

To: Matthew Betenson[mbetenso@blm.gov]; Larry Crutchfield[lcrutchf@blm.gov]; Cynthia Staszak[cstaszak@blm.gov]; Theresa Romasko[tromasko@blm.gov]; Travis Chewning[tchewning@blm.gov]
Cc: Dana Backer[dbacker@blm.gov]
From: Backer, Dana
Sent: 2017-07-24T18:11:42-04:00
Importance: Normal
Subject: Fwd: Science plan focus on mngt decisions in next 5 plus years
Received: 2017-07-24T18:11:58-04:00
[vcnm-scienceplan .pdf](#)
[Gunnison Gorge Science Plan Final PDF.pdf](#)
[McInnis Canyons Science Plan final draft.pdf](#)
[Section 3 summary.docx](#)

Thanks for the opportunity to present to you today. Below is the email that Cindy and I were referring to. I've also attached Section 3 for vegetation and social science. These were "management decisions" that I came up with or from taking to Matt or specialist. They can be used as is or used to help generate thoughts on what management decisions need to be made in next 5+ years.

Dana Backer
Science Program Administrator
Grand Staircase Escalante National Monument
Kanab, UT 84741
435-644-1257

----- Forwarded message -----

From: Backer, Dana <dbacker@blm.gov>
Date: Tue, Jun 20, 2017 at 11:39 AM
Subject: Re: Science plan focus on mngt decisions in next 5 plus years
To: Cynthia Staszak <cstaszak@blm.gov>, Matthew Betenson <mbetenso@blm.gov>, Larry Crutchfield <lcrutchf@blm.gov>

All,

First, sorry for the length of the email; I'm trying to provide relevant information that might guide the MLT and your input into the science plan.

As a follow up, Matt asked me to provide examples of section 3 from other Science Plans. Apparently there are only a few science plans out there. Because I do not have the appropriate software to extract text out of pdf documents, I will reference the page numbers in each of the plans.

Vermilion Cliffs National Monument - Aug 2014

page 14 - 18

Note that this plan references the Kane and Two Mile Ranches applied research plan

Gunnison Gorge NCA - July 2013

page 16-21

You will notice there is a lot of similarity across the plans. In addition, they all use a table which is recommended for simplification. Also note, not every resource topic discussed in section 2 is addressed in section 3.

Here is an example I did from the vegetation and physical resource sections

Section 1: MANAGEMENT DECISIONS AND SCIENCE NEEDS

A. Describe the management decisions that the BLM expects to make in the next five-plus years for the unit

Veg: Protection and management of T/E/S species. Determine degree of investment into protecting existing objects, surveying for additional populations, and conducting inventories for State and BLM sensitive species.

Physical: As part of soil salinity program, the Monument has to regularly maintain and reconstruct sediment retention basins. Each year, the Monument needs to determine which sediment basins need reconstruction.

B. Describe the scientific knowledge needed to support those management decisions

Veg: Status, trends and conditions of the three threatened and endangered plants and the extent of BLM sensitive plants. Understanding the threats, stressors, and degree of impacts.

Physical: Determining the condition and sediment yield in each of the sediment basins and develop estimates of annual sediment retention. Develop method to estimate sediment basin life cycle and maintenance requirements.

C. Of the scientific knowledge needed, identify which knowledge is already accessible and which knowledge needs more scientific effort. The latter are the unit's science needs.

Veg: Analyze annual monitoring data on the three Threatened and Endangered species to determine status and trend. Evaluate the robustness of the current monitoring plan. Continue monitoring on a frequency appropriate for each species.

Physical: *Proposed research is underway to evaluate sediment yields using repeat topographic surveys and new photogrammetric techniques (Structure from Motion photogrammetry). This will help inform maintenance needs for salinity retention ponds.*

Dana

Dana Backer
Science Program Administrator
Grand Staircase Escalante National Monument
Kanab, UT 84741
435-644-1257

On Thu, Jun 15, 2017 at 11:55 AM, Backer, Dana <dbacker@blm.gov> wrote:

Hi Cindy, Matt and Larry,

As a make slow but steady progress on the science plan, I keep coming against a challenge in writing the third section, **Management Decisions and Science Needs**. I am not familiar with what future mngt decisions are on the horizon that require scientific based information. I recognize you may not have a clear plan moving forward with the high degree of uncertainty that currently exists. However, I do want to proceed in the science plan preparation so perhaps we could use the mngt decisions that were you knew had to be made in the next 5+ years such as livestock grazing permit renewal, habitat restoration projects, etc. What other mngt decisions that require science based information are needed?

I copied the NLCS science plan outline and notes for this section below. Hopefully this will give you some idea of the direction the science plan needs to go.

Thanks

MANAGEMENT DECISIONS AND SCIENCE NEEDS

(Identify and prioritize management questions and science needs)

A. Describe the management decisions that the BLM expects to make in the next five-plus years for the unit

1. Grazing renewal

2. Vegetation treatments

3. Transportation Routes

B. Describe the scientific knowledge needed to support those management decisions

C. Of the scientific knowledge needed, identify which knowledge is already accessible and which knowledge needs more scientific effort. The latter are the unit's science needs

Science needs should:

- ☐ Be kept up-to-date and responsive to changing priorities
- ☐ Consider both local and landscape-level issues
- ☐ Build from information provided in Section 2
- ☐ Prioritize the science needs - TABLE,
- ☐ Describe the prioritization criteria (see VCNM)
- ☐ Acknowledge that science needs can change in priority, when appropriate
- ☐ Display the prioritized science needs in a concise and clear format, accessible to both internal and external audiences

Dana Backer
Science Program Administrator
Grand Staircase Escalante National Monument
Kanab, UT 84741
435-644-1257



SCIENCE PLAN

FOR

MCINNIS CANYONS NATIONAL CONSERVATION AREA

JUNE 2012



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SECTION 1 – INTRODUCTION AND SCIENTIFIC MISSION

PURPOSE OF NLCS 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). This system encompasses nearly 900 units spread across approximately 27 million acres of public lands managed by the Bureau of Land Management (BLM). The BLM is mandated to conserve, protect and restore the outstanding cultural, ecological, and scientific values of NLCS units. Scientific investigation can aid in the conservation, protection, and restoration of these lands, and therefore, science is strategically planned and organized within NLCS units.

The objectives of NLCS 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 NLCS units are considered 'living' documents and should be revised and updated frequently (e.g. 3-5 years). 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.

Science has been defined within the BLM several times (e.g. BLM 2007, BLM 2008a), but is essentially 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. Within NLCS 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).

UNIT AND GEOGRAPHIC AREA DESCRIPTION

In 2000, McInnis Canyons National Conservation Area (MCNCA)¹, including the Black Ridge Canyons Wilderness, was created to conserve, protect, and restore 'the areas making up the Black Ridge and Ruby Canyons of the Grand Valley and Rabbit Valley, which contain unique and valuable scenic,

¹ The original legislation (P.L. 106-353) named the unit the Colorado Canyons National Conservation Area. Effective January 1, 2005, the Colorado Canyons National Conservation Area's name was changed to McInnis Canyons National Conservation Area (MCNCA) in honor of former U.S. Representative Scott McInnis (Legislation P.L. 108-400).

recreational, multiple use opportunities (including grazing), paleontological, natural, and wildlife components enhanced by the rural western setting of the area, provide extensive opportunities for recreational activities, and are publicly used for hiking, camping, and grazing, and are worthy of additional protection as a national conservation area’ (Section 10). Specifically, the legislation mandated the BLM to ‘conserve, protect, and enhance for the benefit and enjoyment of present and future generations the unique and nationally important values of the public lands...including geological, cultural, paleontological, natural, scientific, recreational, environmental, biological, wilderness, wildlife education, and scenic resources of such public lands’ (Colorado Canyons National Conservation Area and Black Ridge Canyons Wilderness Act of 2000, Public Law 106-353; Section 10).

MCNCA is part of the Colorado Plateau eco-region as defined by the Environmental Protection Agency (Gallant et al 1989). There are numerous other conservation areas in the nearby vicinity (including NLCS units, National Park Service’s monuments and national parks, and the US Forest Service’s national forests).

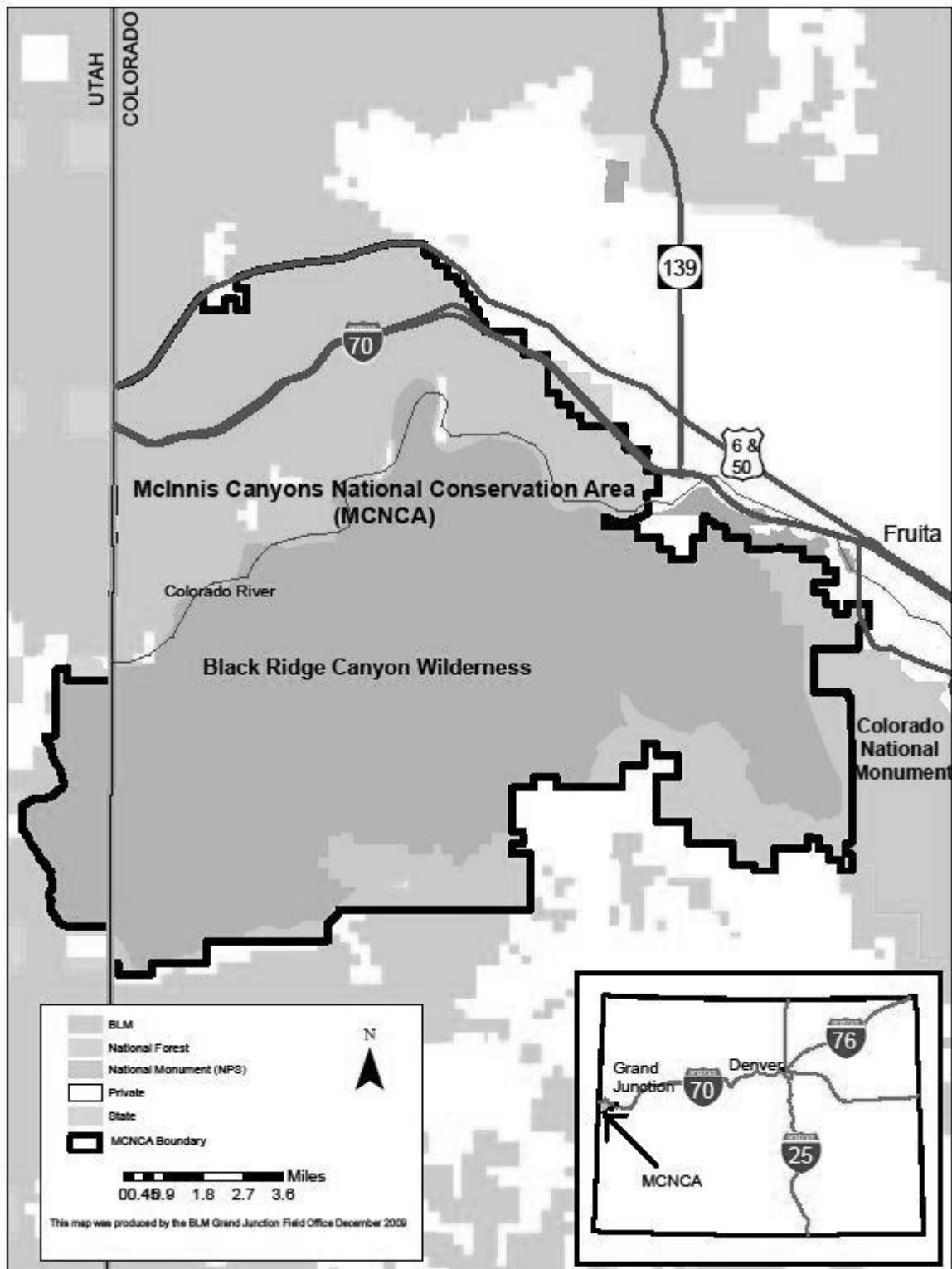
The unit encompasses 123,430 surface acres of land and includes a 24 mile stretch of the Colorado River and 75,500 acres of the Black Ridge Canyons Wilderness (Figure 1). MCNCA is located west of Grand Junction, Colorado (Mesa County) within the BLM Grand Junction Field Office (GJFO) in Colorado’s North West District, and continues just over the Utah border. It is comprised of four main areas: Mack Ridge, Rabbit Valley, Black Ridge Canyons Wilderness Area, and the Colorado River corridor, which are managed for multiple-use according to the Resource Management Plan (RMP) for the area (Table 1; BLM 2004). Recreation sites within MCNCA include developed areas, picnic areas, and camping sites.

Table 1. MCNCA planning zones and primary activities as set by the RMP (BLM 2004).

Planning zone	Primary activities
Mack Ridge	Mountain bike riding and horseback riding
Rabbit Valley	Off-highway vehicle (OHV) riding, hiking, Native American rock art viewing, camping, wildlife watching, mountain bike riding, horseback riding, and grazing
Wilderness	Hiking, backpacking, horseback riding, grazing and hunting
River corridor	Boating, hiking, and camping

MCNCA supports a diverse plant and animal community, and has significant cultural and paleontological resources. There are considerable challenges facing these resources. As BLM managers strive to determine the best management practices for these areas, scientific study can and should serve as an important and integral tool.

Figure 1 Map of McInnis Canyons National Conservation Area and surrounding area.



SCIENTIFIC MISSION

This science plan will be used as the basis for conducting science in the MCNCA.

Scientific efforts within MCNCA should support the conservation, protection, and restoration of the values identified in the designating language. Since MCNCA is managed for multiple-use, some level of resource disturbance is inevitable. However, resource conditions should be such that predictable disturbance, for example from grazing and recreational use, is maintained at levels that allow sustained function of natural resources and preservation of socio-cultural and paleontological resources.

Specifically, it is the scientific mission of MCNCA to:

- 1) Allow and encourage pertinent science that can:
 - a. inform management decisions and evaluate management methods within MCNCA;
 - b. improve and maintain ecosystem resiliency and function;
 - c. improve and maintain land health;
 - d. maintain diversity and viability of plant and animal populations; and,
 - e. preserve and understand socio-cultural and paleontological sites.
- 2) Allow and encourage long term and short term investigations.
- 3) Allow scientific inquiry across diverse disciplines, as appropriate within MCNCA.
- 4) Serve as a model system for surrounding areas, so that scientific findings can be exported to other federal and non-federal lands.

SECTION 2 – SCIENTIFIC BACKGROUND

BACKGROUND INFORMATION AND SCIENTIFIC INVESTIGATIONS

Scientific investigations in MCNCA have covered a diverse array of topics, including studies on vegetation, wildlife, paleontology, and the impacts of recreation. The following is a brief summary of the past scientific research that has occurred with the unit; this summary is not meant to be exhaustive or static.

VEGETATION AND SOILS

McInnis Canyons National Conservation Area is located within the Colorado Plateau surface management area, as defined by the U.S. Environmental Protection Agency (Gallant et al. 1989). Diverse vegetation communities are found within MCNCA borders including salt-desert in lower elevations, piñon-juniper communities in canyons and on mesa tops, and sagebrush communities. MCNCA also encompasses a 24 mile corridor along the Colorado River and riparian vegetation along this corridor includes cottonwood galleries, and willow and tamarisk dominated stream banks (BLM 2003). These vegetation communities are influenced by historic and present day disturbances and management efforts including: fire, livestock grazing, re-seeding efforts, and recreation. Drought, use by wildlife, and climate change also influence these vegetation communities.

Soils in the MCNCA are generally derived from sandstone and shale, as well as from mixed alluvium. Soil textures are somewhat variable and include sandy loam, loam, silty clay, and silty loam (BLM 2003). As in many arid ecosystems soils may be rapidly eroded by wind or water, especially where vegetative cover is lacking. Another component of the soils which deserves special note is cryptobiotic crusts. Cryptobiotic soil crusts are an important component of soils in cold deserts and may increase soil stability, enhance moisture, and nutrient retention (Belnap and Gardner 1993). These soil crusts may be easily damaged by trampling and physical disturbance (Belnap and Gardner 1993). Some rare plants are known to occur within MCNCA including the Dolores river skeleton plant (*Lygodesmia doloresensis*, also referred to as Dolores desert pink), Osterhout's cryptantha (*Oreocarya osterhoutii*), and Jones' bluestar (*Amsonia jonesii*) (BLM GJFO, unpublished data).

In 2004, the Colorado Natural Heritage Program provided MCNCA with a biological inventory of the imperiled and vulnerable plants, animals, and natural communities in the Rabbit Valley and Mack Ridge areas (Stevens 2004).

Many invasive and noxious weeds are found within MCNCA. Several of these are actively managed. The following list provides some details on the weeds present, and actions that have/are occurring to manage these species:

- Russian knapweed (*Acroptilon repens*) is an aggressive weed which competes with native vegetation in several ways, including the production of allelopathic substances and ability to grow from seed or hearty root masses (Maddox et al. 1985). Control of this weed can be difficult and biological agents may increase chances of longer term suppression.

