and will have to go before the RAC for final approval.

In FY 2019, the Monument hosted 117,146 visitors, a slight decrease from peak visitation due to the 35-day Government shutdown. The RMP preferred alternative forecast visitation stabilizing at “approximately 50,000 to minimize intrusion & resource degradation” (USDI, BLM 2007). To date, this figure has more than doubled since its inception. Continued visitor use increases not only impacts on cultural, geologic, and biologic resources in the area, but challenges RFPO’s ability to provide for resource protection, visitor health and safety, and outstanding customer service for visitors while controlling visitor use (USDI, BLM 2007b). Visitors often wait in 2-hour lines to enter the Monument with cars at idle in extreme summer weather. Partners at the Pueblo de Cochiti have voiced concerns regarding increased traffic and the negative impacts associated in the community and during traditional ceremonies.

In coordination with Pueblo de Cochiti, management's original goal was that Kasha Katuwe National Monument would transition to Recreation.gov in the by spring of FY21. The Monument and the Pueblo closed in March 2020 due to the COVID-19 Pandemic. The BLM COVID-19 Adaptive Recovery Plan released on May 19th stated management should be adhering to "No-contact transaction methods to reduce person-to-person interactions should be publicly messaged and strongly encouraged. Units are encouraged to promote on-line payments, pay in advance, no-contact credit card transactions, and discouraging cash or check transactions."

The Recovery Plan recommended:

- sequencing or timed entry
- online reservations for programming and
- cashless transactions.

This proposal was originally intended for and in alignment with Washington Office/HQ/1220 (Recreation Resources Management), Instruction Memorandum No. 2018-056-Launching the New Recreation.gov, and NM 1220 Directive: *"States and Field Office's (FO) are required to transition their recreation fee programs toward use of electronic fee collection systems where practical. FO's will coordinate implementation of these systems with the Washington Office Recreation Permit and Fee Program Manager and the National Operations Center."*

As of August 2020, KKTR has transitioned to Recreation.gov for all public entry into the Monument. This administrative action will address resource impacts, visitor experience and comply with 2007 RMP preferred alternative of "approximately 50,000 visitors annually to minimize intrusion & resource degradation" (USDA, BLM 2007) and the following identified objectives:

- Enhance the manageability of the Monument [RU-2a].
- Provide for resource protection, and visitor health and safety [RU-2b].
- Provide outstanding customer service for visitors while controlling visitor use [RU-2c].
- Provide for economic opportunity through employment and services [RU-2d].
- Ensure continuity of traditional tribal practices [RU-2e].
- Maintain tranquility for the Pueblo de Cochiti [RU-2f].

This change will allow for additional resource protection and compliance patrols, interpretation and project/maintenance needs that are called for in the RMP. To date there is not a formal interpretation program at the Monument. The future intent is to establish a more formal education program that informs the public not only of the natural resources and associated science, but also the social, religious, and cultural perspectives of the Puebloan people who have used the area of the KKTR for hundreds of years.

2.1.17: Environmental Justice

BLM POC: Carin Farley

Per the 2007 Record of Decision, the BLM must identify, inform, and consult with minority and low-income groups about Federal actions that may affect them, and should not disproportionately impact these groups in an adverse way [EJ-1] (USDA, BLM 2007). BLM environmental justice policy identifies federally recognized Tribes as environmental justice populations of concern. Local Pueblos have a clearly identified and documented interest in the KKTR, and management decisions concerning the area would impact these groups. Other minority and low-income groups may also be affected by actions in the Monument and Planning Area. Therefore, concerned tribes and local minority and low income populations will be afforded an opportunity to voice their concerns about Federal actions related to the KKTR that may have disproportionate impacts. [EJ-2].

As noted earlier, increased visitation is resulting in negative and disproportionate impacts to at least one Pueblo (Pueblo de Cochiti). This, and other, environmental justice issues arising from the increased use of the Planning Area would be usefully addressed by longterm research and monitoring efforts.

2.2: Ongoing research and science on KKTR

Notable ongoing research projects on the KKTR National Monument are highlighted in Table 2.

Table 2. Ongoing Research in the KKTR National Monument

Science Area	Research Topic/Question	Research Description
American Indian Uses and Traditional Practices – Sean Daugherty		None
Cultural Resources –Sean Daugherty		None
Air Quality – David Mattern		None
Soil and Water Resources – David Mattern		None
Riparian Areas – Josh Freeman	Seepage and flow rates along Peralta Creek	Ongoing research conducted by BLM RPFO Staff Hydrologist to determine how much water is infiltrating along the 2.05 mile stretch of Peralta Canyon. Results can then be used to determine the potential for successful planting of riparian vegetation.
Upland Vegetation and Woodlands – Jack River	Ponderosa pine health and resiliency	Ongoing monitoring of <i>Pinus ponderosa</i> by RPFO forester within the monument to assess reproductive rates and to determine health and resiliency to stress factors such as drought, climate change, erosion, etc.
	Climate-induced patterns and mechanisms of juniper die-off	Response of fuels, understory plants, and invasive species to juniper die-off in Kasha-Katuwe Tent Rocks National Monument. Detailed in section 2.1.6
Fire Management – Todd Richards		None
Livestock Grazing – Joseph Pruitt		None (see section 2.1.8)
Noxious Weeds – Joseph Pruitt	What is the infestation rate of noxious and invasive weeds present and what measures need to be taken to control rate of spread?	Ongoing research for best management practices to monitor and control rate of spread for noxious and invasive species. See Table 3 for more information.