- The invasive species cheatgrass (*Bromus tectorum*) is an aggressive invader present throughout much of the arid west (Pellant 1996). Cheatgrass has changed historic fire regimes and increased the likelihood of more frequent fires (Pellant 1996). Traditionally, managers have used techniques to try to mitigate the spread of cheatgrass such as reseeding after fires. However, there is uncertainty as to the effectiveness of this technique at limiting cheatgrass recovery and spread (Getz and Baker 2008), and recovery depends on several variables and is not well understood.
 - In 2004, a study was performed by Mesa State scientists to study how different soil amendments (C addition as sugar, C addition as sawdust, NaCl addition, ammonium fertilizer, one time herbicide application prior to reseeding, and no treatment) would affect the establishment of native species from seed within sites dominated by invasive cheatgrass (*Bromus tectorum*), tumble mustard (*Sysymbrium altissimum*), and Russian thistle (*Salsola iberica*). The study was conducted in an area of acquired lands within MCNCA. Before becoming BLM property, these lands were the site of a proposed golf course where initial work was not completed. Initial findings showed that essentially no native plants established under any of the treatments, therefore, follow up monitoring efforts was not continued (Dr. Tamera Minnick, personal communication).
- Hoary cress, also known as whitetop (*Cardaria draba*), is a rhizomatous perennial plant that invades rangelands and can be abundant on alkali soils (Jacobs 2007). This species spreads by rhizomes, which can be extensive, as well as seed and produces allelopathic chemicals that may inhibit the growth of other plant species (Jacobs 2007).
- Russian olive trees (*Elaeagnus angustifolia*) were introduced to western North America from Europe and Asia around 1900. This species is found in riparian areas, often with tamarisk (Katz and Shafroth 2003). An extensive effort to eliminate this weed has been undertaken by the GJFO and approximately 95% of the species has been removed from MCNCA river corridor (BLM Staff, personal communication).
- Perennial pepperweed (*Lepidium latifolium*) is an invasive species that appears to be increasing in density within MCNCA. This species can be problematic to remove as it spreads primarily through sprouts from roots, which can be very hardy, and treating aboveground plant parts may only temporarily reduce population size (Young et al. 1998). It is often found in riparian or wet areas. This plant can alter soil properties, inhibiting native plant restoration after the plant has been removed, and treating young infestations may drastically reduce the effort needed for restoration once this weed is removed (Renz and Blank 2004). Native plants may be able to exclude this invasive species (Young et al. 1998); therefore, if perennial pepperweed is removed, restoration is a priority.
- Purple loosestrife (*Lythrum salicaria*) is an invasive species found in riparian areas and wetlands that can reproduce and regenerate by seed, buds on roots, and stems (Jacobs 2008). In addition, seed viability is high, seed banks of this seed can outnumber native seed, and seed germination and seedling growth are often faster for this species than for native species (Jacobs 2008). These characteristics give this plant a distinct advantage over native riparian species (Jacobs 2008). When this species invades, it can reduce native plant diversity, reduce pollination and seed

production of some species, and reduce habitat suitability for some bird species (Blossey, Skinner et al. 2001). Along with Mesa County, Colorado and Grand County, Utah, the Grand Junction BLM has an ongoing eradication program along the Colorado River (which goes through MCNCA). This weed has been actively managed for almost a decade and it now exists as isolated plants within MCNCA (BLM GJFO unpublished data).

- Tamarisk (*Tamarix spp.*) is an invasive shrub that can exclude native riparian vegetation and alter native systems through changes to water flow, wildlife habitat, and soil properties (Di Tomasso 1998). Due to the widespread nature and difficulty in effectively removing this species, a biological control agent (the tamarisk beetle, *Diorhabda carinulata*) was released in the Horsethief Canyon area in the River corridor planning area in 2005. However, the tamarisk beetle was not very effective in tamarisk control until a population of beetles from a release in Utah moved into the canyon in 2008 (Dr. Dan Bean, Pallisade Insectory, personal communication). Scientists from Pallisade Insectory and Colorado State University are collecting data (from 2005 to present) in Horsethief Canyon, as well as other release sites of tamarisk beetle, to determine the effects of the beetle on target (tamarisk) and non-target vegetation (Dr. Dan Bean, personal communication”).

Other invasive species in MCNCA include: Canada thistle (*Cirsium arvense*), musk thistle (*Carduus nutans*), yellow toadflax (*Linaria vulgaris*), Siberian elms (*Ulmus pumila*), halogeton (*Halogeton glomeratus*), and annual wheatgrass (*Eremopyrum triticeum*).

The BLM GJFO ecologist, in collaboration with Mesa State scientists, began a study in 2003 to determine appropriate methods of transplanting the threatened Colorado hookless cactus (*Sclerocactus glaucus*), using fishhook cactus (*Sclerocactus parviflorus*) as a proxy. Transplants have occurred in Rabbit Valley within MCNCA. This project is ongoing with high survival rates to date (Ballard et al. in prep).

WILDLIFE

MCNCA is home to a diversity of wildlife which serves as an attraction to visitors to the area. The fauna of MCNCA is typical of piñon-juniper dominated woodlands, red rock canyons, cold deserts, sagebrush parks, and river habitats. Additionally, fauna associated with irrigated agriculture and metropolitan areas (found around the conservation area) are found within the boundaries of MCNCA.

MCNCA is home to four listed threatened or endangered species: bonytail entire chub (*Gila elegans*), humpback entire chub (*Gila cypha*), Pikeminnow (squawfish) (*Ptychocheilus lucius*), and greenback cutthroat trout (*Oncorhynchus clarki stomias*). Other species of concern include: western snowy plover (*Charadrius alexandrinus nivosus*), western burrowing owl (*Athene cunicularia hypogaea*), gray vireo (*Vireo vicinior*), long-billed curlew (*Numenius americanus*), wilson’s phalarope (*Phalaropus tricolor*), canyon treefrog (*Hyla arenicolor*), long-nosed leopard lizard (*Gambelia wislizenii*), and river otter (*Lutra canadensis*) (Colorado sensitive species,

http://www.blm.gov/co/st/en/BLM_Programs/botany/Sensitive_Species_List_.html). Breeding pairs of burrowing owls have been documented within GJFO and are likely within MCNCA (klute et al. 2003, BLM GJFO unpublished data). Long-nosed leopard lizards have also been documented within the MCNCA area

(McCoy 1967). Additionally, in MCNCA there are two known nests of the recently de-listed bald eagle (*Haliaeetus leucocephalus*) (BLM GJFO, unpublished data).

Another species of concern in MCNCA is the Gunnison sage grouse (*Centrocercus minimus*) which is found only in sagebrush rangelands in western North America. Population declines of Gunnison sage grouse have been attributed to decreasing overall habitat and increasing fragmentation of remaining habitat (Oyler-McCance et al. 2001). The Gunnison sage grouse is currently a candidate under review for listing as threatened or endangered by the U.S. Fish and Wildlife Service. In 2000, the Gunnison sage grouse working group authored a conservation plan for the Piñon Mesa, Colorado population (BLM 2004, Appendix 4). This population of Gunnison's sage grouse has habitat along the south-eastern edge of MCNCA. Stemming from this plan, there have been several habitat treatments aimed at improving habitat in this area, by the BLM and other agencies and private land owners. For example, three areas near to the southern edge of Black Ridge Wilderness were seeded with native grasses and forbs in 2009 and 2010, and are currently being monitored determine the effectiveness of these treatments (Grant-Hoffman, unpublished data). In addition, GJFO is currently determining the extent of Gunnison sage grouse habitat in MNCNA and surrounding areas.

Desert bighorn sheep (*Ovis canadensis*) were extirpated from the Black Ridge Canyon Wilderness area prior to European settlement, but were reintroduced in the 1970's, 80's, and 90's. The Black Ridge desert bighorn sheep herd initially grew, but experienced population declines in the 1990's (BLM 2004, Appendix 4). In order to monitor this herd and get accurate estimates of populations and habitat use, 25 ewes and 6 rams were collared by the Colorado Department of Wildlife in 2008 and 2009. This study is being expanded in collaboration with Colorado State University.

Historically, kit foxes (*Vulpes macrotis*; listed as endangered by the State of Colorado) have been present within MCNCA (Grand Junction Field Office BLM Wildlife Biologist, personal communication). However, populations have declined and the current status of this species in western Colorado is uncertain. There is an ongoing study by the University of Colorado, Boulder together with the BLM and the Colorado Department of Wildlife to determine the status of this species as well as its habitat in Western Colorado. Kit Fox artificial dens and 'quick escapes' were installed by the BLM wildlife biologist in August 2004 and June 2005 to increase habitat suitability for kit foxes. Research is on-going as to the success of these efforts (Reed-Eckert 2010).

White-tailed prairie dogs (*Cynomys leucurus*) are found in many areas within MCNCA. Prairie dogs have been termed keystone species because of the influence they have on their surrounding environment and other animals (Kotliar et al. 1999). There are numerous threats to prairie dog populations including decreasing habitat and sylvatic plague (*Yersinia pestis*). Sylvatic plague can reduce prairie dog populations and extirpate prairie dog towns (e.g. Collinge et al 2005).

MCNCA is likely home to several bat species (Fitzgerald et al. 1994). Confirmed bat species are: Brazilian free-tailed bat, California myotis, Western small-footed myotis, long-eared myotis, little brown myotis, fringed myotis, long-legged myotis, Yuma myotis, spotted bat, pallid bat, big brown bat, silver-haired

bat, and Canyon bat (Dan Neubaum personal communication). Unconfirmed but species likely found within the NCA include: big free-tailed bat, Townsend's big-eared bat, and hoary bat, and possible Allen's big-eared bat (Dan Neubaum personal communication). Since 2006 a fungal infection, white-nosed syndrome, has been linked with high mortality rates of bats in the northeastern U.S. (Buchnen 2010). While this disease has not yet been reported in Colorado, it has been moving west (<http://www.fws.gov/whitenosesyndrome/#map>).

The Audubon Society named an Important Bird Area in 1999 within the Rabbit Valley Recreation Area. Data collected to support this nomination include: bird counts and bird ranges, the BLM Bald Eagle Survey (1978-1980), Mesa County Spring Bird Count (1979-1999), and personal observations by BLM staff (http://co.audubon.org/birdcon_iba.html).

Pollinators, including honeybees, are important members of the MCNCA wildlife community. However, both feral and managed honeybee populations have significantly dropped in recent years, 25% since 1990 (Allen-Wardell et al 1998). Declines may be due to several factors but likely include: introduced mites, pesticides, weather, and competing introduced bees (Allen-Wardell et al 1998). Information about other pollinators is lacking and many of these populations may also be in decline (Buchmann and Nabhan 1996). Decreases in pollinators can cause decreases in crop yields and native plant seed production. Within Mesa County agriculture, including fruit production and wineries are important industries. According to the Colorado State University extension office, there are over 1700 farms (over 370,000 acres of land) in Mesa county and over \$61,000,000 in agricultural products are sold from this county (Colorado State University Extension Office, <http://www.extension.colostate.edu/TRA/>). Thus, maintaining healthy populations of pollinators is important for the local economies.

SOCIO CULTURAL HERITAGE

MCNCA is home to significant cultural heritage. For example, McDonald Creek Cultural Resource Management Area is an area where rock art from Native American Fremont people who inhabited the area 1000 years ago can still be seen (BLM GJFO, unpublished data). Pack rat middens can also be found in MCNCA, but have not yet been closely cataloged or studied (BLM GJFO, unpublished data).

While many prehistoric and historic cultural sites have been identified within MCNCA (Hauck 2003), few have been extensively studied. These sites represent significant and irreplaceable components of our national heritage. In addition, some of these sites may be eligible for the National Register of Historic Places (Martin 2007). Due to increased recreation within the area, some of these sites may be experiencing increased impacts (Connor et al. 2007) and further research on these sites is needed.

PALEONTOLOGY AND GEOLOGY

MCNCA is rich in paleontological and geological resources, especially with fossils from the Jurassic period. One area in the unit, the Trail through Time, includes an active dinosaur quarry which is currently being excavated with many new discoveries (e.g. Foster and Hunt-Foster 2011). The Fruita Paleontological Area is another area rich in paleontological resources and has been described by Kirkland (2006) as "an excellent natural laboratory for the study of late Jurassic faunas, floras,

sedimentology, taphonomy, ecology, and climatology”. The Split Rock Trail is also abundant in paleontological resources and has been cited in several articles for discoveries made there (Bray and Hirsch 1998, Hasiotis et al. 1998, Turner and Peterson 1999).

An example of geological research in MCNCA is a 2003-2004 collaborative study between several universities (Mesa State University, State University of New York Geneseo, Mount Holyoke College, Bucknell University, College of William and Mary, Kansas State University), which considered the past climatic conditions of MCNCA’s Sieber Canyon area. The researchers examined how these past climatic conditions may have influenced arroyo cutting in the Little Dolores River valley (Aslan 2004).

RECREATION

MCNCA supports a wide variety of recreational activities, including hiking, mountain biking, horseback-riding, river running, use of ATVs, etc. Within the four planning zones found within MCNCA are ten outcome-focused management zones², which vary based on physical, social, and administrative classes, and aim to provide different recreation experiences (e.g. more versus less primitive; BLM 2004). These outcome-focused management zones were studied in 1992-1993 and again in 2001-2002 by a group of researchers from Northern Arizona University to determine the recreation and community benefits of this approach to recreation. Both reports addressed recreation topics, such as visitor demographics, expectations, and satisfaction with their experience within MCNCA (Lee 2003).

Visitor-related research has also been conducted by Colorado Mesa University to better understand recreationists’ desired setting and outcomes in MCNCA. These researchers helped to begin to identify recreation ‘niche bundles’ based on setting character and desired participant outcomes, versus the classic activity based groupings, which may not be as robust or accurate. This research aimed to better understand the public’s expectations and impressions of the NLCS unit (Tim Casey unpublished data).

RECENT FIRE HISTORY

Three recent fires have occurred in MCNCA, all of which affect the MCNCA landscape. The restoration efforts that followed each fire, in addition to follow-up monitoring, allow researchers and BLM specialists to analyze the effectiveness of re-seeding techniques (BLM GJFO unpublished data).

- The 1999 Black Ridge / Wrigley fire burned over 3500 acres within the Black Ridge Wilderness as part of a larger complex of fires.
- The 2005 Mee Canyon Fire burned 58 acres near the Colorado River.
- The 2007 Knowles Canyon (human-caused) fire burned 91 acres burned, including approximately 300 cottonwood trees.

GLOBAL CLIMATE CHANGE

Global climate change is an underlying factor in any research or management decisions pertaining to MCNCA. The Colorado Plateau may be particularly susceptible to climate change as it sits at the ends of two moisture trajectories coming from opposite directions (systems arising from the Gulf of Alaska and

² These areas were formerly referred to as benefits-based management zones.

those from the Gulf of Mexico), as such this area can give important information about climate change (Schwinning et al. 2008).

ON-GOING MONITORING OF RESOURCES

In addition to the scientific investigations identified above, ongoing monitoring of resources is a large portion of the science conducted in MCNCA. Monitoring can be useful for determining: areas of resource decline, background information for scientific inquiries, early indicators of invasive weeds, stability of cultural and paleontological resources, effectiveness of management activities, and the identification of new concerns and needs for scientific research. Ongoing monitoring in MCNCA includes:

1. ECOLOGICAL SITE INVENTORIES

Ecological site inventories serve as baseline data for natural resource management and planning (BLM 2001). These inventories involve 'the use of soils information to map ecological sites and plant communities and the collection of natural resource and vegetation attributes (BLM 2001)'.

Ecological site inventories were completed in Ruby Canyon in 1993. The West Salt grazing allotment, located within Rabbit Valley in MCNCA was re-surveyed in summer 2010.

2. LAND HEALTH ASSESSMENTS

Land health assessments are completed periodically to determine if a particular area is 'meeting land health standards' or 'not meeting land health standards' based on vegetation, soil, wildlife and riparian characteristics. In addition, many BLM offices, including the Grand Junction field office, include a 'meeting with problems' category to identify areas that, while not severely degraded, have ecological issues that need to be addressed. Specific sampling methods vary by BLM office, areas identified as 'meeting with problems' or 'not meeting' land health standards are revisited more often than healthy landscapes. Within MCNCA, Land Health Assessments were completed in 2003 (BLM 2003). Several areas within MCNCA have been identified as areas not meeting land health standards. Many of these areas overlap with areas of high use, thus they are visible to the public and potentially have impacts from recreation use.

3. RANGELAND HEALTH MONITORING

In order to determine rangeland health and carrying capacity of grazing allotments, managers collect vegetation data, photo points, and measures of livestock utilization. Nested frequency plots are used to detect significant changes in dominant vegetation. Measurements are taken at time intervals dependent on the category of allotment, but time intervals range between 4 and 10 years.

4. PROPER FUNCTION CONDITION (PFC) ASSESSMENTS

Proper functioning condition assessments are used to determine the overall health of riparian and wetland areas. An interdisciplinary team samples lotic areas approximately every 5 years according to set guidelines (Prichard 1998) to determine if a riparian area is in 'proper functioning condition'. PFC sampling has not historically been linked to land health, but GJFO and MCNCA are moving towards linking the two monitoring approaches.

5. CAMPSITE DISTURBANCE MONITORING

The BLM began sampling campsites according a standard protocol in Fall 2008 (BLM 2008b). This protocol incorporates four areas of sampling: campsite monitoring, visitor satisfaction, visitor contacts, and camping signup.

6. MONITORING CONDUCTED BY VOLUNTEER STEWARDS

Volunteer stewards do yearly visits to several sites, including paleontological sites and areas of critical environmental concern. They complete a form with field observations which includes observations of wildlife, vegetation, human impacts, natural impacts, and management concerns. Relevant photographs are also taken. This information is then provided to the BLM.

7. SUPPLEMENTARY AND SPECIFIC MONITORING

Supplementary monitoring efforts to address specific concerns and management activities are conducted as needed. Due to limited funding, these types of studies must be concentrated on efforts that directly benefit the management goals of MCNCA, and where the information needed cannot be gleaned from other ongoing efforts.

8. MONITORING BY OTHER AGENICES

Wildlife and wildlife habitat within MCNCA is monitored by the Colorado Department of Parks and Wildlife, or the U.S. Fish and Wildlife service.

The BLM's assessment, inventory and monitoring (AIM) strategy for integrated renewable resources management seeks to provide more standardized monitoring across all BLM lands through the use of standardized protocols that concentrate on three key ecosystem attributes; soil/site stability, hydrologic function, and biotic integrity (BLM 2011). Data collected via the AIM Strategy protocols are statistically-sound and usable at multiple scales for multiple purposes. Pilot studies of this initiative are underway, but not within MCNCA. As BLM's AIM Strategy develops, every effort will be made to adopt MCNCA's data collection protocols.

SECTION 3 – IDENTIFICATION AND PRIORITIZATION OF MANAGEMENT QUESTIONS AND SCIENCE NEEDS

SCIENTIFIC NEEDS

The scientific needs of MCNCA are based on pressing management questions and continually change as management decisions are made and new concerns arise. Thus, the scientific needs will remain fluid and opportunities for research should remain open and inclusive. MCNCA's current science needs are listed in Table 2.

PRIORITIZATION

Science needs are prioritized to reflect the needs identified in the Resource Management Plan, needs identified by resource specialists, needs that reflect management and leadership concerns, as well as public concerns. These prioritizations can change based on changing conditions and are not meant to be steadfast or static.

Science needs are categorized as high, medium, or low priorities within topic areas (Table 2). These are pragmatic decisions: even low priority science needs are important.

TABLE 2. Prioritized science needs, by topic area

TOPIC AREA	PRIORITY	FOCUS AREA	QUESTIONS
Cross-cutting	High	Fauna and Flora	What is the full list of flora and fauna found within MCNCA?
		Land Health	There are several areas within MCNCA that do not meet Land Health Standards. What are the best treatments and/or restoration practices to move these lands toward meeting Land Health Standards?
		Climate Change	What are the predicted/realized effects of climate change on the resources of MCNCA? What are strategies to cope with climate change?
Vegetation and Invasive/Noxious Weeds	High	Restoration	As restoration in dry climates can be difficult (Allen 1996), what are best management practices for restoring degraded dry lands in MCNCA and throughout the American West, and potentially globally?
		Tamarisk	How effective are biological controls at long term reduction and suppression of tamarisk?
			Are native species able to increase in cover in areas where biological controls have suppressed tamarisk?
			Does mechanical removal of tamarisk provide a significant increase in native species cover and survival?
			Can native plant species, and under what circumstances, recover from tamarisk invasion without active restoration?
			Does percent cover of other invasive or non-native species increase with tamarisk suppression?
			How are ecosystem processes effected by tamarisk suppression including: food webs (for example migratory bird diversity and abundance, insect diversity and abundance, native fish abundance and reproduction), evapotranspiration and water use, and nutrient cycling?
	Medium	Cheatgrass	What native species can compete with cheatgrass and under what circumstances (precipitation, time of seeding, mix of species, etc.)?
			Can inter-seeding native species with cheatgrass increase diversity and cover of native plants?
			Can removal of cheatgrass followed by seeding with native species increase native plant species diversity and cover?
			What seeded species, and under what circumstances (precipitation, time of fire and seeding, etc.), can prevent cheatgrass domination after fire?
			How are ecosystem process affected by cheatgrass invasion including; fire regimes, insect and animal diversity and abundance, soil nutrient cycling, soil crust

TOPIC AREA	PRIORITY	FOCUS AREA	QUESTIONS
			abundance, and soil microbial communities?
			What impacts do different soil amendments and different levels of soil disturbance have on cheatgrass/ native plant success?
		Russian knapweed	Do management activities, for example chemical or mechanical removal, significantly decrease the cover of Russian knapweed in the presence of the biological agent?
			What is the recovery, in terms of cover and diversity, of native plant species when Russian knapweed is suppressed or removed? What variables influence native plant recovery?
			Does active restoration of former Russian knapweed habitat significantly increase native plant diversity or density?
	Low	Hoary cress	How well do native plant species recover after hoary cress removal?
			Is active restoration of hoary cress habitat necessary to increase native plant cover and diversity?
		Perennial pepperweed	What pepperweed removal methods are most effective in terms of long term removal, cost, and time?
			How well do native plant species recover after pepperweed removal?
			Is active restoration of pepperweed habitat necessary to increase native plant cover and diversity?
Western	High	Desert bighorn sheep	Are populations of desert bighorn sheep increasing, decreasing, or stable within MCNCA?
			What are the patterns of movement and habitat use exhibited by this herd?
			What are the main causes of mortality within this herd?
			Is habitat within MCNCA sufficient to sustain this herd?
		Gunnison sage grouse	Are Gunnison sage grouse present (and what numbers of sage grouse are present) within MCNCA?
			Have habitat treatments aimed at improving sage grouse habitat improved habitat by increasing native plant species diversity and abundance, and are Gunnison sage grouse utilizing these areas in increased numbers?
			What sage grouse life history stages are supported by habitat within MCNCA (for example breeding, nesting, brood rearing)?
		Kit fox	Are kit foxes still present within MCNCA?
			What are the main causes for mortality of kit foxes in MCNCA and western Colorado?
			What are the reproductive success rates for kit foxes within MCNCA and western Colorado?
			Is habitat sufficient to sustain kit fox populations within MCNCA and western Colorado?

TOPIC AREA	PRIORITY	FOCUS AREA	QUESTIONS
	Medium	Bats	Where are bat hibernacula in and around MCNCA?
			What are appropriate monitoring protocols for early detection of white-nosed syndrome?
			What are other stressors and trends in these bat populations?
		Audubon BA	Is the diversity of birds stable in this area?
			What migrant species are present?
			What year round residents are present?
			What species use the area for breeding and brood rearing?
			Can MNCA birds serve as an indicator of the general health of MCNCA habitats (Carignan and Villard 2002)?
		Pollinators	How important are wild pollinators to agriculture in MCNCA, especially considering the close proximity of agriculture to this protected area?
			Are populations of pollinators increasing or decreasing in MCNCA?
			What factors are contributing to pollinator population fluctuations in MCNCA, for example parasites, disease, pesticide use, etc.?
			What common plants are 'pollinator friendly' and are they included in common seed mixes?
			What are appropriate long term monitoring strategies for pollinators within MCNCA?
	Low	Burrowing owl	How many burrowing owls are present within MCNCA and where are they present?
			What are nestling survival rates? What factors limit nestling survival?
			Due to the use of active prairie dog burrows for breeding, burrowing owl populations decline with declining prairie dog populations (Desmond, Savidge et al. 2000). How able are burrowing owls to locate active prairie dog towns? How burrowing owl populations react to fluctuating prairie dog populations?
		Canyon tree frogs	What is the density of canyon tree frogs within MCNCA and where are they present?
			What is the life history/population dynamics of canyon tree frogs? E.g. What are the reproductive and death rates, and what limits these rates?
			What are habitat requirements for canyon tree frogs?
		Long nosed leopard lizard	What is the density of long nosed leopard lizards within MCNCA?
			What is the life history/population dynamics of long nosed leopard lizards? E.g. What are the reproductive and death rates, and what limits these rates?
			What are habitat requirements for long nosed leopard lizards?
		White tailed prairie dog	Where within MCNCA where are active and in-active prairie dog towns found?
			Are towns being impacted by plague?
			What are the death and re-colonization rates of prairie dog towns in MCNCA and what drives these rates?
			What other factors drive prairie dog population fluctuations in this area?
			What are the dynamics of plague and the population fluctuations of prairie dogs in the presence of plague?

TOPIC AREA	PRIORITY	FOCUS AREA	QUESTIONS
Socio-Cultural Heritage	Medium	Socio-cultural, general	What is the full list of MCNCA socio-cultural heritage sites? Where are important areas for archeological excavation?
			What can MCNCA's socio-cultural heritage sites tell us about past climatic and cultural changes, and movement of historical peoples? This type of information can be invaluable as we are facing potentially rapid climate changes.
			What are the locations of past Ute trails?
			What is ethno-history of the MCNCA area including but not limited to Native Americans and early settlers/homesteaders?
			What can pack rat middens in MCNCA tell us about historical vegetation and ecosystem conditions (Cole 1986)?
Paleontology	Medium	Paleontology, general	What is the full list of fossil fauna and flora found within MCNCA?
			What can fossil biota tell us about paleo-environments at MCNCA? Can information about these paleo-environments and their changes help predict effects of local and global climate change and thus inform modern management of BLM lands?
			What are potential gains, and how can these gains be quantified, from further prospecting and excavation at certain areas including: Mygatt-Moore quarry, Fruita Paleontological Area, and cliffs and fall blocks in canyon areas?
			How can paleontology research efforts over potentially large geographic areas be prioritized to concentrate limited resources in areas most likely to produce scientifically significant results?
Recreation	Medium	Recreation, general	How are the targeted beneficial outcomes for users, households/communities, the economy, and the environment, which are identified in the MCNCA plan, realized and how do we measure our success in meeting these outcomes?
			What are the negative outcomes of recreational use of MCNCA and how can we analyze, both qualitatively and quantitatively, these outcomes to be avoided?
			How do we engage essential services providers and other non-participants in a way that informs management of desired outcomes of affected communities? Key service providers and non-participants have been identified.
			What relationships underpin recreation 'niche bundles'?

SECTION 4 – MEETING SCIENCE NEEDS

INTERNAL ORGANIZATION

Internal organization is necessary to strategically identify and address science in MCNCA. A science coordinator has been established in MCNCA to coordinate all scientific efforts in the unit. The NCA ecologist will serve as the science coordinator, and will coordinate with appropriate specialists as needed to address science within MCNCA³.

The role of the coordination team is to:

- 1) Coordinate and collaborate to identify and prioritize MCNCA's science needs;
- 2) Ensure that partners and collaborators are familiar and engaged with MCNCA's documented science needs;
- 3) Coordinate with staff to approve science proposals;
- 4) Engage and remain engaged with partners and collaborators working within MCNCA;
- 5) Ensure that results of scientific inquiries are available to BLM staff, in appropriate formats, including progress and final reports;
- 6) Communicate results of scientific inquiries to researchers, staff, and managers both within and outside of the BLM, and to the general public when appropriate; and,
- 7) As necessary, coordinate and collaborate to update and revise the MCNCA science plan.

Additionally, the science coordinator will:

- 8) Conduct needed monitoring and scientific inquiries, as time permits, within MCNCA;
- 9) Interpret long term data and periodically publish results; and,
- 10) Serve as the contact person for scientific inquiries within MNCNA.

COLLABORATION AND PARTNERS

It is imperative that MCNCA have good working relationships with a variety of partners that can assist in the diverse scientific needs of MCNCA. As scientific study is often not part of the work that BLM field staff performs, partnering with numerous outside entities can greatly increase the BLM's ability to use science to improve management decisions and actions.

Furthermore, collaboration between BLM offices and with other government agencies, universities, and science partners can ensure that all parties have a clear and common understanding of management needs. This type of collaboration can aid in the sharing of information, which can help to save time and resources by reducing duplicative effort, and can help to improve outcomes on broad scales by addressing common problems with common solutions.

As management questions and needs are not bound by jurisdictional boundaries, the success of management efforts in one geographical area will often be dependent on management efforts in

³ Internal organization will be different for each unit. The duties of the science coordinator may be assigned to a single person as a collateral duty, several people may serve on a 'coordination team', or an interdisciplinary team may be assigned.

another area. Regular conversations, inter-agency work groups, and attendance at regional and national meetings (e.g. the Colorado Plateau Cooperative Ecosystem Studies Unit (CPCESU) meetings, and the Colorado Plateau Biennial Science Conference) can help foster these relationships and collaborative opportunities.

There are numerous potential partners for scientific study within MCNCA, some current partners include: Colorado Canyons Association, Audubon Society, Tamarisk Coalition, Colorado Mesa University, Colorado State University, Museum of Western Colorado, and Chicago Botanic Garden.

When appropriate, MCNCA will coordinate research needs through the Cooperative Ecosystem Study Unit (CESU) network (<http://cesu.org>).

SECTION 5 – SCIENCE PROTOCOLS

SCIENCE GUIDELINES

It is anticipated that three main types of science are likely to occur within MCNCA:

- 1) Assessment, inventory, and monitoring;
- 2) Solicited science addressing management questions/science needs; and,
- 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, wildlife studies, anthropology (including archaeology), paleontology, and recreation studies.

General guidelines that apply to all of types of science in MCNCA include:

- 1) All scientific investigation must comply with relevant laws and regulations.
- 2) All non-permitted external scientific investigations must be authorized, according to the procedures described below.
 - a. The final decision for granting authorization will be the MCNCA manager.
- 3) Science should not impact the long term health or sustainability of the resources of MCNCA, especially the values for which MCNCA was designated.
 - a. If impacts are anticipated, appropriate government 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 MCNCA resources.
- 5) Scientists initiating research projects within MCNCA should be aware of existing data within the BLM and should incorporate these data into projects whenever possible.
- 6) Proposed research within the Black Ridge Wilderness Area should comply with appropriate laws and regulations including the Wilderness Act of 1964 and BLM wilderness policy (Manual 6340)
 - a. Proposals must be carefully evaluated for legal and policy compliance, scientific merit, and impacts and benefits (Landres 2000). A set of worksheets may be used to ensure that scientific proposals are evaluated in a consistent way and should be completed for each scientific proposal considered within the wilderness area (found here: <http://www.wilderness.net/index.cfm?fuse=toolboxes&sec=resSciAct>).
- 7) MCNCA staff should use all available monitoring protocols to achieve adequate monitoring of the resources of MCNCA (e.g. land health assessments), especially with consideration to the national Assessment, Inventory, and Monitoring Strategy (AIM; BLM 2011).
 - a. For example, sampling techniques and consideration of the three identified key ecosystem attributes; soil/site stability, hydrologic function, and biological integrity (BLM 2011).

SCIENCE AUTHORIZATIONS

Currently, there is no formal process for scientific authorizations with MCNCA outside of the state-wide process for permitting paleontological and archaeological research. The process described below is not meant to replace or duplicate these processes. When a prior process is already in place, it will take precedence and researchers will only need to complete one permitting process. The process outlined below will only take effect when no other permitting process applies. However, permits and authorizations will be shared between appropriate state and field office staff for research taking place within MCNCA.

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

1. Scientist submits proposal to MCNCA science coordinator.
 - a. Proposals must include:
 - i. Contact information for the principal investigator
 - ii. Summary of proposed research (not to exceed 3 pages) including
 1. A brief explanation of background information;
 2. Rationale for research;
 3. Research methods;
 4. Timeline for field work; and,
 5. Outline of public outreach effort, if appropriate.
2. The proposal will be considered by the MCNCA science coordinator for completeness. The coordinator will consult with staff specialists, as appropriate ,to determine if the proposal is:
 - a. Complete;
 - b. Conforms to the MCNCA Science Guidelines (including all relevant laws and regulations);
 - c. Conforms to the MCNCA Resource Management Plan;
 - d. Meets the MCNCA scientific mission.
3. The science coordinator will brief the MCNCA manager on the review of the science proposal. Subsequently, the MCNCA manager (or the manager's designee) will grant or deny authorization to conduct the scientific investigation.
4. If a proposal is denied authorization:
 - a. 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. A determination will be made as to what, if any, NEPA analysis is necessary.
 - b. A letter of authorization will be provided to the scientist, signed by the MCNCA 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.
 - c. The proposal will be added to an internal tracking document of on-going scientific investigations in MCNCA, accessible by all MCNCA staff.
 - d. Reporting requirements for all scientific investigations will require:

- i. Progress reports (at least annually), filed with the science coordinator;
 - 1. Progress reports should include status of the investigation and preliminary findings when possible.
 - ii. Final reports, filed with the science coordinator;
 - 1. Final report should include:
 - a. Research background and results;
 - b. Discussion of the results including how the results are relevant to the NLCS unit and potential management decisions;
 - c. A summary of the public outreach effort if appropriate;
 - d. Raw data where appropriate; and,
 - e. Electronic copies of any published papers resulting from the scientific investigation.
 - iii. Manager's summary report
 - 1. Manager's summary reports are brief presentations (in any appropriate format) of research results to BLM managers, which ensure that:
 - a. Management questions are answered;
 - b. Managers have a full understanding of scientific findings; and,
 - c. Managers can incorporate these findings into their management decisions.
 - iv. If results of research are not sensitive material (for example some cultural and paleontological studies), a public outreach component.
- 6. The authorization is routed to MCNCA and GJFO staff.
 - a. Copies of the authorization will be made available to BLM staff, for example on the shared drive.
 - b. Short descriptions of ongoing research will be made available to the general public, for example on the MCNCA webpage.
 - i. Sensitive topics, for example location of specific cultural or paleontological sites, should be excluded from public information for protection of resources.
- 7. Research is initiated.
 - a. Research must be conducted according to the stipulations outlined in the authorization.
- 8. Research is completed, and final report is filed with the science coordinator.