Science Area	Research Topic/Question	Research Description
Special Status Plants and Animals – Josh Freeman	What habitat is available to special status plants and animals?	Observations made by RPFO Wildlife Biologist and NM State Botanist
Wildlife Habitat – Josh Freeman		None
Paleontology – Sean Daugherty		None
Visual Resources – Jamie Garcia		None
Recreation – Jamie Garcia		None
Socioeconomics – Carin Farley		None
Environmental Justice – Carin Farley		None

3: MANAGEMENT DECISIONS AND SCIENCE NEEDS

Table 3 describes desired future science needs and associated management decisions, with the following Priority Levels:

High: Research that is critical to inform management decisions on NLCS units within 1-3 years.

Medium: Research that could be relevant to future management of NLCS units.

Low: Research that will advance the scientific understanding of NLCS units, but that is not immediately relevant for management decisions.

Table 3. Science Needs in the KKTR National Monument

Science Area	Desired Research Topic	Priority level	Description/ Pertinent Management Decisions
American Indian Uses and Traditional Practices – Sean Daugherty	What are the traditional uses of the cultural areas?	Medium	All questions could be answered employing a comprehensive ethnographic study and honest and open consultation
	Are the needs of the local tribal users being met?	Medium	See above
	How can BLM increase availability of resources to tribal users?	Medium	See above
Cultural Resources – Sean Daugherty	What are the effects to cultural resources from visitation/numbers of visitors?	Medium	Site updates and monitoring
	Better understand the glyphs in the slot canyon.	Medium	Look through the records to determine if the glyphs were present earlier and consult with Pueblo de Cochiti.
	Can we add cultural interpretive elements to the visitor experience without risking deterioration to the resource?	Medium	

Science Area	Desired Research Topic	Priority level	Description/ Pertinent Management Decisions
Cultural Resources, cont.	Identify additional cultural sites	Medium	Would require ethnographic study or tribal consultation
Air Quality – David Mattern	None	NA	
Soil and Water Resources – David Mattern	Is there riparian potential in Peralta Creek? (intergral with <i>Riparian Areas</i> below). Is the surface and ground water hydrology sufficient to support riparian areas?	High	There was major stream morphology change in 2013 with post fire flooding, an after-effect of the 2011 Las Conchas fire in upper watershed, apparently increasing infiltration into the stream bed. Question: Do we want to try another trial planting of riparian species with improved planting techniques and in a more favorable spring snowmelt runoff year from the upper Peralta watershed planting?
	Does KKTR meet Land Health Standards?	Medium	Should we employ a qualitative assessment such as Pellant et al. (2018) to gain understanding of the current ecological site conditions in KKTR? This protocol assesses indicators for soil and site stability, hydrologic function, and biotic integrity; it may be useful to augment or focus other ecological condition questions and topics presented in this document.
Riparian Areas – Josh Freeman	Does Peralta Canyon experience frequent enough inundation to support willow, cottonwood, and other riparian vegetation?	Medium	Studying the vadose zone (soil from the surface to the water table) to determine how much water is being retained when unsaturated, and how quickly the water in this zone percolates out into the water table.

Science Area	Desired Research Topic	Priority level	Description/ Pertinent Management Decisions
Upland Vegetation and Woodlands – Jack River	What degree of vegetation management is needed, if any, within the Monument to maintain forest/woodland health while still maintaining values consistent with Proclamation 7394?	Medium	Determine the need for vegetation manipulation/management through a statistically rigorous data collection of forest and vegetation health indicators such as those used through the Common Stand Exam protocol (USFS) and the Assessment, Inventory, and Monitoring (AIM) program (USDI, BLM 2018b).
Fire Management – Todd Richards	None		See “Upland Vegetation and Woodlands” above for relevant priorities.
Livestock Grazing – Joseph Pruitt	None		No authorized grazing allowed within the Monument.
Noxious Weeds – Joseph Pruitt	Better understand cheatgrass dynamics, specifically: 1. What are the factors influencing the spread of cheatgrass? 2. What management options are available to slow or stop the spread of cheatgrass	Medium	Proposed new version from Marikay: Cheatgrass has recently been observed on the monument; research on environmental and land use factors that are influencing the invasion would be useful to inform management decisions that address the root causes of invasion in addition to direct cheatgrass removal or mitigation options.
Special Status Plants and Animals – Josh Freeman	Inventories of all 8 sensitive species that are believed to have suitable habitat within KKTR	High	Understanding the abundance and distribution of the 2 arthropods, 4 birds, and 2 bats that have suitable habitat within KKTR. It would also be pertinent to measure habitat status and trend for these populations.