SECTION 6 – ORGANIZATION AND COMMUNICATION OF COMPLETED SCIENCE

INTERNAL ORGANIZATION OF COMPLETED SCIENCE

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.

All reports, as described in Section 5, submitted to the MCNCA science coordinator will be stored and organized on a shared drive, or via a similar medium (e.g. a Sharepoint site), accessible by all MCNCA staff. The science coordinator should aim to organize periodic presentations of scientific results to MCNCA staff.

CONTRIBUTIONS TO BROADER BLM ORGANIZATIONS OF COMPLETED SCIENCE

The MCNCA science coordinator will comply, in a timely manner, with all requests for completed scientific investigations' information/reports from BLM Field Offices, District Offices, State Offices, and Washington D.C. Office.

COMMUNICATING SCIENTIFIC RESULTS TO THE PUBLIC

The science coordinator will strive to make information on science projects within MCNCA accessible to the general public, and the MCNCA webpage is a logical place for dissemination of this type of information. The format to present material may include but is not limited to: links to short informational videos or written descriptions of scientific inquiries occurring within MCNCA, public presentations, and citations of published research papers.

One innovative avenue for communicating science to the public is to show interested individuals the scientific process, first-hand. MCNCA manages the hiking trail, Trail through Time, which includes passing through an active dinosaur research quarry. This type of first-hand view of active research is sometimes the most effective means to share information, and should be encouraged throughout the unit.

The general public has a vested interest in MCNCA which is heavily utilized by varied outdoor enthusiasts. Thus, sharing what research is occurring (or has occurred) within MCNCA and why it is occurring (or has occurred) should be a priority, and can help avoid confusion and discontent that can stem from misunderstandings about the nature of scientific inquiries. However, while communication with the public is important, sensitive information about certain scientific projects may need to be kept confidential to ensure the protection of these resources.

SECTION 7 – INTEGRATING SCIENCE INTO MANAGEMENT

INTEGRATING SCIENTIFIC FINDINGS INTO MANAGEMENT DECISIONS

It is the responsibility of the science coordinator to ensure that scientific findings are communicated to managers. Managers can then use scientific information as they deem appropriate.

Written progress reports, final reports, published papers, and manager's summary will all be available to decision-makers, as described in Section 6, to help inform decisions. Furthermore, direct dialogue between scientists and managers will be encouraged.

SECTION 8 – SCIENCE PLAN REVIEW AND APPROVAL

SIGNATURE PAGE

I approve the McInnis Canyons National Conservation Area Science Plan.

This plan will be used as the basis for conducting science in the McInnis Canyons NCA and Black Ridge Canyons Wilderness. “Science” is defined in Section 1 of this plan.

As a living and working document, this plan will be updated no less than every five years, preferably more frequently. 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 unit’s scientific mission.

Madeline N. Grant-Hoffman, Science Coordinator McInnis Canyons National Conservation Area	Date
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Katie A. Stevens, NCA Manager McInnis Canyons National Conservation Area	Date
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Marcia H. deChadenedes, Colorado NLCS Lead Colorado State Office	Date
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Matthew Preston NLCS Science Coordinator Washington, D.C.	Date
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SECTION 10 - UNIT'S LEGISLATION: COLORADO CANYONS NATIONAL CONSERVATION AREA AND BLACK RIDGE CANYONS WILDERNESS ACT OF 2000

114 STAT. 1374

PUBLIC LAW 106-353—OCT. 24, 2000

PUBLIC LAW 106-353—OCT. 24, 2000

114 STAT. 1375

Public Law 106-353
106th Congress

An Act

Oct. 24, 2000
[H.R. 4275]

To establish the Colorado Canyons National Conservation Area and the Black Ridge Canyons Wilderness, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SECTION 1. SHORT TITLE.

This Act may be cited as the "Colorado Canyons National Conservation Area and Black Ridge Canyons Wilderness Act of 2000".

SEC. 2. FINDINGS AND PURPOSE.

(a) FINDINGS.—Congress finds that certain areas located in the Grand Valley in Mesa County, Colorado, and Grand County, Utah, should be protected and enhanced for the benefit and enjoyment of present and future generations. These areas include the following:

(1) The areas making up the Black Ridge and Ruby Canyons of the Grand Valley and Rabbit Valley, which contain unique and valuable scenic, recreational, multiple use opportunities (including grazing), paleontological, natural, and wildlife components enhanced by the rural western setting of the area, provide extensive opportunities for recreational activities, and are publicly used for hiking, camping, and grazing, and are worthy of additional protection as a national conservation area.

(2) The Black Ridge Canyons Wilderness Study Area has wilderness value and offers unique geological, paleontological, scientific, and recreational resources.

(b) PURPOSE.—The purpose of this Act is to conserve, protect, and enhance for the benefit and enjoyment of present and future generations the unique and nationally important values of the public lands described in section 4(b), including geological, cultural, paleontological, natural, scientific, recreational, environmental, biological, wilderness, wildlife education, and scenic resources of such public lands, by establishing the Colorado Canyons National Conservation Area and the Black Ridge Canyons Wilderness in the State of Colorado and the State of Utah.

SEC. 3. DEFINITIONS.

In this Act:

(1) CONSERVATION AREA.—The term "Conservation Area" means the Colorado Canyons National Conservation Area established by section 4(a).

16 USC
460mm-1.

Colorado
Canyons
National
Conservation
Area and Black
Ridge Canyons
Wilderness Act of
2000.
Utah.
16 USC 460mm
note.
16 USC
460mm.

(2) COUNCIL.—The term "Council" means the Colorado Canyons National Conservation Area Advisory Council established under section 8.

(3) MANAGEMENT PLAN.—The term "management plan" means the management plan developed for the Conservation Area under section 6(h).

(4) MAP.—The term "Map" means the map entitled "Proposed Colorado Canyons National Conservation Area and Black Ridge Canyons Wilderness Area" and dated July 18, 2000.

(5) SECRETARY.—The term "Secretary" means the Secretary of the Interior, acting through the Director of the Bureau of Land Management.

(6) WILDERNESS.—The term "Wilderness" means the Black Ridge Canyons Wilderness so designated in section 5.

SEC. 4. COLORADO CANYONS NATIONAL CONSERVATION AREA.

(a) IN GENERAL.—There is established the Colorado Canyons National Conservation Area in the State of Colorado and the State of Utah.

(b) AREAS INCLUDED.—The Conservation Area shall consist of approximately 122,300 acres of public land as generally depicted on the Map.

SEC. 5. BLACK RIDGE CANYONS WILDERNESS DESIGNATION.

Certain lands in Mesa County, Colorado, and Grand County, Utah, which comprise approximately 75,550 acres as generally depicted on the Map, are hereby designated as wilderness and therefore as a component of the National Wilderness Preservation System. Such component shall be known as the Black Ridge Canyons Wilderness.

SEC. 6. MANAGEMENT.

(a) CONSERVATION AREA.—The Secretary shall manage the Conservation Area in a manner that—

(1) conserves, protects, and enhances the resources of the Conservation Area specified in section 2(b); and

(2) is in accordance with—

(A) the Federal Land Policy and Management Act of 1976 (43 U.S.C. 1701 et seq.); and

(B) other applicable law, including this Act.

(b) USES.—The Secretary shall allow only such uses of the Conservation Area as the Secretary determines will further the purposes for which the Conservation Area is established.

(c) WITHDRAWALS.—Subject to valid existing rights, all Federal land within the Conservation Area and the Wilderness and all land and interests in land acquired for the Conservation Area or the Wilderness by the United States are withdrawn from—

(1) all forms of entry, appropriation, or disposal under the public land laws;

(2) location, entry, and patent under the mining laws; and

(3) the operation of the mineral leasing, mineral materials, and geothermal leasing laws, and all amendments thereto. Nothing in this subsection shall be construed to affect discretionary authority of the Secretary under other Federal laws to grant, issue, or renew rights-of-way or other land use authorizations consistent with the other provisions of this Act.

(d) OFF-HIGHWAY VEHICLE USE.—

16 USC
460mm-2.

16 USC
460mm-3, 1132
note.

16 USC
460mm-4.

(1) IN GENERAL.—Except as provided in paragraph (2), use of motorized vehicles in the Conservation Area—

(A) before the effective date of a management plan under subsection (h), shall be allowed only on roads and trails designated for use of motor vehicles in the management plan that applies on the date of the enactment of this Act to the public lands in the Conservation Area; and

(B) after the effective date of a management plan under subsection (h), shall be allowed only on roads and trails designated for use of motor vehicles in that management plan.

(2) ADMINISTRATIVE AND EMERGENCY RESPONSE USE.—Paragraph (1) shall not limit the use of motor vehicles in the Conservation Area as needed for administrative purposes or to respond to an emergency.

(e) WILDERNESS.—Subject to valid existing rights, lands designated as wilderness by this Act shall be managed by the Secretary, as appropriate, in accordance with the Wilderness Act (16 U.S.C. 1131 et seq.) and this Act, except that, with respect to any wilderness areas designated by this Act, any reference in the Wilderness Act to the effective date of the Wilderness Act shall be deemed to be a reference to the date of the enactment of this Act.

(f) HUNTING, TRAPPING, AND FISHING.—

(1) IN GENERAL.—Hunting, trapping, and fishing shall be allowed within the Conservation Area and the Wilderness in accordance with applicable laws and regulations of the United States and the States of Colorado and Utah.

(2) AREA AND TIME CLOSURES.—The head of the Colorado Division of Wildlife (in reference to land within the State of Colorado), the head of the Utah Division of Wildlife (in reference to land within the State of Utah), or the Secretary after consultation with the Colorado Division of Wildlife (in reference to land within the State of Colorado) or the head of the Utah Division of Wildlife (in reference to land within the State of Utah), may issue regulations designating zones where, and establishing limited periods when, hunting, trapping, or fishing shall be prohibited in the Conservation Area or the Wilderness for reasons of public safety, administration, or public use and enjoyment.

(g) GRAZING.—

(1) IN GENERAL.—Except as provided by paragraph (2), the Secretary shall issue and administer any grazing leases or permits in the Conservation Area and the Wilderness in accordance with the same laws (including regulations) and Executive orders followed by the Secretary in issuing and administering grazing leases and permits on other land under the jurisdiction of the Bureau of Land Management.

(2) GRAZING IN WILDERNESS.—Grazing of livestock in the Wilderness shall be administered in accordance with the provisions of section 4(d)(4) of the Wilderness Act (16 U.S.C. 1133(d)(4)), in accordance with the guidelines set forth in Appendix A of House Report 101-405 of the 101st Congress.

(h) MANAGEMENT PLAN.—

(1) IN GENERAL.—Not later than 3 years after the date of the enactment of this Act, the Secretary shall develop a comprehensive management plan for the long-range protection

and management of the Conservation Area and the Wilderness and the lands described in paragraph (2)(E).

(2) PURPOSES.—The management plan shall—

(A) describe the appropriate uses and management of the Conservation Area and the Wilderness;

(B) take into consideration any information developed in studies of the land within the Conservation Area or the Wilderness;

(C) provide for the continued management of the utility corridor, Black Ridge Communications Site, and the Federal Aviation Administration site as such for the land designated on the Map as utility corridor, Black Ridge Communications Site, and the Federal Aviation Administration site;

(D) take into consideration the historical involvement of the local community in the interpretation and protection of the resources of the Conservation Area and the Wilderness, as well as the Ruby Canyon/Black Ridge Integrated Resource Management Plan, dated March 1998, which was the result of collaborative efforts on the part of the Bureau of Land Management and the local community; and

(E) include all public lands between the boundary of the Conservation Area and the edge of the Colorado River and, on such lands, the Secretary shall allow only such recreational or other uses as are consistent with this Act.

(i) NO BUFFER ZONES.—The Congress does not intend for the establishment of the Conservation Area or the Wilderness to lead to the creation of protective perimeters or buffer zones around the Conservation Area or the Wilderness. The fact that there may be activities or uses on lands outside the Conservation Area or the Wilderness that would not be allowed in the Conservation Area or the Wilderness shall not preclude such activities or uses on such lands up to the boundary of the Conservation Area or the Wilderness consistent with other applicable laws.

(j) ACQUISITION OF LAND.—

(1) IN GENERAL.—The Secretary may acquire non-federally owned land within the exterior boundaries of the Conservation Area or the Wilderness only through purchase from a willing seller, exchange, or donation.

(2) MANAGEMENT.—Land acquired under paragraph (1) shall be managed as part of the Conservation Area or the Wilderness, as the case may be, in accordance with this Act.

(k) INTERPRETIVE FACILITIES OR SITES.—The Secretary may establish minimal interpretive facilities or sites in cooperation with other public or private entities as the Secretary considers appropriate. Any facilities or sites shall be designed to protect the resources referred to in section 2(b).

(l) WATER RIGHTS.—

(1) FINDINGS.—Congress finds that—

(A) the lands designated as wilderness by this Act are located at the headwaters of the streams and rivers on those lands, with few, if any, actual or proposed water resource facilities located upstream from such lands and few, if any, opportunities for diversion, storage, or other uses of water occurring outside such lands that would adversely affect the wilderness or other values of such lands;

Deadline.

(B) the lands designated as wilderness by this Act generally are not suitable for use for development of new water resource facilities, or for the expansion of existing facilities;

(C) it is possible to provide for proper management and protection of the wilderness and other values of such lands in ways different from those utilized in other legislation designating as wilderness lands not sharing the attributes of the lands designated as wilderness by this Act.

(2) **STATUTORY CONSTRUCTION.**—

(A) Nothing in this Act shall constitute or be construed to constitute either an express or implied reservation of any water or water rights with respect to the lands designated as a national conservation area or as wilderness by this Act.

(B) Nothing in this Act shall affect any conditional or absolute water rights in the State of Colorado existing on the date of the enactment of this Act.

(C) Nothing in this subsection shall be construed as establishing a precedent with regard to any future national conservation area or wilderness designations.

(D) Nothing in this Act shall be construed as limiting, altering, modifying, or amending any of the interstate compacts or equitable apportionment decrees that apportion water among and between the State of Colorado and other States.

(3) **COLORADO WATER LAW.**—The Secretary shall follow the procedural and substantive requirements of the law of the State of Colorado in order to obtain and hold any new water rights with respect to the Conservation Area and the Wilderness.

(4) **NEW PROJECTS.**—

(A) As used in this paragraph, the term “water resource facility” means irrigation and pumping facilities, reservoirs, water conservation works, aqueducts, canals, ditches, pipelines, wells, hydropower projects, and transmission and other ancillary facilities, and other water diversion, storage, and carriage structures. Such term does not include any such facilities related to or used for the purpose of livestock grazing.

(B) Except as otherwise provided by section 6(g) or other provisions of this Act, on and after the date of the enactment of this Act, neither the President nor any other officer, employee, or agent of the United States shall fund, assist, authorize, or issue a license or permit for the development of any new water resource facility within the wilderness area designated by this Act.

(C) Except as provided in this paragraph, nothing in this Act shall be construed to affect or limit the use, operation, maintenance, repair, modification, or replacement of water resource facilities in existence on the date of the enactment of this Act within the boundaries of the Wilderness.

(5) **BOUNDARIES ALONG COLORADO RIVER.**—(A) Neither the Conservation Area nor the Wilderness shall include any part of the Colorado River to the 100-year high water mark.

(B) Nothing in this Act shall affect the authority that the Secretary may or may not have to manage recreational uses on the Colorado River, except as such authority may be affected by compliance with paragraph (3). Nothing in this Act shall be construed to affect the authority of the Secretary to manage the public lands between the boundary of the Conservation Area and the edge of the Colorado River.

(C) Subject to valid existing rights, all lands owned by the Federal Government between the 100-year high water mark on each shore of the Colorado River, as designated on the Map from the line labeled “Line A” on the east to the boundary between the States of Colorado and Utah on the west, are hereby withdrawn from—

- (i) all forms of entry, appropriation, or disposal under the public land laws;
- (ii) location, entry, and patent under the mining laws; and
- (iii) the operation of the mineral leasing, mineral materials, and geothermal leasing laws.

SEC. 7. MAPS AND LEGAL DESCRIPTIONS.

16 USC
460mm-5.

(a) **IN GENERAL.**—As soon as practicable after the date of the enactment of this Act, the Secretary shall submit to Congress a copy of the Map and a legal description of the Conservation Area and of the Wilderness.

(b) **FORCE AND EFFECT.**—The Map and legal descriptions shall have the same force and effect as if included in this Act, except that the Secretary may correct clerical and typographical errors in the Map and the legal descriptions.

(c) **PUBLIC AVAILABILITY.**—Copies of the Map and the legal descriptions shall be on file and available for public inspection in—

- (1) the Office of the Director of the Bureau of Land Management;
- (2) the Grand Junction District Office of the Bureau of Land Management in Colorado;
- (3) the appropriate office of the Bureau of Land Management in Colorado, if the Grand Junction District Office is not deemed the appropriate office; and
- (4) the appropriate office of the Bureau of Land Management in Utah.

(d) **MAP CONTROLLING.**—Subject to section 6(i)(3), in the case of a discrepancy between the Map and the descriptions, the Map shall control.

SEC. 8. ADVISORY COUNCIL.

16 USC
460mm-6.
Deadline.

(a) **ESTABLISHMENT.**—Not later than 6 months after the date of the enactment of this Act, the Secretary shall establish an advisory council to be known as the “Colorado Canyons National Conservation Area Advisory Council”.

(b) **DUTY.**—The Council shall advise the Secretary with respect to preparation and implementation of the management plan, including budgetary matters, for the Conservation Area and the Wilderness.

(c) **APPLICABLE LAW.**—The Council shall be subject to—

- (1) the Federal Advisory Committee Act (5 U.S.C. App.); and

(2) the Federal Land Policy and Management Act of 1976 (43 U.S.C. 1701 et seq.).

(d) **MEMBERS.**—The Council shall consist of 10 members to be appointed by the Secretary including, to the extent practicable:

(1) A member of or nominated by the Mesa County Commission.

(2) A member nominated by the permittees holding grazing allotments within the Conservation Area or the Wilderness.

(3) A member of or nominated by the Northwest Resource Advisory Council.

(4) Seven members residing in, or within reasonable proximity to, Mesa County, Colorado, with recognized backgrounds reflecting—

(A) the purposes for which the Conservation Area or Wilderness was established; and

(B) the interests of the stakeholders that are affected by the planning and management of the Conservation Area and the Wilderness.

16 USC
460mm-7.

SEC. 9. PUBLIC ACCESS.

(a) **IN GENERAL.**—The Secretary shall continue to allow private landowners reasonable access to inholdings in the Conservation Area and Wilderness.

(b) **GLADE PARK.**—The Secretary shall continue to allow public right of access, including commercial vehicles, to Glade Park, Colorado, in accordance with the decision in Board of County Commissioners of Mesa County v. Watt (634 F. Supp. 1265 (D.Colo.; May 2, 1986)).

Approved October 24, 2000.

LEGISLATIVE HISTORY—H.R. 4275:

SENATE REPORTS: No. 106-460 (Comm. on Energy and Natural Resources).

CONGRESSIONAL RECORD, Vol. 146 (2000):

July 25, considered and passed House.

Oct. 5, considered and passed Senate.

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SCIENCE PLAN
FOR
GUNNISON GORGE NATIONAL CONSERVATION
AREA
JULY 2013



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SECTION 1– INTRODUCTION AND SCIENTIFIC MISSION

PURPOSE OF NLCS 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). This system encompasses nearly 900 units spread across approximately 27 million acres of public lands managed by the Bureau of Land Management (BLM). The BLM is mandated to conserve, protect and restore the outstanding cultural, ecological, and scientific values of NLCS units.

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

The objectives of NLCS 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 NLCS units are considered ‘living’ documents and should be revised and updated frequently (e.g. 3-5 years). 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.

UNIT DESCRIPTION

Gunnison Gorge National Conservation Area and Wilderness (GGNCA) was designated by Congress in 1999 in recognition of its outstanding geologic, scenic, wilderness, recreational, and scientific resources. GGNCA is located approximately 10 miles northeast of Montrose, Colorado within the boundaries of the BLM Uncompahgre Field Office (UFO). GGNCA is bordered by the Black Canyon of the Gunnison National Park and originally encompassed 57,725 acres of public land as designated in the Black Canyon of the Gunnison National Park and Gunnison Gorge National Conservation Area Act of 1999 (Public Law 106-76). However, GGNCA expanded to 62,844 acres with the Black Canyon of the Gunnison Boundary Revision Act of 2003 (PL 108-78). GGNCA includes the Gunnison Gorge Wilderness (17,784 acres) and 22 river miles of the Gunnison River. Fourteen of these river miles pass through the wilderness (Figure 1).

GGNCA is composed of adobe badlands formations, sagebrush flats, oakbrush parks, piñon-juniper slopes, river canyons, and mesas, along with the plants and animals found in these habitats. Elevations

range from 5,000ft to 9,000ft and are part of the Gunnison uplift, cut by the Gunnison and Uncompahgre Rivers (BLM 2001). The climate is semi-arid to arid with variable precipitation, ranging from approximately 9 to 14 inches annually (Colorado Climate Center 2010). Temperatures also vary but range from near 0°F in January to approaching 90°F in July (Colorado Climate Center 2010). GGNCA has significant cultural resources and recreational value.

UNIT'S RESOURCE MANAGEMENT PLAN (RMP)

The GGNCA RMP was completed in 2004 and included the NCA as well as additional public, private, and state lands totaling 196,000 acres of land (BLM 2004, Appendix A). The following mission statement from the RMP provides an underlying vision for managing GGNCA and the associated planning area:

“The BLM will manage the NCA to protect the resources in accordance with the designating legislation, FLPMA, the Wilderness Act of 1964, as amended, and other applicable provisions of the law. The BLM will incorporate multiple uses to the extent that important resources are protected and the combination of uses takes into account the long-term needs of future generations for renewable and nonrenewable resources. The purpose of the planning effort is to establish an integrated guiding plan for future site-specific analysis and decisions that maintains or improves existing conditions to meet or exceed Colorado BLM Land Health Standards (BLM 2004).”

The RMP focuses management on ecosystem management; that is management based on the ecological system instead of a single species or resource. Morrissey et al. (1994) defines ecosystem-based management as “the integration of ecological, economic, and social principles to manage biological and physical systems in a manner safeguarding the long-term ecological sustainability, natural diversity, and productivity of the landscape.” The goal of BLM ecosystem management is “to develop and implement management that conserves, restores, and maintains the ecological integrity, productivity, and biological diversity of public lands” (Morrissey et al. 1994). One mechanism to achieve integrated, ecosystem-based management is to utilize an adaptive approach to management (defined by, for example, Noss and Cooperider 1994, Reever Morghan et al. 2006, Williams et al. 2007), where management actions are treated as scientific experiments. In doing so, assumptions are tested, actions and outcomes are monitored, and future management actions are refined based on the results.

The Gunnison Gorge RMP was the first BLM plan to incorporate the Benefits-Based Management (BBM) approach for recreation management in a RMP-level document. The BLM partnered with Arizona State University on the development of BBM visitor surveys that were used to gather information on visitor profiles prior to the start of the planning process. In general, this approach requires managers, to consider the benefits to users in balance with resource protection.

The RMP designated six management zones based on ‘a particular geographic area’s public land resources, uses, and values relative to the goals and objectives of the RMP’ (BLM 2004, Table 1). The plan designated three Areas of Critical Environmental Concern (ACEC): the Native Plant Community

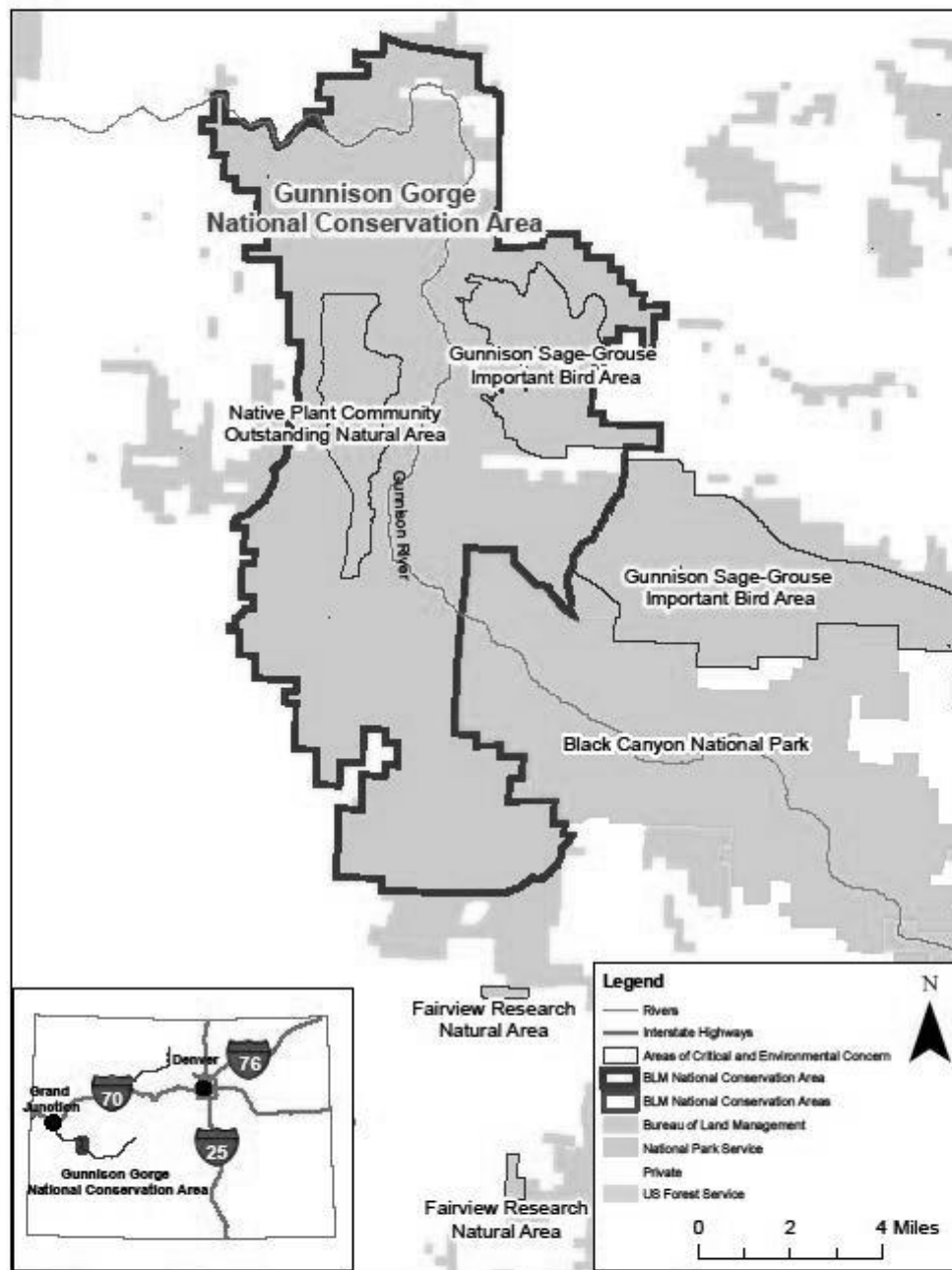
ACEC and Outstanding Natural Area (3,800 acres), the Gunnison Sage Grouse ACEC/Important Bird Area (22,200 acres), which also has a portion outside of GGNCA, and the Fairview Native Plant ACEC (160 acres) (Figure 1). The RMP also identified three Special Recreation Management Areas (SRMA's): the Gunnison Gorge Wilderness SRMA (17,784 acres), the Flat Top-Peach Valley OHV SRMA (9,754 acres), and the Gunnison and North Fork River SMRA (13,502 acres) which was designated to enhance riparian and recreation resources.

GGNCA receives approximately 90,000 visitors a year, 17,700 of which visit the Wilderness. There are four major vehicle entrances to GGNCA and four major wilderness trailheads. There are over 60 dispersed campsites, trailheads, overlooks, and other high-use areas. GGNCA has over 65 miles of designated roads and over 126 miles of designated trails. In 2005, an assessment of use allocation was conducted in the Wilderness area, including feedback from Gunnison Gorge commercial outfitters, in order to begin development of the RMP's Wilderness Recreation Strategy (BLM 2005).

Table 1 – GGNCA management zones identified in the RMP (BLM 2004).

Management Unit	Acres of Public Land	Percentage of Planning Area	Important Values, Resources, or Land Uses
1	17,784	19	Protect Wilderness (Gunnison Gorge Wilderness)
2	9,754	10	Enhance natural, scenic, and recreational values (Flat Top-Peach Valley OHV Recreation Area)
3	13,502	14	Protect and enhance riparian and recreation resources (Gunnison and North Fork Rivers Special Recreation Management Area (SRMA))
4	22,200	23	Protect Gunnison sage grouse (<i>Centrocercus minimus</i>), elk (<i>Cervus elaphus</i>), and mule deer (<i>Odocoileus hemionus</i>) winter concentration (Gunnison Sage-Grouse Area of Critical Environmental Concern (ACEC)/ Important Bird Area (IBA))
5	3,785	4	Protect native plants (Native Plant Community ACEC/Outstanding Natural Area (ONA))
6	28,755	30	Provide for multiple use under common management

Figure 1 – Map of Gunnison Gorge National Conservation Area and surrounding area.



This map was produced by the Grand Junction Field Office September 2012

SCIENTIFIC MISSION

Science in National Landscape Conservation System (NLCS) units is defined broadly as ‘including basic and applied research in natural and social science, as well as inventory and monitoring initiatives’ (BLM 2007). In addition, within NLCS 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 (e.g. BLM 2007, BLM 2008); it is essentially 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 in GGNCA. Scientific efforts within GGNCA should support the conservation, protection, and restoration values identified in the designating language, such as ecosystem resiliency and function, land health, diversity and viability of plant and animal populations, and cultural and paleontological sites. Since GGNCA is managed for multiple-use, some level of resource disturbance is inevitable (e.g. from grazing and recreational use). Scientific knowledge can provide information to ensure the authorized uses do not negatively impact GGNCA’s conservation mission.

Specifically, it is the scientific mission of GGNCA to:

- 1) Allow and encourage pertinent science that can directly or indirectly:
 - a. inform management decisions and evaluate management methods;
 - b. improve and maintain GGNCA’s resources, objects, and values;
 - c. improve and maintain ecosystem resiliency and function;
 - d. improve and maintain land health, and address land health concerns;
 - e. maintain diversity and viability of plant and animal populations;
 - f. preserve and understand socio-cultural and paleontological sites;
 - g. improve understanding of the impacts of authorized uses; and,
 - h. improve understanding, development, and implementation of best management practices.
- 2) Allow and encourage:
 - a. long term and short term investigations;
 - b. internal and external scientific investigations; and,
 - c. scientific inquiry across diverse disciplines, as appropriate.
- 3) Serve as a model system for surrounding areas, so that scientific findings can be exported to other federal and non-federal lands.

SECTION 2 – SCIENTIFIC BACKGROUND

Past and present research in GGNCA is abundant and has covered a diverse array of topics, including studies on vegetation, wildlife, paleontology, archaeology, and the impacts of recreation (Section 9 - Bibliography of published studies related to GGNCA). The following is a brief review of subjects, topics, and areas of research that have been published about GGNCA, or that are directly relevant to GGNCA. Some of the research is also linked with the bordering Black Canyon of the Gunnison National Park.

In addition to the scientific research above, ongoing monitoring of resources is a large portion of the science conducted in GGNCA. Monitoring in GGNCA is used to 'assess resource conditions, identify resource conflicts, and determine if resource objectives are being met, and periodically refine and update desired conditions and management strategies' (BLM 2004). Monitoring can be useful for determining: areas of resource decline, background information for scientific inquiries, early indicators of invasive weeds, stability of cultural and paleontological resources, effectiveness of management activities, and the identification of new concerns and needs for scientific research.

VEGETATION

GGNCA is home to several distinct vegetation communities including salt-desert shrublands, semi-desert grasslands on sandstone derived soils, piñon-juniper woodlands on shallow soils, big sagebrush flats on deeper soils, and oakbrush dominated sites at higher elevations (BLM 2001). In addition, pockets of aspen can be found at the highest elevations and riparian vegetation along river corridors (BLM 2001). Numerous sensitive plant species and communities exist in GGNCA (BLM 2013).

Vegetation research efforts in GGNCA include:

The Colorado Natural Heritage Program's (CNHP; www.cnhp.colostate.edu) studies in GGNCA on sensitive and rare species (Decker 2005, Panjabi and Anderson 2004, Lyon and Denslow 2001, Lyon et al. 1999). CNHP projects included:

- establishing permanent monitoring plots for endangered clay-loving wild buckwheat (*Eriogonum pelinophilum*);
- designing rapid, cost efficient monitoring programs for four additional rare species: Uinta Basin hookless cactus (*Sclerocactus wetlandicus*), Delta lomatium (*Lomatium concinnum*), Rocky Mountain thistle (*Cirsium perplexans*), and good neighbor bladderpod (*Lesquerella vicina*);
- mapping the extent of sensitive native plant communities in the Native Plant ACEC; and,
- conducting inventories for endangered and rare plants on 5,700 acres of the conservation area (report available upon request, Uncompahgre Field Office, UFO).

Internal BLM research has examined the effectiveness of planting cottonwood poles and willow cuttings at eleven sites in GGNCA (BLM 2008).

Pinyon woodland stand structure-historic range of variation research was conducted by the University of Colorado, Boulder (Eisenhart 2004).

USGS research examined the tie between plant community condition, rare plants, and mancos shale-derived soils (USGS unpublished report).

General vegetation monitoring efforts within GGNCA include:

- The BLM monitors land health at 33 sites (evaluated every 10 years) in GGNCA, beginning in 2001. As one aspect of land health monitoring, the status and trend of vegetation is measured and analyzed to determine if established land health standards are being met. This information is then used to rate landscapes as 'meeting', 'meeting with problems', or 'not meeting' land health standards. These ratings are used to inform management actions.
- The effects of vegetation treatments (e.g. burned area rehabilitation projects, tree or shrub removal plus seeding, typically implemented to improve habitat for deer, elk or sage grouse, or reduce fuels) are monitored at 2, 5, and 10 year intervals following the treatment.