Science Area	Desired Research Topic	Priority level	Description/ Pertinent Management Decisions
Wildlife Habitat – Josh Freeman	What plant and animal species exist within the Monument and what is their local abundance?	High	<p>“Conduct a complete biotic survey of the area to determine the plant and animal species present.” (KKTR RMP, 2007)</p> <p>The RMP intended this to include “vascular and non-vascular plants” as well as “arthropods and other invertebrates.”</p> <p>The purpose of this study is to understand species presence and abundance in order to preserve and protect their habitat.</p>
	What are the trends of bird populations at KKTR?	High	<p>“Conduct breeding bird surveys on a regular and repeating schedule” (USDA, BLM 2007b). If populations do decline, we need to know as soon as possible in order to coordinate with NMDGF, and effectively mitigate.</p>
Geologic Resources – Calvin Parson	What effect does concentrated public visitation have on the erodibility of the geologic features and the trails within the Monument?	High	<p>Though there has been a lot of research of the geology of the area, there are no known or ongoing studies that have analyzed the effect of the human interface with the geologic features or trails within the Monument.</p> <p>Use drone technology to measure the tents as well as the elevation of the trails and develop volumetric calculations based on a submeter Digital Elevation Model (DME) created from high resolution imagery.</p> <p>We would want to create a baseline image then fly the same areas periodically thereafter to determine the amount of erosion/deflation or sediment buildup, if any, and how that compares to areas around the Monument that are not accessible by the public.</p>

Science Area	Desired Research Topic	Priority level	Description/ Pertinent Management Decisions
Paleontology – Sean Daugherty	Are there any sensitive or important Paleo locations within the Monument?	Medium	Conduct paleo inventory in high probability areas.
Visual Resources – Jamie Garcia	None	NA	
Recreation – Jamie Garcia	Are increasing visitation numbers impacting the trails and formations?	High	Visitor degradation study is needed to monitor the trail degradation. Digital imaging by drone would be a useful tool in the visitor degradation study as well as interpretation tool for distance learning.
	Has social media impacted the Monument with increased visitor use OR encouraged off trail use by visitors? How can monitoring social media use benefit management of the Monument?	Medium	Continuation of social media study and monitoring that was initiated in 2018 to continue monitoring trail usage as well as visitor interest via social media posts. It would also provide insight to RPFO about what the visitor would like to see at the Monument or any prohibited acts that can be remedied by planning decisions.
Socioeconomics – Carin Farley	None	Medium	Social and economic research on locally acceptable economic development opportunities, as well as changing sociocultural perceptions of the ongoing use of the KKTR, would provide important insight for developing management options.
Environmental Justice – Carin Farley	None	High	Developing consistent methods of incorporating the perspectives of impacted environmental justice communities, including Pueblo people and local Hispanic ranchers, is vital to continued operations of KKTR in cooperation with local communities.

4: MEETING SCIENCE NEEDS

The Cooperative Ecosystem Study Units (CESU) Network is a national consortium of federal agencies, tribes, academic institutions, state and local governments, nongovernmental conservation organizations, and other partners working together to support informed public trust resource stewardship. As part of BLM, KKTR could engage with external partners through the CESU network to do research at the Monument. In the event that a CESU agreement is established with KKTR, BLM will adhere to the Federal Agency Roles and Responsibilities as described in the CESU MOU 2017-2023 to the extent possible based on available resources.

4.1. Internal Organization

An effective internal organization is necessary to strategically identify and address science in KKTR. The internal organization is effective if it promotes **interdisciplinary** awareness among staff and scientists. Specifically, communication among scientists and management specialists in different disciplines is critical for successful incorporation of science pertaining to management on the National Monument

The Monument Manager and Field Office Manager will serve as the overarching managers of scientific inquiries on the National Monument. The role of KKTR Science Coordinator will be fulfilled by the Monument Manager. The Science Coordinator will work directly with the Field Office Manager to assist in this process, collaborating with appropriate BLM staff in the Rio Puerco Field Office and at the BLM New Mexico State Office, and with other science partners. The roles of the Science Coordinator in relation to scientific inquiries on KKTR are:

- Serving as the point of contact for scientific inquiries, from both internal and external sources. Scientific inquiry proposals must be submitted in writing to the science coordinator.
- Distributing information about new and ongoing research to the Interdisciplinary (ID) Team.
- Coordinating the processing of research permits for the Monument by working with resource specialists at the Rio Puerco Field Office or NMSO to (if applicable): identify the issues in conducting the research; ensure appropriate planning, environmental and wilderness reviews are in place; and ensure appropriate mitigation measures and research permit stipulations are implemented. If appropriate, the KKTR Science

Coordinator will also prepare the research permit for signature by the Field Manager or the authorized officer (See Section 5.2). Note that there may be instances when issuance of a permit for scientific research is best issued by a specific resource specialist, under whom the research areas falls . Contact information for these employees is listed in Section 11.

- Coordinating internal/external scientific inquiries with the Field Office Manager.
- Coordinating the inquiry process with the applicant and other scientific partner, if necessary.
- When appropriate, coordinating the process of requesting, administering, and utilizing BLM funds for proposed inquiries.