Invasive plants are present throughout GGNCA and are actively managed. Annual inventories of invasive plants and noxious weeds, via photo points and field inspections, are conducted in partnership with Delta and Montrose counties. The following list provides some details on the non-native plants present and management responses:

- Tamarisk (*Tamarix spp.*) is an invasive shrub that can exclude native riparian vegetation and alter native systems through changes to water flow, wildlife habitat, and soil properties (Di Tomasso 1998). A biological control agent, the tamarisk beetle (*Diorhabda carinulata*) was released in Colorado in 2005 to control this species. Research is on-going to test its efficacy (Palisade Insectory; Colorado State University). In GGNCA, numerous projects and partner groups have worked on Tamarisk control, including: Delta County's tamarisk/noxious weed eradication program, the Tamarisk Coalition, and the Denver Botanic Gardens.
- Russian knapweed (*Acroptilon repens*) is an aggressive weed which competes with native vegetation in several ways, including the production of allelopathic substances and an ability to grow from seed or hearty root masses (Maddox et al. 1985). Control of this weed can be difficult and biological agents may increase chances of longer term suppression.
- Hoary cress, also known as whitetop (*Cardaria draba*), is a rhizomatous perennial plant that invades rangelands and can be abundant on alkali soils (Jacobs 2007). This species spreads by rhizomes, which can be extensive, as well as seed, and produces allelopathic chemicals that may inhibit the growth of other plant species (Jacobs 2007).
- The invasive species cheatgrass (*Bromus tectorum*) is an aggressive invader present throughout much of the arid west (Pellant 1996). Cheatgrass has changed historic fire regimes and increased the likelihood of more frequent fires (Pellant 1996). Managers have often tried to mitigate the spread of cheatgrass by reseeding after fires; however, there is uncertainty as to this method's effectiveness (Getz and Baker 2008).

- Halogeton (*Halogeton glomeratus*) is a native of China that was introduced to the United States in the early 1900s and rapidly spread throughout the west (Davis et al. 2009). Halogeton usually invades previously disturbed communities, but once established may out-compete native vegetation. Halogeton can rapidly use summer rainfall for growth and seed production, produces seeds that can germinate anytime and seeds that can survive for long periods, which make it well adapted to the erratic desert weather (Davis et al 2009). It does well on alkaline soils and can be toxic to livestock (Whitson et al. 2009).
- To control yellow toadflax (*Lunaria vulgaris*) and dalmation toadflax (*Linaria genistifloia spp. dalmatica*), a noctuid moth (*Calophasia lunula*) has been released, with limited success. A new agent (*Mecinus janthinus*) may be released for control of yellow toadflax (Colorado Department of Agriculture 2011).
- Invasive thistles in and around GGNCA include: musk thistle (*Carduus nutans*), Canada thistle (*Cirsium arvense*), Scotch thistle (*Onopordum acanthium*), and bull thistle (*Cirsium vulgare*). The thistle seed weevil (*Rhinocyllus conicus*) was released to control Musk thistle (*Carduus nutans*) in the late 1960's. While this biological agent provides some control of this species it also feeds on native thistles and is no longer released. This weevil is established throughout Colorado and likely offers some control of non-native thistles in GGNCA. This weevil may also be found on Canada thistle, but is not as effective in controlling this species (Wiggins et al 2010).
- Field bindweed (*Convolvulus arvensis*) is typically found in croplands. A small eriophyid mite (*Aceria malherbae*) was released in 1987 in the west to control this invasive species and is established in Colorado and GGNCA (Colorado Department of Agriculture Insectory 2011, Boydston and Williams 2004). Another biological control agent, the bindweed moth (*Tyta luctuosa*) is also being released in Colorado and has been found to overwinter in Mesa county, this first place of documented establishment in the US (Colorado Department of Agriculture Insectory 2011).
- Additionally, several 'early detection, rapid response' invasive plants exist in small populations in GGNCA and surroundings areas. These species are not yet a substantial problem, but should be treated whenever they are found and include: spotted knapweed (*Centaurea stoebe*), diffuse knapweed (*Centaurea diffusa*), leafy spurge (*Euphorbia esula*), and yellow starthistle (*Centaurea solstitialis*).

WILDLIFE

GGNCA houses a variety of upland, riparian, and aquatic species, as well as year-round and migrant bird species, and listed and threatened species. Wildlife serves as one of the main attractions of GGNCA (e.g. parts of the Gunnison River are considered 'gold medal trout waters' by Colorado Parks and Wildlife).

Birds

Gunnison sage grouse (*Centrocercus minimus*; USFWS candidate species for endangered status) are dependent on sagebrush and their population declines have been attributed to decreasing overall habitat and increasing fragmentation of remaining habitat (Oyler-McCance et al. 2001). Within GGNCA the Gunnison Sage Grouse Important Bird Area/ Area of Critical Environmental Concern encompasses

approximately 22,000 acres of sage grouse habitat. This area is home to the Crawford population of Gunnison sage grouse, which occupies both Montrose and Delta Counties. Conservation plans have been published for the Crawford population (BLM 2004, Appendix H; Crawford Area Gunnison sage grouse conservation plan, 2011; available upon request, UFO).

An ongoing project with the USGS has fitted Gunnison sage grouse and elk (*Cervus elaphus*) with GPS transmitters to determine traffic effects on Gunnison sage grouse, habitat use and population dynamics, and elk migration routes (Ouren and Watts 2005a, b). A climate monitoring station was installed on the east side of GGNCA to track weather conditions, which is used to monitor Gunnison sage grouse habitat.

Between 2011 and 2013, 60 sage grouse were captured in the Gunnison Basin and translocated into the Crawford area population in and adjacent to GGNCA. Some birds were fitted with radio collars or GPS transmitters by Colorado Parks and Wildlife (Crawford Area Gunnison Sage-grouse Conservation Plan, 2011). Yearly Gunnison sage grouse lek counts are performed by Colorado Parks and Wildlife and Crawford Working Group in GGNCA.

Vegetation surveys are completed within the ACEC every 10 years by the BLM, results of these are incorporated into BLM land health reports.

An inventory of bird species, relative abundance, and breeding status was conducted within GGNCA in 2011. Prominent habitat types were surveyed. A total of 91 native bird species and 5 non-native bird species were found (Dunne 2011, report available upon request). More broadly, the Colorado Breeding Bird Atlas gives habitat, breeding, and distribution information on bird species found in Colorado, including in GGNCA (Kingery 1998). Information is currently being collected for an updated version.

Raptors, including bald eagles (*Haliaeetus leucocephalus*; USFWS delisted species), peregrine falcons (*Falco peregrines anatum*; USFWS delisted species), and golden eagles (*Aquila chrysaetos*; USFWS species of concern) inhabit GGNCA and locations of some nesting pairs is known.

Burrowing owls (*Athene cunicularia hypugea*; State of Colorado species of concern) are found within GGNCA. Burrowing owls are closely linked to active prairie dog towns and use prairie dog burrows for breeding. Burrowing owl populations decline with declining prairie dog populations (Desmond, Savidge et al. 2000).

The yellow-billed cuckoo (*Coccyzus americanus*; USFWS candidate species for endangered status; Federal Register 2012)). This species may breed in riparian areas in Western Colorado (Laymon 1998), and while it has not been documented within GGNCA, breeding pairs have been documented near the town of Paonia (about 15 miles of GGNCA; Rocky Mountain Bird Observatory, Black Canyon Audubon unpublished data).

Mammals

White-tailed prairie dogs (*Cynomys leucurus*), a keystone species (Kotliar et al. 1999), are found in many areas within GGNCA. Prairie dog towns were mapped by BLM in Peach Valley in 1978-1979 (BLM 2001).

There are numerous threats to prairie dog populations in GGNCA including decreasing habitat and sylvatic plague (*Yersinia pestis*); however it is unknown how these factors affect long term prairie dog populations (Federal Register 2010).

Recent inventory has used both mist netting and acoustic surveys to determine the presence of bats in GGNCA and throughout the Uncompahgre Field Office (Hayes et al. 2009, as well as reports available on request, UFO). Five of the 17 bat species found in western Colorado are considered sensitive wildlife species by the BLM UFO in GGNCA: Townsend's big-eared bat (*Corynorhinus townsendii*), spotted bat (*Euderma maculatum*), Allen's big-eared bat (*Idionycteris phyllotis*), fringed myotis (*Myotis thysanodes*), and Yuma myotis (*Myotis yumanensis*). For over two decades, Colorado Parks and Wildlife has conducted bat surveys at abandoned mines. While white-nosed syndrome has not been found in GGNCA or in Colorado, its spread westward is of concern. Research is ongoing.

Kit fox status in GGNCA is uncertain (*Vulpes macrotis*; State of Colorado endangered species), but their populations may have declined from historic levels. A recent study modeled kit fox habitat in Western Colorado (Reed-Eckert 2010). Ongoing research by Colorado Parks and Wildlife in GGNCA and elsewhere utilizes trapping and hair snares.

Rocky Mountain bighorn sheep (*Ovis canadensis canadensis*) are an iconic animal in Colorado and in GGNCA. Between 1947 and 2007 bighorns were released in Colorado to establish new populations or supplement existing populations (George et al. 2009). Concerns with bighorns include disease, overgrazing, plant community succession and forestation of native ranges, human development, and competition with livestock (George et al. 2009).

Elk (*Cervus elaphis*) and mule deer (*Odocoileus hemionus*) use habitat within GGNCA, especially in winter, and may impact other species (e.g. sage grouse) and habitat (e.g. shrub use). Research by USGS scientists had addressed elk migration routes (Ouren and Watts 2005a, b).

Fish, reptiles, and amphibians

The midget faded rattlesnake (*Crotalus viridis concolor*; BLM sensitive species) is a subspecies of western rattlesnake that ranges from eastern Utah to the Four Corners area, within a range of dry habitats (Stevens 2004). A few individuals have been detected within GGNCA as part of an ongoing research project (Parker and Spear 2013, unpublished data), but accurate population estimates have not been determined, this species may be decreasing with decreasing prairie dog populations (Stevens 2004).

Amphibian species are present within GGNCA, but a baseline has not been scientifically established. Amphibian species have been in decline throughout the world, with poorly understood causal factors (Stuart et al. 2004).

The introduction of whirling disease in the 1990's caused declines in the rainbow trout population of the Gunnison River and stocking of these fish has occurred since 2004 in an attempt to increase populations (Hebein et al. 1998, Schiesler and Fetherman 2010). Research with Colorado Parks and Wildlife is

ongoing and these species may be found within GGNCA. In 2009, BLM researchers surveyed the fish population at the Smith Fork, a perennial tributary to the Gunnison River in the Gunnison Gorge Wilderness. The survey found limited fish, likely attributed to a steep stream gradient and high water temperatures (Fresques unpublished data, report available upon request, UFO).

The bluehead sucker (*Catostomus discobolus*), flannelmouth sucker (*Catostomus latipinnis*), and roundtail chub (*Gila robusta*) are listed as BLM sensitive fish species. These species may be present within GGNCA. Threats to these fish include water diversion and changes to flow regimes and competition with non-native fish (e.g. Rees et al 2005, Bezzerides and Bestgen 2002).

HYDROLOGY AND WATER FLOW

Hydrologic resources include the Gunnison River, North Fork of the Gunnison, and Smith Fork of the Gunnison, as well as other intermittent streams and springs.

Research has addressed sediment distribution and movement within the Gunnison River, especially as it pertains to regulated flows (Dubinski and Wohl 2006, Elliott and Parker 1997). Related research has addressed flows and uses of the Dolores River (Vandas et al 1990), which is a nearby western river.

Baseline surveys of macro-invertebrates have been completed in some perennial streams within GGNCA (information available on request from UFO). Currently surveys follow protocols outlined by the Utah State University National Aquatic Monitoring Center.

Riparian monitoring includes:

- BLM's Proper Functioning Condition (PFC) monitoring (a qualitative assessment) and,
- ground water monitoring wells to track changing water levels and salinity levels (installed in 2009 and 2012).

SOILS

Soils within GGNCA are variable, generally have low potential for plant production, and are susceptible to erosion (BLM 2001).

Research has addressed basic information about the stability of Mancos Shale soils (one of the soil types found within GGNCA, and links between biological soil crusts and soil stability (Carpenter and Chong 2010, Carpenter 2008).

Some research has been done on the composition of Mancos Shale soils especially as it pertains to potential salt run-off into the Colorado River (Whittig et al 1982). Internal research details a study of salinity of the Elephant Skin Wash area of GGNCA (Murphy 1990, Available upon request, UFO).

From 2003 to 2008 the BLM participated in the 'Mancos Shale Landscape Project'. This project involved studies in regional geochemistry, geologic and soil mapping, digital elevation and GIS modeling, soil and rock mineralogy, remote sensing, landscape classifications, erosion processes, and inventories of

Mancos vegetation communities. The U. S. Geological Survey (USGS) website provides information on this project including data, research updates, summaries, maps, Landsat and LIDAR imagery, and scientist contact information (USGS 2013).

In 2006, the BLM tested the feasibility of using close-range photogrammetry to collect three-dimensional data to detect and monitor hill slope erosion processes and the effects of surface disturbance in Mancos Shale soils (report available on request from UFO).

From 2007 to 2011, the USGS used ground-based LIDAR imagery to measure disturbed and undisturbed Mancos Shale hill slopes in the GGNCA and to detect and quantify changes in surface soil elevations (information available on request, UFO).

In 2008 and 2009, seasonal GeoCorps interns inventoried, mapped, and documented erosion and invasive weed areas on over 1,200 salinity control check dam structures in GGNCA's Mancos Shale areas (data available on request from UFO).

In 2010, BLM, USGS, and NPS hydrologists conducted preliminary hydrologic function assessments and water testing on the network of irrigation canals and natural arroyos in a newly acquired GGNCA inholding. Water in these channels cuts through highly erosive Mancos Shale soils picking up increasingly higher loads of salinity and selenium, which can cause water quality and fish toxicity problems in the lower Gunnison and Colorado River systems (Grand Basin and Grand Valley selenium task forces 2013).

GEOLOGY AND PALEONTOLOGY

The geologic history of western Colorado (Kirkham et al 2002, O'Sullivan 1992) in general, and Gunnison Gorge in particular (Kellog 2004, Aslan et al. 2008) have been extensively studied including: how rock layers were formed, uplifted, and eroded, as well as information on fault-lines in the area and the geologic history of the Gunnison River.

In 2002, a BLM report provided an overview and analysis of the paleontological resources and known fossil localities of the GGNCA (Armstrong 2002, report available on request from UFO). A subsequent study documented the Molluscan fossils in GGNCA (Merewether et al. 2006).

Jurassic and Cretaceous paleontological localities have been identified by BLM seasonal GeoCorps interns. Cretaceous age dinosaur trackways (including dinosaur skin imprints), particularly the Suncliff Canyon trackway, have been studied in GGNCA, information available upon request UFO.

CULTURAL RESOURCES AND ARCHAEOLOGY

The archaeological record of the GGNCA spans the known pre-history of North America.

Ongoing research at the Eagle Rock shelter in the northern extent of the gorge has discovered human occupational deposits dating back as far as 12,880 years ago, making the site one of the oldest known Clovis occupation sites in the nation (more information available, UFO). Since 2006, Western Wyoming

College has worked closely with the BLM on excavations of prehistoric deposits and documentation of rock art at the site (research is ongoing, more information available from UFO). Analysis and reporting of this project is in progress.

Other known cultural sites in GGNCA include: archaic period rock art, campsites and hunting stands, formative era occupations and evidence of corn horticulture, late prehistoric and historic period Ute occupations and rock art, historic European homesteading, mining and ranching operations, including Howell Village and the “Stemwinder” cattle trail (unpublished data, UFO).

Ongoing research in the GGNCA has been focusing on a discovery of Ute map rocks in the gorge. Sometime between ca. 1600 AD and 1800 AD, Ute people left detailed maps of trails, wildlife and hunting areas inscribed on rock panels in the area. The rock art maps have recently been interpreted with the help of elders from the Ute tribes, and a series of archaeological surveys have been implemented. The trails depicted on these “map rocks” can still be found, and in many cases can provide information valuable to other research. For example, the Smith Canyon map rock shows detailed renderings of a trail system leading through more inaccessible areas of the canyon to areas on the upland benches where figures of sage grouse are depicted. These mapped renderings on the rock panel coincide quite closely with areas that wildlife researchers are examining for their historic and current sage grouse populations. Likewise, the mapped trails with figures of elk closely match locales currently identified by wildlife professionals as elk migration and wintering ranges (unpublished data, UFO). Archaeological survey of these trails and hunting areas is ongoing and may serve to inform current research.

Cultural site inventory and monitoring are performed with volunteers as part of the GGNCA Volunteer Site Steward program.

- Stewards are trained by the BLM archaeologist during an annual training course emphasizing regional cultural history, archaeological ethics, impact assessment, photo-documentation, and record keeping. Site stewards visit their assigned sites on at least a quarterly basis, photograph the site from pre-established points, and keep a regular site assessment log. These logs and photos are kept at the GGNCA cultural resources office and are tracked on the GGNCA site monitor log. In addition to site monitoring, protection and management, volunteers also assist in inventory, site stabilization, and data recovery projects. As of 2012, there were four monitoring teams (eight people) responsible for monitoring six cultural sites eligible for the National Register of Historic Places.

RECREATION

As part of GGNCA’s RMP development, researchers at the BLM partnered with Arizona State University at Tempe on a study of GGNCA visitors to determine their attitudes and preferences in order to help implement benefits-based management (BBM). The study identified baseline visitor profiles and increased understanding of desired user activities, experiences, and benefits derived from recreating in GGNCA. These results informed the development of GGNCA’s fifteen recreation management zones, including identification of the zones’ management objectives and prescriptions (BLM 2004). BLM

managers use this information to inform decisions and balance benefits to users with resource protection.