4.2. Collaboration and Partnerships

- Collaboration and open communication with existing and potential science partners are critical to the success of implementing the Science Plan. This collaboration will ensure that research on KKTR is pertinent to the protection of National Monument objects and future management decisions.
- Cooperative Ecosystem Study Units (CESUs) enable effective collaboration with universities, tribes, and other not-for-profit organizations. KKTR could use the CESU framework to engage external research partners on the Monument. Current Scientific Partnerships with KKTR National Monument:
 - Ongoing science is listed in Table 2, but there is not much, and most of the ongoing monitoring is internal to BLM RPFO.
 - The University of New Mexico Department of Earth and Planetary Sciences has worked with KKTR for more than 20 years to coordinate field trips under educational permits for a wide range of graduate and undergraduate courses including those in volcanology, field geology, and structural geology. Generations of students have participated in field trips to this world-class site for direct observation of many geologic processes.

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 National Monument objects or other resources of KKTR.
- Scientists initiating research projects within KKTR must be aware of existing data within the BLM and should incorporate these data into projects whenever possible.
- Proposed research within the KKTR should comply with appropriate laws and regulations.
- 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 UAS data collection, must apply for and receive a research permit from the Science Coordinator in order to proceed (Section 5.2).
- All scientific inquiries will be presented to the ID team for review.

5.2. Authorization and tracking process

- Proposals, including those from the Research and Stewardship Partnership, will be submitted to the KKTR Science Coordinator. Archaeological and Paleontological research that proposes removal and/or destruction of artifacts or specimens will require approval from the appropriate Deputy State Director from the New Mexico BLM State Office and either an ARPA or PARPA permit.
 - The proposal (not to exceed 3 pages) will include the following:
 - Contact information of the principal investigator;
 - Background information of the question being studied (including any existing research);
 - Site locations, including any geospatial information;
 - Rationale for research;
 - Methods of conducting the research;
 - Timeline for field work;
 - Deliverables; and,
 - Outline of public outreach effort, if appropriate.

- The Monument Manager will review the proposal for completeness and consult with the appropriate BLM resource specialists to determine the scientific validity and integrity of the proposal, and potential impacts to resource and resource uses.

- The Monument Manager will brief the Field Manager upon receipt of request to conduct research. In coordination with the Monument Manager, the Field Manager will determine whether the proposal:
 - Is consistent with this Science Plan;
 - Meets KKTR' scientific mission (see Section 1);
 - Conforms with the KKTR Plan 2001; and,
 - Is consistent with other current and relevant agency laws and regulations.
 - In addition, for proposals from the Research and Stewardship Partnership, the Field Manager and Monument Manager will coordinate with the partnership to ensure it meets the goals and objectives of the partnership.

- If the proposal is not accepted, the Field Manager will provide written notification and justification to the applicant of the decision as soon as practical.

- If the proposal is accepted:
 - The Field Manager will determine what, if any, NEPA analysis is required to carry out inquiry.
 - If a Categorical Exclusion or an Environmental Assessment is needed, the Field Manager 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 KKTR Science Coordinator will prepare a research permit for the applicant to be approved by the Field Manager.
 - The research permit will be sent to the applicant for review and signature. The permit will be returned to the Field Manager for final signature and approval unless the permit falls under one of the following:
 - Archaeological and Paleontological research that proposes excavation/removal and/or destruction of artifacts or specimens will require approval from the appropriate Deputy State Director from the New Mexico BLM State Office and either an ARPA or PARPA permit.
 - Reporting for all scientific investigations will require:
 - Annual progress reports to be filed with the Monument Manager and appropriate BLM resource specialist.
 - A final report that includes an executive summary, research background and results; results' relevance to KKTR management; public outreach efforts; and copies of published papers resulting from the scientific inquiry.
- If permit stipulations are not adhered to, the research permit can be canceled, in writing, by the Field Manager.

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 (Section 9) of this science plan. At every revision of the science plan, these sections will be updated.

6.2. Internal Communications and Tracking

- All reports described in Section 5 will be stored, organized, and shared on a share drive or sharepoint site, accessible to all staff on the Rio Puerco Field Office. The Science Coordinator should strive to organize periodic presentations of scientific results to Field Office staff.
- A separate project file shall be set up for each research proposal received with all associated documents stored in this location.
- A tracking spreadsheet will be set up by Fiscal year on the shared drive to track project status of each proposal received within that Fiscal Year.
- All internal communications will be shared with the ID team.

6.3. Communication with the Broader BLM Organization

- The Monument Manager will comply, in a timely manner, with all requests for completed scientific investigations (e.g. reports, publications, etc.) from BLM Field, District, State, and Washington offices.
- Ongoing studies will be documented in the National Monument annual report.
- Project titles and summaries will be shared with the NMSO. The NMSO Science Coordinator will work with all NCL Science Coordinators on how to make these available to a wider audience.
- It is essential that any new or ongoing research awarded, planned or originated by the NMSO is coordinated with RPFO to assure adequate time to for proper NEPA analysis, compliance and coordination with specialists.

6.4. Communication of Scientific Results to the Public

- The Monument Manager, in coordination with the State Public Affairs Specialist, will strive to make information on science projects within the KKTR National Monument accessible to the general public. This includes posting updates on the KKTR National Monument's website in formats such as written descriptions of scientific inquiries or citations of published research; press releases; using social media websites like Facebook or Twitter; brown bag lunch presentations; leading field tours; participating in community outreach events, etc.

7: INTEGRATING SCIENCE INTO MANAGEMENT

7.1. Communications

- Direct communication between the District Manager, Field 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 Field Manager, Monument Manager, the District Manager and the State 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 the KKTR National Monument.

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.

8: SCIENCE PLAN REVIEW AND APPROVAL

SIGNATURE PAGE

I affirm that I have read, understood, and approve the 2020 Science Plan for the Kasha-Katuwe Tent Rocks National Monument.

This plan will be used as the basis for conducting science in KKTR 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 the KKTR National Monument, and the Bureau of Land Management.

RUBEN SANCHEZ Digitally signed by RUBEN SANCHEZ
Date: 2020.08.20 11:12:28 -06'00'

Ruben Sanchez Date
Field Manager (Acting)
Rio Puerco Field Office, Bureau of Land Management

CARIN FARLEY Digitally signed by CARIN FARLEY
Date: 2020.08.14 08:19:14 -06'00'

Carin L. Farley Date
Monument Manager
Rio Puerco Field Office, Bureau of Land Management

MCKINNEY BRISKE Digitally signed by MCKINNEY
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Date: 2020.08.20 12:39:08 -06'00'

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USGS: Jens Stevens

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10: UNIT'S LEGISLATION

Designating Authority: Presidential Proclamation 7394, Section 2 of the Antiquities Act (34 Stat. 225, 16 U.S.C. 431)

Proclamation 7394—Establishment of the Kasha-Katuwe Tent Rocks National Monument

January 17, 2001 By the President of the United States of America A Proclamation Located on the Pajarito Plateau in north central New Mexico, the Kasha-Katuwe Tent Rocks National Monument is a remarkable outdoor laboratory, offering an opportunity to observe, study, and experience the geologic processes that shape natural landscapes, as well as other cultural and biological objects of interest. The area is rich in pumice, ash, and tuff deposits, the light-colored, coneshaped tent rock formations that are the products of explosive volcanic eruptions that occurred between 6 and 7 million years ago. Small canyons lead inward from cliff faces, and over time, wind and water have scooped openings of all shapes and sizes in the rocks and have contoured the ends of the ravines and canyons into smooth semicircles. In these canyons, erosion-resistant caprocks 146 Jan. 17 / Administration of William J. Clinton, 2001 protect the softer tents below. While the formations are uniform in shape, they vary in height from a few feet to 90 feet, and the layering of volcanic material intersperses bands of grey with beige colored rock. Amid the formations and in contrast to the muted colors of the rocks of the monument, vibrant green leaves and red bark of manzanita, a shrubby species from the Sierra Madre of Mexico, cling to the cracks and crevices of the cliff faces. Red-tailed hawks, kestrels, violet-green swallows, and Western bluebirds soar above the canyons and use the pinion and ponderosa covered terrain near the cliffs. The complex landscape and spectacular geologic scenery of the Kasha-Katuwe Tent Rocks National Monument has been a focal point for visitors for centuries. Human settlement is believed to have begun in the monument as a series of campsites during the Archaic period, from approximately 5500 B.C. During the fifteenth century, several large ancestral pueblos were established in the area. Their descendants, the Pueblo de Cochiti, still inhabit the surrounding area. Although the Spanish explorer Don Juan de On~ ate reached the Pajarito Plateau in 1598, it was not until the late eighteenth century that families began to claim land grants around Tent Rocks from the Spanish Crown. Remnants of human history are scattered throughout the monument. 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 Kasha-Katuwe Tent Rocks 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 KashaKatuwe Tent Rocks 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 "Kasha-Katuwe Tent Rocks National Monument" attached to and forming a part of this proclamation. The Federal land and interests in land reserved consist of approximately 4,148 acres, which is the smallest area compatible with the proper care and management of the objects to be protected. 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. For the purpose of protecting the objects identified above, the Secretary shall prohibit all motorized and mechanized vehicle use off road, except for emergency or authorized administrative purposes. 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. The Secretary of the Interior shall manage the monument through the Bureau of Land Management, pursuant to applicable legal authorities and in close cooperation with the Pueblo de Cochiti, to implement the purposes of this proclamation. The Secretary of the Interior shall prepare, within 3 years of this date, a management plan for this monument, and shall promulgate such regulations for its management as he deems appropriate. The management plan shall include appropriate transportation planning that addresses the actions, including Administration of William J. Clinton, 2001 / Jan. 17 147 road closures or travel restrictions, necessary to protect the objects identified in this proclamation and to further the purposes of the American Indian Religious Freedom Act of August 11, 1978 (42 U.S.C. 1996). Only a very small amount of livestock grazing occurs inside the monument. The Secretary of the Interior shall retire the portion of the grazing allotments within the monument, pursuant to applicable law, unless the Secretary specifically finds that livestock grazing will advance the purposes of the proclamation. The establishment of this monument is subject to valid existing rights. Nothing in this proclamation shall be deemed to enlarge or diminish the jurisdiction of the State of New

Mexico with respect to fish and wildlife management. This proclamation does not reserve water as a matter of Federal law. Nothing in this reservation shall be construed as a relinquishment or reduction of any water use or rights reserved or appropriated by the United States on or before the date of this proclamation. The Secretary shall work with appropriate State authorities to ensure that any water resources needed for monument purposes are available. 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 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 [Filed with the Office of the Federal Register, 8:45 a.m., January 19, 2001]
NOTE: This proclamation was published in the Federal Register on January 22.