In 2008, researchers from the University of Idaho examined visitor satisfaction at GGNCA's Chukar Trailhead, following protocols used throughout several western states, and found overall visitor satisfaction to be good (University of Idaho 2008, available on request, UFO).

In 2008, Northern Arizona University developed a human-impact monitoring program that used several impact indicators to rapidly assess recreation areas and recreational impacts. The method was designed to analyze trends in site conditions, determine landscape-level problems versus site-specific problems, and identify key sites for further monitoring. This method involves inventory of riparian and upland recreation sites and cultural sites. These monitoring data can be used to inform the management of designated campsites and implementation of the Gunnison Gorge Wilderness use allocation plan (information available upon request, UFO).

The effects of OHV's (off-highway vehicles, where they are used) on natural resources and socioeconomics were examined by USGS scientists. The project identified mitigation and restoration techniques, in addition to further research and monitoring needs (Ouren et al. 2007).

Ongoing recreation monitoring in GGNCA includes:

- Wilderness and riparian campsite monitoring is performed based on monitoring protocols developed by Northern Arizona University faculty, including the 2008 project described above (protocol available on request, UFO). Data are used to determine visitor use trends, carrying capacities, and resource protection and regulatory needs.
- Visitor use data is collected annually using the Wilderness self-issuing permit program, trailhead registration forms, law enforcement and seasonal river ranger patrol logs, photos and videos, outfitter trip logs, trail counters, and visitor contacts.
- Motorized and mechanized use on trails, roads, and in designated open areas is tracked via trail counters, law enforcement patrols, and contacts by BLM staff and the public. Helmet cams record trail and riding conditions, safety hazards, and maintenance needs.

MANAGEMENT PROJECTS

While land management actions are not typically scientific experiments, their implementation and the monitoring of their outcomes can be used for adaptive management purposes and can identify science needs. A list of management projects can be found in the Manager's reports, beginning in 2006 and published annually (reports available upon request, UFO). Management projects can include habitat treatments, cottonwood plantings, rehabilitation of closed routes, etc. Many times these projects are done with uncertainty in a difficult, arid environment with limited resources. Therefore research, especially in an adaptive management framework, is needed to improve the success of these projects.

Historic grazing and fire, or lack thereof, may have dramatically altered vegetation conditions within GGNCA. Therefore, it is difficult to accurately determine historic conditions. With that in mind reference conditions are not always available, and managers and specialists may need to define what 'restoration' should look like in GGNCA and what will constitute restoration success to have measurable targets.

SECTION 3 – IDENTIFICATION AND PRIORITIZATION OF MANAGEMENT QUESTIONS AND SCIENCE NEEDS

The following is a list of scientific needs, questions, and opportunities within GGNCA. However, this list is not meant to be exhaustive or static. The scientific needs of GGNCA are based on pressing management questions and continually change as management decisions are made and new concerns arise. Thus, the scientific needs will remain fluid and opportunities for research should remain open and inclusive. GGNCA's current science needs are listed in Table 2.

Science needs are prioritized to reflect the needs identified in the Resource Management Plan, needs identified by resource specialists, needs that reflect management and leadership concerns, as well as public concerns. These prioritizations can change based on changing conditions and are not meant to be steadfast or static. Science needs are categorized as high, medium, or low priorities within topic areas (Table 2). These are pragmatic decisions: even low priority science needs are important.

Table 2 – Prioritized science needs by topic area.

TOPIC	PRIORITY	FOCUS AREA	QUESTIONS
Vegetation and Soils	High	Sensitive plants	Genetic studies of Clay-loving wild buckwheat (<i>Eriogonum pelinophilum</i>) to determine species, and the feasibility of population augmentation. What are the habitat requirements of this plant and what are minimum viable populations? What are the effects of human activities, including grazing, on this plant?
			How do sensitive native plants, from the BLM sensitive species list, respond to disturbance and other stressors (recreation, off highway vehicles, livestock use, etc.)?
			What are population trends of sensitive native plant species (upward or downward) and what are the driving factors for these trends?
			What management decisions can influence trends in sensitive native plant populations?
			Where are populations of sensitive plants?
			What are the effects of human activities on hookless cacti populations?
		Riparian communities	What are effective means of restoring and managing degraded riparian communities in altered river systems?
			What are the relationships between river flows, riparian vegetation and riparian weeds?
		Salt Desert shrub community	What methods can be used to successfully restore and manage degraded salt desert shrub sites?
			What restoration techniques are effective in restoring native diversity of grasses (both warm and cool season) and forbs?
		Russian knapweed (non native)	If biological agents are used, what is their effectiveness in terms of suppression and removal of the target species?
			Do management activities (e.g. chemical or mechanical) significantly decrease the cover of this non-native in the presence of the biological agent?
			What is the recovery, in terms of cover and diversity of native plants, when this species is suppressed or removed? What variables influence native plant recovery?
			Does active restoration significantly increase native plant diversity or cover, when Russian knapweed is removed?
			How likely is reinvasion after removal of this species, and what factors influence whether a site is re-invaded or not?
			What native species can compete with this species and under what circumstances (seeding time or method, pre-treatments, mix of species, etc.)?
		Soils/ Hydrology	What are the impacts from multiple uses, for example OHV use, livestock grazing, mountain biking, and other surface-disturbing uses, on Mancos shale soils? Specifically what are impacts to sediment, selenium, and salinity production? How can these be mitigated?
			What are the contributions to soil erosion, salt and selenium loading, sedimentation and dust from OHV use, livestock grazing, mountain biking, and other surface-disturbing uses? How can these be mitigated?
	Medium	Tamarisk (non-native)	How effective are biological controls at long term reduction and suppression this species?
			Are native species able to increase in cover in areas where biological controls have suppressed this species?
			Does mechanical removal of this species provide a significant increase in native species cover and survival?

TOPIC	PRIORITY	FOCUS AREA	QUESTIONS
			When tamarisk is removed, can native plant species recover without active restoration, if so under what circumstances?
			Does percent cover of other invasive or non-native species increase with this species' suppression or removal, under what conditions?
			How are ecosystem processes effected by this species' suppression and removal including: food webs (for example migratory bird diversity and abundance, insect diversity and abundance, native fish abundance and reproduction, etc.), evapotranspiration and water use, nutrient cycling?
		Cheat grass (non-native)	Can inter-seeding native species with this species increase diversity and cover of native plants?
		Halogeton (non-native)	What seeded species, and under what circumstances, can prevent this species' domination after fire?
			How are ecosystem processes affected by this species' invasion including: fire regimes, insect and animal diversity and abundance, soil nutrient cycling, soil crust abundance, and soil microbial communities?
			How can establishment and cover of desirable native plant species be increased in areas currently dominated by halogeton (interseeding, transplants, etc.)?
			After disturbance, how can domination by halogeton be prevented (appropriate seed mixes, measures to help establishment of native species)?
	Low	Ecosystem function	When is piñon-juniper expansion 'encroachment' and when is it a more natural process?
			What role does fire play in piñon-juniper expansion?
			What are appropriate dynamics for native shrub communities (age class structure)?
			What is the likely local fire history?
		Biocontrol agents	How effective are bio-control agents at controlling the target plant (yellow toadflax, Canada and musk thistle, field bindweed)?
			How are the bio-control agents for the species mentioned above affecting native systems and non-target species?
		Whitetop	How well do native species recover after this species' removal?
			Is active restoration necessary to increase native plant cover and diversity?

TOPIC	PRIORITY	FOCUS AREA	QUESTIONS
		(non-native)	How likely is reinvasion after removal of this species and what factors influence whether a site is reinvaded or not?
Wildlife	High	Gunnison sage grouse	How does traffic effect migration patterns and habitat use by sage grouse?
			How are sage grouse using habitat in GGNCA and the surrounding areas?
			How is collecting of antler sheds effecting sage grouse habitat use and at what time of year might this be an issue?
			How effective have habitat treatments been at improving sage grouse habitat? Are sage grouse using treated areas?
		Bats	What are the locations and uses (e.g. roosting, reproduction) of bat inhabited caves and roosts, and which species of bats are present?
			How to gain early detection of the presence of white-nosed syndrome?
		Midget faded rattlesnake	What are the occupied or otherwise important habitats for midget faded rattlesnake populations?
			What is the relationship, if any, between midget faded rattlesnakes and prairie dog towns?
		Reintroduction	What are the population dynamics of midget faded rattlesnakes within GGNCA and what factors contribute to population fluctuations?
			What is the feasibility of reintroduction of native wildlife species, such as kitfox, pronghorn, bighorn sheep? What are the implications for habitat?
	Medium	Raptors	Where are breeding pairs of bald eagles, peregrine falcons, and golden eagles, how many are there, and what are the habitat types where they are found?
			What is the status and trend of habitat used by bald eagles, peregrine falcons, and golden eagles in GGNCA?
		Burrowing Owls	How many burrowing owls are present within GGNCA, including where they are present and in what habitat types?
			What are the population dynamics of burrowing owls within GGNCA and what factors, especially as related to habitat, contribute to population fluctuations?
			How do population dynamics of prairie dogs influence population dynamics of burrowing owls?
		Amphibians	What are the effects of OHV recreation on nest site selection?
			What species of amphibians are present within GGNCA? Where are important habitats and what are the characteristics of important habitats?
	Medium	Recreation	Are populations of amphibians growing, in decline, or stable?
			What are the effects of the open use areas on land health, noise, dust, user conflicts, and safety?

TOPIC	PRIORITY	FOCUS AREA	QUESTIONS
Paleontology	Medium	Paleontology	Identification and interpretation, when appropriate, of known and unknown paleontological sites.

SECTION 4 – MEETING SCIENCE NEEDS

INTERNAL ORGANIZATION

Internal organization is necessary to strategically identify and address science in GGNCA. An NLCS science coordinator has been established for the Dominguez-Escalante, McInnis Canyons, and Gunnison Gorge NCAs to assist in coordination of scientific efforts in these units. The UFO ecologist serves as the GGNCA unit science coordinator, and works with appropriate specialists as needed to address GGNCA science needs. The NLCS and GGNCA science coordinators and the GGNCA manager make up the GGNCA science coordination team.

The role of the coordination team is to:

- 1) Coordinate and collaborate to identify and prioritize GGNCA's science needs;
- 2) Ensure that partners and collaborators are familiar and engaged with GGNCA's documented science needs;
- 3) Coordinate with staff to approve science proposals;
- 4) Engage and remain engaged with partners and collaborators working within GGNCA;
- 5) Ensure that results of scientific inquiries are available to BLM staff, in appropriate formats, including progress and final reports;
- 6) Communicate results of scientific inquiries to researchers, staff, and managers both within and outside of the BLM, and to the general public when appropriate; and,
- 7) As necessary, coordinate and collaborate to update and revise the GGNCA science plan.

Additionally, the GGNCA science coordinator will:

- 8) Conduct needed monitoring and scientific inquiries, as time permits, within GGNCA;
- 9) Interpret long term data and periodically publish results; and,
- 10) Serve as the contact person for scientific inquiries within GGCNA.

COLLABORATION AND PARTNERS

It is imperative that GGNCA have good working relationships with a variety of partners that can assist in the diverse scientific needs of GGNCA. Scientific study is generally not part of the work that BLM field staff performs. However, this type of study can greatly improve the ability of managers to effectively manage these special areas. By partnering with numerous outside entities, the BLM can greatly increase its ability to use science to improve management decisions and actions.

Collaboration between BLM offices, other government agencies, and local universities can help scientists and managers better understand the needs of the area and ongoing science, and can provide opportunities to share information. Management issues are not defined by office boundaries and by sharing knowledge, management outcomes can be improved on larger and larger scales. Also, the success of management efforts in one geographical area will often be dependent on management efforts in another area. Regular conversations between local scientists and managers can help foster these relationships and collaborative opportunities.

GGNCA is part of the Southern Rockies eco-region as defined by the Environmental Protection Agency, and GGNCA will coordinate research needs through Rocky Mountain Cooperative Ecosystem Studies Unit, Uncompahgre Plateau Partnership, North Rim Landscape Strategy, and others as appropriate.

GGNCA has a history of partnering with varied organizations for scientific research and outreach, for example universities, private organizations, community groups, and local, state and other federal agencies. For a more complete list of past and present partners see the GGNCA Manager's reports (reports available upon request, UFO).

SECTION 5 – SCIENCE PROTOCOLS

GUIDELINES FOR SCIENTIFIC RESEARCH

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

- 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 of these types of research.

- 1) All scientific investigation must comply with relevant laws, regulations, and policies, including any permit needs.
- 2) All non-permitted external scientific investigations must be authorized by the GGNCA 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 GGNCA, especially the resources, objects, and values for which GGNCA was designated.
 - a. 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 GGNCA resources, objects, and values.
- 5) Scientists initiating research projects within GGNCA should be aware of existing data within the BLM and should incorporate these data into projects whenever possible.
- 6) Proposed research within the Gunnison Gorge Wilderness Area should comply with appropriate laws and regulations including the Wilderness Act of 1964 and BLM wilderness policy (Manual 6340).
 - a. Proposals must be carefully evaluated for legal and policy compliance, scientific merit, and impacts and benefits (Landres 2000). A set of worksheets may be used by GGNCA to ensure that scientific proposals in Wilderness are evaluated in a consistent way (found here: <http://www.wilderness.net/index.cfm?fuse=toolboxes&sec=resSciAct>).
- 7) GGNCA staff should use all available monitoring protocols to achieve adequate monitoring of the resources of GGNCA (e.g. land health assessments), especially with consideration to the national Assessment, Inventory, and Monitoring Strategy (AIM; BLM 2011).
 - a. For example, staff should use the AIM Strategy's sampling techniques and key ecosystem attributes, as feasible (BLM 2011).

SCIENCE AUTHORIZATIONS

Currently, there is no formal process for scientific authorizations within GGNCA outside of the state-wide process for permitting paleontological and archaeological research. The process described below is not meant to replace or duplicate these processes. When a prior process is already in place, it will take

precedence and researchers will only need to complete one permitting process. The process outlined below will only take effect when no other permitting process applies (e.g. non-paleontological or archeological projects). Permits and authorization projects will be shared between appropriate state and field office staff for research taking place within GGNCA.

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

1. Scientist submits proposal to GGNCA science coordinator.
 - a. Proposals must include:
 - i. Contact information for the principal investigator
 - ii. Summary of proposed research (not to exceed 3 pages) including
 1. A brief explanation of background information;
 2. Rationale for research;
 3. Research methods;
 4. Timeline for field work; and,
 5. Outline of public outreach effort, if appropriate.
2. The proposal will be considered by the GGNCA science coordinator for completeness. The coordinator will consult with the Colorado State Science Coordinator and staff specialists, as appropriate ,to determine if the proposal is:
 - a. Complete;
 - b. Conforms to the GGNCA Science Guidelines (including all relevant laws and regulations);
 - c. Conforms to the GGNCA Resource Management Plan;
 - d. Meets the GGNCA scientific mission.
3. The science coordinator will brief the GGNCA manager on the review of the science proposal. Subsequently, the GGNCA manager (or the manager's designee) will grant or deny authorization to conduct the scientific investigation.
4. If a proposal is denied authorization:
 - a. 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. A determination will be made as to what, if any, NEPA analysis is necessary.
 - b. A letter of authorization will be provided to the scientist, signed by the GGNCA 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.
 - c. The proposal will be added to an internal tracking document of on-going scientific investigations in GGNCA, accessible by all GGNCA staff.
 - d. Minimum reporting requirements for all scientific investigations will include:
 - i. Progress reports (at least annually), filed with the science coordinator.

1. Progress reports should include status of the investigation, areas studied, approximate dates of fieldwork, partners involved, and preliminary findings when possible.
 - ii. Final reports, filed with the science coordinator.
 1. Final reports should include:
 - a. Research background and results;
 - b. Discussion of the results including how the results are relevant to the NLCS unit and potential management decisions;
 - c. A summary of the public outreach effort if appropriate;
 - d. Raw data where appropriate; and,
 - e. Electronic copies of any published papers resulting from the scientific investigation.
 - iii. Manager's summary report
 1. Manager's summary reports are brief presentations (in any appropriate format) of research results to BLM managers, which ensure that:
 - a. Management questions are answered;
 - b. Managers have a full understanding of scientific findings; and,
 - c. Managers can incorporate these findings into their management decisions.
 - iv. If results of research are not sensitive material (for example some cultural and paleontological studies), a public outreach component.
6. The authorization is routed to GGNCA and UFO staff.
 - a. Copies of the authorization will be made available to BLM staff, for example on the shared drive.
 - b. Short descriptions of ongoing research will be made available to the general public, for example on the GGNCA webpage.
 - i. Sensitive topics, for example location of specific cultural or paleontological sites, should be excluded from public information for protection of resources.
7. Research is initiated.
 - a. Research must be conducted according to the stipulations outlined in the authorization.
8. Research is completed, and final report is filed with the science coordinator.