<https://www.govinfo.gov/content/pkg/WCPD-2001-01-22/pdf/WCPD-2001-01-22-Pg145.pdf>

APPENDIX A: FIRE REGIME AND CONDITION CLASS ASSESSMENT ON KASHA-KATUWE TENT ROCKS NATIONAL MONUMENT

Dave Boreland

April 2004

Objectives

- Evaluate and assess the Fire Regime and Condition Class (FRCC), Standard Landscape method established by the Interagency Fire Working Group.
- Utilize NRCS Ecological Site Descriptions to supplement Potential Natural Vegetation Group descriptions.
- Provide the Albuquerque Field Office with data and information on vegetation conditions and fire ecology.

Issues

- Fire suppression and land-use impacts on vegetation composition and structure
- Protection and enhancement of other resource values including watershed stability, site productivity, recreation, wildlife habitat, vegetation resources and cultural resources.
- Management strategies that provide for restoration and monitoring of fuels treatments and vegetation management.

Observations

A. Background

Pinyon (*Pinus edulis*) within and adjacent to the monument have been impacted by drought and *ips* bark beetle. The existing stand densities of pinyon and juniper are hazardous and exacerbated by dying pinyon trees.

B. Reconnaissance Methodology

On April 13, the Fire Ecologist, NMSO, met with a team of resource personnel from the Albuquerque Field Office and Cuba Field Station.

The soil mapping units for area was provided by Jerry Wall, AUFO.

The ecological site descriptions were provided by Brett O'Haver of the Cuba Field Station. Todd Richards, Fuels Specialist with AUFO assisted Dave Borland, Forest/Fire Ecologist, NMSO in conducting fixed-plot woodland stand examination data. On April 15, Dave Borland continued gathering field data on vegetation conditions, canopy coverage and tree ages. Fifteen 1/20th acre fixed plots over the landscape in each ecological site were gathered as well as six 1/10th acre canopy cover plots were taken.

Findings

1) Vegetation

From the data of fixed plots taken the following data was compiled. Raw data is available in the full Borland report.

- Average stem density is 353.3 per acre.
- The range of stem count is 60 to 720 per acre.
- This represents an average spacing of 11 feet.
- The average canopy coverage is 46 percent, (14% dead Pinyon).
- The range of canopy coverage is 5% to 65%.
- The percentage of one-seed juniper is 70 %.
- The percentage of Pinyon is 30 %.
- An average of 88 Pinyon trees per acre are dead (due to Ips beetle)
- An average of 28 Pinyon seedlings and saplings are live.
- More than 60 percent of stems are less than 4 inches in diameter.
- The average wood content is 135 cubic feet per acre.

There are three ecological sites within the National Monument:

Strata 1: Foothills Pinyon-Juniper

57% of landscape is Foothills ecological site which is primarily a Pinyon-Juniper plant community with a grass/forb and shrub understory depending on aspect. On north facing slopes the tree component is higher than south facing slopes. The description of this ecological site helped solidify the Potential Natural Vegetation Reference Condition (Juniper-Pinyon-Frequent Fire Type) or PNVG Code: JUP1.

Table A1: Vegetation Type and Structure in Foothills Pinyon-Juniper

Class	Percent of Landscape (Potential or Reference)	Description	Current Composition Within Strata
A: Early seral/ post-replacement	20	Post fire community of forbs and perennial grasses	12
B: Mid-development-closed	10	Mid-development, dense (>40% cover) woodland; understory being lost	20
C: Mid-Open	20	Mid-development , open (<40% cover) woodland with mixed shrub/herbaceous community in understory	42
D: Late-open	40	Late-development, open Pinyon-juniper stand with “savannah-like” appearance; mixed shrub/herbaceous community	5
E: Late-closed	10	Late-development, closed Pinyon-Juniper forest. May be multi-storied. Substantial mortality.	21

The current vegetation departure is 43 percent of the reference conditions. This places the Veg-Fuel Condition Class as a 2, (34-66%). The current fire frequency is somewhere between 85 and 120 years based on the age of the larger size trees and the modern era fire suppression. The reference fire frequency is 31 years or a range 10-49 years based on research on fire regimes in pinyon-juniper.

The reference or natural fire severity is 41 percent or the portion of the area that would experience greater than 75% upper canopy replacement during an unconstrained, naturally occurring fire. The current fire severity was placed at 60% since this was the average crown canopy percent currently. The current fire frequency departure is 70 percent and the current fire severity departure is 32 percent giving a Frequency-Severity Condition Class of 51% which is the Strata Condition Class of 2 (34-66%).



Figure A1: Current conditions on Foothills Pinyon Juniper Ecological Site

Strata 2: Savannah

33 % of landscape is the Savannah ecological site which is primarily a scattered Pinyon-Juniper plant community with a grass/forb and shrub understory. The description of this ecological site helped solidify the Potential Natural Vegetation Reference Condition (Juniper-Pinyon-Frequent Fire Type) or PNVG Code: JUP1.

Table A2: Vegetation Type and Structure in Savannah

Class	Percent of Landscape (Potential or Reference)	Description	Current Composition Within Strata
A: Early seral/ post-replacement	20	Post fire community of forbs and perennial grasses	10
B: Mid-development-closed	10	Mid-development, dense (>40% cover) woodland; understory being lost	34
C: Mid-Open	20	Mid-development, open (<40% cover) woodland with mixed shrub/herbaceous community in understory	30
D: Late-open	40	Late-development, open Pinyon-juniper stand with "savannah-like" appearance; mixed shrub/herbaceous community	5
E: Late-closed	10	Late-development, closed P-J forest. May be multi-storied. Substantial mortality.	21

The current vegetation departure is 45 percent of the reference conditions. This places the Veg-Fuel Condition Class as 2, (34-66%). The current fire frequency is somewhere between 85 and 120 years based on the age of the larger size trees and the modern era fire suppression. The reference fire frequency is 31 years or a range 10-49 years based on research on fire regimes in pinyon-juniper.

The reference or natural fire severity is 41 percent or the portion of the area that would experience greater than 75% upper canopy replacement during an unconstrained, naturally occurring fire. The current fire severity was placed at 74 % since this was the average crown canopy percent currently. The current fire frequency departure is 70 percent and the current fire severity departure is 45 percent giving a Frequency-Severity Condition Class of 58 percent which is the Strata Condition Class of 2 (34-66%).



Figure A2: Current conditions on Savannah Ecological Site

Strata 3: Sandy Ecological Site

10% of landscape is the Sandy ecological site which is made of the soil mapping units (300) that comprise sandy loam alluvium bottoms along the Peralta Canyon. The reference condition class that best fits the ecological site is Desert Grassland with Trees or PNVG Code DGRA2.

Table A3: Vegetation Type and Structure in Sandy Ecological Site

Class	Percent of Landscape (Potential or Reference)	Description	Current Composition Within Strata
A: Early seral/ post-replacement	5	Dominated by resprouts of grassland species and post-fire associated forbs and half-shrubs.	20
B: Mid-development-closed	25	Greater than 40 percent grasses and forbs; generally associated with productive soils on gentle slopes, flats, and mesa tops.	5
C: Mid-Open	67	Less than 40 percent grasses and forbs on more gravelly or cobbly soil.	28
D: Late-open	2	5-15 percent cover of mature pinyon-juniper	26
E: late-closed	0	Substantial mortality of Pinyon currently	21

The current vegetation departure is 60 percent of the reference conditions. This places the Veg-Fuel Condition Class as 2, (34-66%). The current fire frequency is somewhere between 85 and 120 years based on the age of the larger size trees and the modern era fire suppression. The reference fire frequency is 8 years based on research on fire regimes in desert grasslands and PJ.

The reference or natural fire severity is 99 percent or the portion of the area that would experience greater than 75% upper canopy replacement during an unconstrained, naturally

occurring fire. The current fire severity was placed at 35 % since this was the average crown canopy percent currently. The current fire frequency departure is 92 percent and the current fire severity departure is 65 percent giving a Frequency-Severity Condition Class of 79% which is the Strata Condition Class of 3 (67-100 %).

The Fire Regime and Condition Class Summary Worksheet (not included) summarizes the three strata on the landscape and reveals that the weighted Veg-Fuel departure is 45%, the weighted Fire frequency-Severity departure is 56 %. Therefore the weighted Project or landscape Fire Regime Condition Class is 56 percent (highest of two) or Fire Regime Condition Class of 2 (Moderate 34-66%).



Figure A3: Current conditions on Sandy Ecological Site



Figure A4: Fire scar on old stump



Figure A5: Surface fire evidence on south facing slopes



Figure A6: Surface fire evidence on older Juniper- North facing slope

Recommendations

- The sandy ecological site reveals that the native seed bank of perennial grasses is very low. Recommend seeding native perennial grasses by broadcast and covering or before fuels treatments so that lop and scatter slash will cover.
- Utilize interdisciplinary teams in providing input to Fuels management prescriptions
- Recommend that a portion of landscape not undergo any treatment to represent a “control” or reference of current conditions.

Additional files not enclosed in document:

- Woodland Stand Exam results
- FRCC Documents and worksheets
- PNVG descriptions
- NRCS Ecological Site Descriptions
- FRCC definition

Compiled by David S. Borland, Forest/ Fire Ecologist

April 2004

Bureau of Land Management

New Mexico State Office

505-438-7523

APPENDIX B: RECENT FUELS MANAGEMENT ON KASHA-KATUWE TENT ROCKS NATIONAL MONUMENT

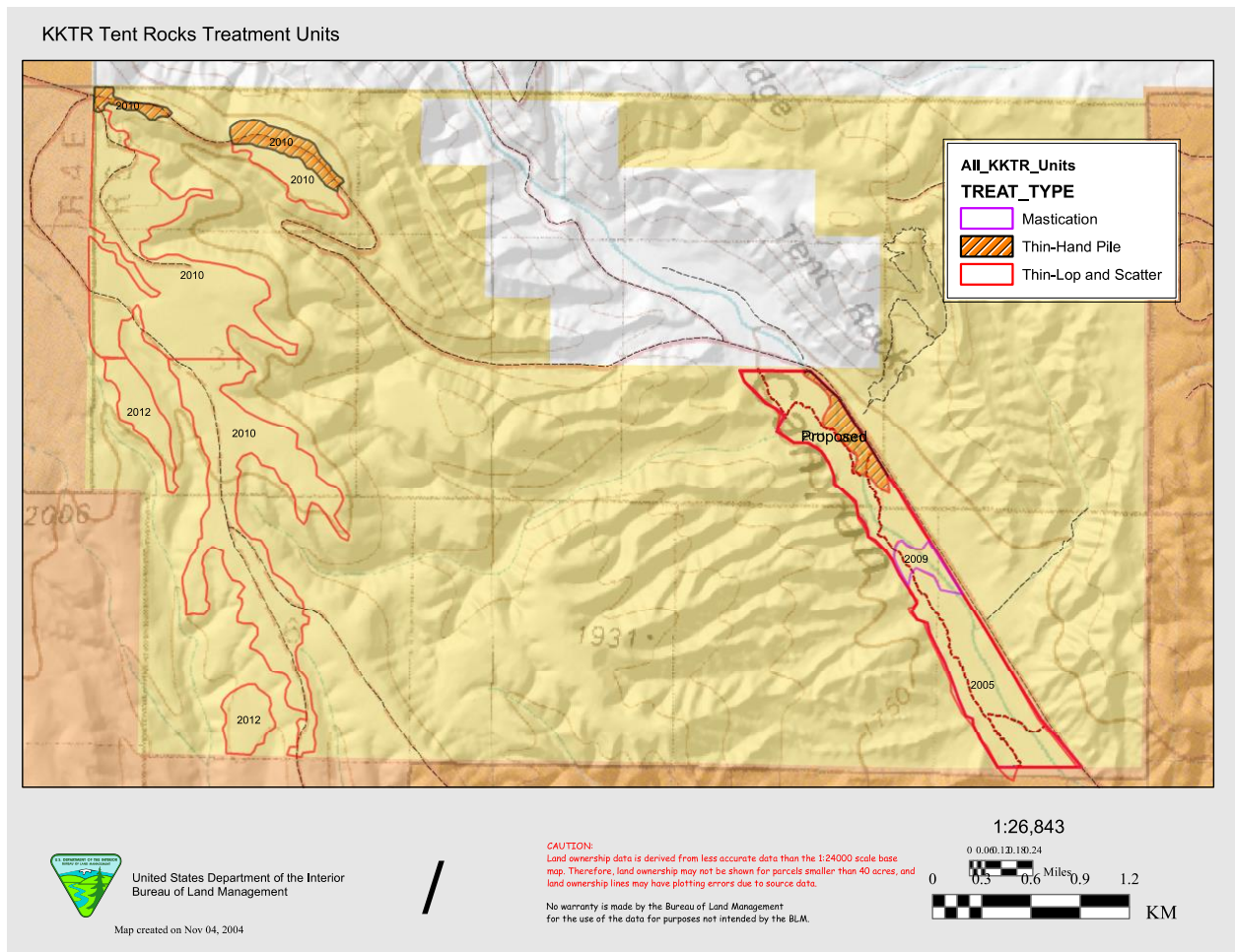


Figure B1: Fuel Treatment Units laid out in 2004. BLM POC: Todd Richards

Table B1: Completed Fuel Treatments in KKTR, 2004-2012

KKTR WOODLAND/WATERSHED RESTORATION TREATMENTS				
Location	FY	Treatment Type	Acres	Objectives
Peralta Canyon (BLM Rd 1011)	2004, 2005	Lop & Scatter	140	Woodland/Watershed Restoration, Hazardous Fuels Reduction, WUI- Fire Fighter and Public Safety
Peralta Canyon (BLM Rd 1011)	2004, 2005	Bio Mass Removal	140	Hazardous Fuels Reduction, Provide Fuelwood to Pueblo de Cochiti
Peralta Canyon (BLM Rd 1011)	2009-2012	Mastication	45	Woodland/Watershed Restoration, Hazardous Fuels Reduction, WUI- Fire Fighter and Public Safety
SW Acquisition	2010	Lop & Scatter	425	Woodland/Watershed Restoration, Hazardous Fuels Reduction, WUI- Fire Fighter and Public Safety
SW Acquisition	2010	Bio Mass Removal	315	Hazardous Fuels Reduction, Provide Fuelwood to Pueblo de Cochiti
KKTR Overlook	2009	Lop & Scatter	50	Woodland/Watershed Restoration, Hazardous Fuels Reduction, WUI- Fire Fighter and Public Safety
KKTR Overlook	2010	Chipping	15	Woodland/Watershed Restoration, Hazardous Fuels Reduction, WUI- Fire Fighter and Public Safety
Total Acres Treated			1130	