SECTION 6 – ORGANIZATION AND COMMUNICATION OF COMPLETED SCIENCE

INTERNAL ORGANIZATION OF COMPLETED SCIENCE

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

All reports, as described in Section 5, submitted to the GGNCA science coordinator will be stored and organized on a shared drive, or via a similar medium (e.g. a Sharepoint site), accessible by all GGNCA staff. The science coordinator should aim to organize periodic presentations of scientific results to GGNCA staff.

CONTRIBUTIONS TO BROADER BLM ORGANIZATIONS OF COMPLETED SCIENCE

The GGNCA science coordinator will comply, in a timely manner, with all requests for completed scientific investigations' information/reports from BLM Field Offices, District Offices, State Offices, and the Washington D.C. Office.

COMMUNICATING SCIENTIFIC RESULTS TO THE PUBLIC

The science coordinator or coordination team will strive to make information on science projects within GGNCA accessible to the general public, and the GGNCA webpage is a logical place for dissemination of this type of information. GGNCA has a history of communicating with the public about topics of importance to GGNCA through brochures, maps, and other materials. In addition to these types of materials, information may be presented by: links to short informational videos, written descriptions of scientific inquiries occurring within GGNCA, public presentations, and citations of published research papers.

The general public has a vested interest in GGNCA which is heavily utilized by varied outdoor enthusiasts. Sharing what research is occurring (or has occurred) within GGNCA and why it is occurring (or has occurred) should be a priority, and can help avoid confusion and discontent that can stem from misunderstandings about the nature of scientific inquiries. However, while communication with the public is important, sensitive information about certain scientific projects may need to be kept confidential to ensure the protection of these resources.

SECTION 7 – INTEGRATING SCIENCE INTO MANAGEMENT

It is the responsibility of the science coordinator or coordinating team to ensure that scientific findings are communicated to managers. Managers can then use scientific information as they deem appropriate.

Written progress reports, final reports, published papers, and manager's summary will all be available to decision-makers, as described in Section 6, to help inform decisions. Furthermore, direct dialogue between scientists and managers will be encouraged.

SECTION 9 – BIBLIOGRAPHY

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SECTION 8 - SCIENCE PLAN REVIEW AND APPROVAL

SIGNATURE PAGE

I approve the Gunnison Gorge National Conservation Area Science Plan.

This plan will be used as the basis for conducting science in the Gunnison Gorge NCA. "Science" is defined in Section 1 of this plan.

As a living and working document, this plan will be updated no less than every five years, preferably more frequently. 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 unit's scientific mission.



Amanda Clements, Science Coordinator
Gunnison Gorge National Conservation Area

7/23/13

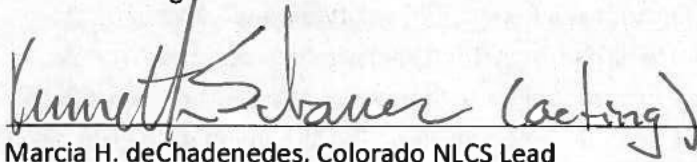
Date



Karen Tucker, Manager
Gunnison Gorge National Conservation Area

7/22/13

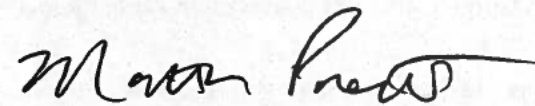
Date



Marcia H. deChadenes, Colorado NLCS Lead
Colorado State Office

9/26/2013

Date



Matt Preston, NLCS Science Coordinator
Washington, D.C.

10/22/13

Date

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SECTION 10 - UNIT'S LEGISLATION: BLACK CANYON OF THE GUNNISON NATIONAL PARK AND GUNNISON GORGE NATIONAL CONSERVATION AREA ACT OF 1999



113 STAT. 1126

PUBLIC LAW 106-76—OCT. 21, 1999

PUBLIC LAW 106-76—OCT. 21, 1999

Public Law 106-76
106th Congress

An Act

Oct. 21, 1999
[S. 323]

To redesignate the Black Canyon of the Gunnison National Monument as a national park and establish the Gunnison Gorge National Conservation Area, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

Black Canyon of the Gunnison National Park and Gunnison Gorge National Conservation Area Act of 1999, Colorado, 16 USC 410fff note, 16 USC 410fff.

SECTION 1. SHORT TITLE.

This Act may be cited as the "Black Canyon of the Gunnison National Park and Gunnison Gorge National Conservation Area Act of 1999".

SEC. 2. FINDINGS.

Congress finds that—

(1) Black Canyon of the Gunnison National Monument was established for the preservation of its spectacular gorges and additional features of scenic, scientific, and educational interest;

(2) the Black Canyon of the Gunnison and adjacent upland include a variety of unique ecological, geological, scenic, historical, and wildlife components enhanced by the serenity and rural western setting of the area;

(3) the Black Canyon of the Gunnison and adjacent land provide extensive opportunities for educational and recreational activities, and are publicly used for hiking, camping, and fishing, and for wilderness value, including solitude;

(4) adjacent public land downstream of the Black Canyon of the Gunnison National Monument has wilderness value and offers unique geological, paleontological, scientific, educational, and recreational resources;

(5) public land adjacent to the Black Canyon of the Gunnison National Monument contributes to the protection of the wildlife, viewshed, and scenic qualities of the Black Canyon;

(6) some private land adjacent to the Black Canyon of the Gunnison National Monument has exceptional natural and scenic value that would be threatened by future development pressures;

(7) the benefits of designating public and private land surrounding the national monument as a national park include greater long-term protection of the resources and expanded visitor use opportunities; and

(8) land in and adjacent to the Black Canyon of the Gunnison Gorge is—

(A) recognized for offering exceptional multiple use opportunities;

BLACK CANYON OF THE GUNNISON NATIONAL PARK AND GUNNISON GORGE NATIONAL CONSERVATION AREA ACT OF 1999

(B) recognized for offering natural, cultural, scenic, wilderness, and recreational resources; and

(C) worthy of additional protection as a national conservation area, and with respect to the Gunnison Gorge itself, as a component of the national wilderness system.

SEC. 3. DEFINITIONS.

16 USC 410fff-1.

In this Act:

(1) **CONSERVATION AREA.**—The term “Conservation Area” means the Gunnison Gorge National Conservation Area, consisting of approximately 57,725 acres surrounding the Gunnison Gorge as depicted on the Map.

(2) **MAP.**—The term “Map” means the map entitled “Black Canyon of the Gunnison National Park and Gunnison Gorge NCA—1/22/99”. The map shall be on file and available for public inspection in the offices of the Department of the Interior.

(3) **PARK.**—The term “Park” means the Black Canyon of the Gunnison National Park established under section 4 and depicted on the Map.

(4) **SECRETARY.**—The term “Secretary” means the Secretary of the Interior.

SEC. 4. ESTABLISHMENT OF BLACK CANYON OF THE GUNNISON NATIONAL PARK.

16 USC 410fff-2.

(a) **ESTABLISHMENT.**—There is hereby established the Black Canyon of the Gunnison National Park in the State of Colorado as generally depicted on the map identified in section 3. The Black Canyon of the Gunnison National Monument is hereby abolished as such, the lands and interests therein are incorporated within and made part of the new Black Canyon of the Gunnison National Park, and any funds available for purposes of the monument shall be available for purposes of the park.

(b) **ADMINISTRATION.**—Upon enactment of this title, the Secretary shall transfer the lands under the jurisdiction of the Bureau of Land Management which are identified on the map for inclusion in the park to the administrative jurisdiction of the National Park Service. The Secretary shall administer the park in accordance with this Act and laws generally applicable to units of the National Park System, including the Act entitled “An Act to establish a National Park Service, and for other purposes”, approved August 25, 1916 (16 U.S.C. 1, 2–4), and the Act entitled “An Act to provide for the preservation of historic American sites, buildings, objects, and antiquities of national significance, and for other purposes, approved August 21, 1935 (16 U.S.C. 461 et seq.).

(c) **MAPS AND LEGAL DESCRIPTION.**—As soon as practicable after the date of the enactment of this Act, the Secretary shall file maps and a legal description of the park with the Committee on Energy and Natural Resources of the United States Senate and the Committee on Resources of the United States House of Representatives. Such maps and legal description shall have the same force and effect as if included in this Act, except that the Secretary may correct clerical and typographical errors in such legal description and maps. The maps and legal description shall be on file and available for public inspection in the appropriate offices of the National Park Service.

(d) **WITHDRAWAL.**—Subject to valid existing rights, all Federal lands within the park are hereby withdrawn from all forms of entry, appropriation, or disposal under the public land laws; from

location, entry, and patent under the mining laws; and from disposition under all laws relating to mineral and geothermal leasing, and all amendments thereto.

(e) **GRAZING.**—(1)(A) Consistent with the requirements of this subsection, including the limitation in paragraph (3), the Secretary shall allow the grazing of livestock within the park to continue where authorized under permits or leases in existence as of the date of the enactment of this Act. Grazing shall be at no more than the current level, and subject to applicable laws and National Park Service regulations.

(B) Nothing in this subsection shall be construed as extending grazing privileges for any party or their assignee in any area of the park where, prior to the date of the enactment of this Act, such use was scheduled to expire according to the terms of a settlement by the United States Claims Court affecting property incorporated into the boundary of the Black Canyon of the Gunnison National Monument.

(C) Nothing in this subsection shall prohibit the Secretary from accepting the voluntary termination of leases or permits for grazing within the park.

(2) Within areas of the park designated as wilderness, the grazing of livestock, where authorized under permits in existence as of the date of the enactment of this Act, shall be permitted to continue subject to such reasonable regulations, policies, and practices as the Secretary deems necessary, consistent with this Act, the Wilderness Act, and other applicable laws and National Park Service regulations.

(3) With respect to the grazing permits and leases referenced in this subsection, the Secretary shall allow grazing to continue, subject to periodic renewal—

(A) with respect to a permit or lease issued to an individual, for the lifetime of the individual who was the holder of the permit or lease on the date of the enactment of this Act; and

(B) with respect to a permit or lease issued to a partnership, corporation, or other legal entity, for a period which shall terminate on the same date that the last permit or lease held under subparagraph (A) terminates, unless the partnership, corporation, or legal entity dissolves or terminates before such time, in which case the permit or lease shall terminate with the partnership, corporation, or legal entity.

16 USC 410fff-3.

SEC. 5. ACQUISITION OF PROPERTY AND MINOR BOUNDARY ADJUSTMENTS.

(a) **ADDITIONAL ACQUISITIONS.**—

(1) **IN GENERAL.**—The Secretary may acquire land or interests in land depicted on the Map as proposed additions.

(2) **METHOD OF ACQUISITION.**—

(A) **IN GENERAL.**—Land or interests in land may be acquired by—

(i) donation;

(ii) transfer;

(iii) purchase with donated or appropriated funds;

or

(iv) exchange.

(B) **CONSENT.**—No land or interest in land may be acquired without the consent of the owner of the land.

(b) **BOUNDARY REVISION.**—After acquiring land for the Park, the Secretary shall—

- (1) revise the boundary of the Park to include newly-acquired land within the boundary; and
- (2) administer newly-acquired land subject to applicable laws (including regulations).

(c) **BOUNDARY SURVEY.**—As soon as practicable and subject to the availability of funds the Secretary shall complete an official boundary survey of the Park.

(d) **HUNTING ON PRIVATELY OWNED LANDS.**—

(1) **IN GENERAL.**—The Secretary may permit hunting on privately owned land added to the Park under this Act, subject to limitations, conditions, or regulations that may be prescribed by the Secretary.

(2) **TERMINATION OF AUTHORITY.**—On the date that the Secretary acquires fee ownership of any privately owned land added to the Park under this Act, the authority under paragraph (1) shall terminate with respect to the privately owned land acquired.

SEC. 6. EXPANSION OF THE BLACK CANYON OF THE GUNNISON WILDERNESS. 16 USC 410fff-4, 1132 note.

(a) **EXPANSION OF BLACK CANYON OF THE GUNNISON WILDERNESS.**—The Black Canyon of the Gunnison Wilderness, as established by subsection (b) of the first section of Public Law 94-567 (90 Stat. 2692), is expanded to include the parcel of land depicted on the Map as “Tract A” and consisting of approximately 4,419 acres.

(b) **ADMINISTRATION.**—The Black Canyon of the Gunnison Wilderness shall be administered as a component of the Park.

SEC. 7. ESTABLISHMENT OF THE GUNNISON GORGE NATIONAL CONSERVATION AREA. 16 USC 410fff-5.

(a) **IN GENERAL.**—There is established the Gunnison Gorge National Conservation Area, consisting of approximately 57,725 acres as generally depicted on the Map.

(b) **MANAGEMENT OF CONSERVATION AREA.**—The Secretary, acting through the Director of the Bureau of Land Management, shall manage the Conservation Area to protect the resources of the Conservation Area in accordance with—

- (1) this Act;
- (2) the Federal Land Policy and Management Act of 1976 (43 U.S.C. 1701 et seq.); and
- (3) other applicable provisions of law.

(c) **WITHDRAWAL.**—Subject to valid existing rights, all Federal lands within the Conservation Area are hereby withdrawn from all forms of entry, appropriation or disposal under the public land laws; from location, entry, and patent under the mining laws; and from disposition under all laws relating to mineral and geothermal leasing, and all amendments thereto.

(d) **HUNTING, TRAPPING, AND FISHING.**—

(1) **IN GENERAL.**—The Secretary shall permit hunting, trapping, and fishing within the Conservation Area in accordance with applicable laws (including regulations) of the United States and the State of Colorado.

(2) **EXCEPTION.**—The Secretary, after consultation with the Colorado Division of Wildlife, may issue regulations designating

zones where and establishing periods when no hunting or trapping shall be permitted for reasons concerning—

- (A) public safety;
- (B) administration; or
- (C) public use and enjoyment.

(e) **USE OF MOTORIZED VEHICLES.**—In addition to the use of motorized vehicles on established roadways, the use of motorized vehicles in the Conservation Area shall be allowed to the extent the use is compatible with off-highway vehicle designations as described in the management plan in effect on the date of the enactment of this Act.

(f) **CONSERVATION AREA MANAGEMENT PLAN.**—

(1) **IN GENERAL.**—Not later than 4 years after the date of the enactment of this Act, the Secretary shall—

- (A) develop a comprehensive plan for the long-range protection and management of the Conservation Area; and
- (B) transmit the plan to—

- (i) the Committee on Energy and Natural Resources of the Senate; and
- (ii) the Committee on Resources of the House of Representatives.

(2) **CONTENTS OF PLAN.**—The plan—

(A) shall describe the appropriate uses and management of the Conservation Area in accordance with this Act;

(B) may incorporate appropriate decisions contained in any management or activity plan for the area completed prior to the date of the enactment of this Act;

(C) may incorporate appropriate wildlife habitat management plans or other plans prepared for the land within or adjacent to the Conservation Area prior to the date of the enactment of this Act;

(D) shall be prepared in close consultation with appropriate Federal, State, county, and local agencies; and

(E) may use information developed prior to the date of the enactment of this Act in studies of the land within or adjacent to the Conservation Area.

(g) **BOUNDARY REVISIONS.**—The Secretary may make revisions to the boundary of the Conservation Area following acquisition of land necessary to accomplish the purposes for which the Conservation Area was designated.

16 USC 410fff-6, 1132 note.

SEC. 8. DESIGNATION OF WILDERNESS WITHIN THE CONSERVATION AREA.

(a) **GUNNISON GORGE WILDERNESS.**—

(1) **IN GENERAL.**—Within the Conservation Area, there is designated as wilderness, and as a component of the National Wilderness Preservation System, the Gunnison Gorge Wilderness, consisting of approximately 17,700 acres, as generally depicted on the Map.

(2) **ADMINISTRATION.**—

(A) **WILDERNESS STUDY AREA EXEMPTION.**—The approximately 300-acre portion of the wilderness study area depicted on the Map for release from section 603 of the Federal Land Policy and Management Act of 1976 (43 U.S.C. 1782) shall not be subject to section 603(c) of that Act.

(B) INCORPORATION INTO NATIONAL CONSERVATION AREA.—The portion of the wilderness study area described in subparagraph (A) shall be incorporated into the Conservation Area.

(b) ADMINISTRATION.—Subject to valid rights in existence on the date of the enactment of this Act, the wilderness areas designated under this Act shall be administered by the Secretary in accordance with the Wilderness Act (16 U.S.C. 1131 et seq.) except that any reference in such provisions to the effective date of the Wilderness Act shall be deemed to be a reference to the effective date of this Act and any reference to the Secretary of Agriculture shall be deemed to be a reference to the Secretary of the Interior.

(c) STATE RESPONSIBILITY.—As provided in section 4(d)(7) of the Wilderness Act (16 U.S.C. 1133(d)(7)), nothing in this Act or in the Wilderness Act shall affect the jurisdiction or responsibilities of the State of Colorado with respect to wildlife and fish on the public land located in that State.

(d) MAPS AND LEGAL DESCRIPTIONS.—As soon as practicable after the date of the enactment of this section, the Secretary of the Interior shall file a map and a legal description of the Gunnison Gorge Wilderness with the Committee on Energy and Natural Resources of the United States Senate and the Committee on Resources of the United States House of Representatives. This map and description shall have the same force and effect as if included in this Act. The Secretary of the Interior may correct clerical and typographical errors in the map and legal description. The map and legal description shall be on file and available in the office of the Director of the Bureau of Land Management (BLM).

SEC. 9. WITHDRAWAL.

Subject to valid existing rights, the Federal lands identified on the Map as “BLM Withdrawal (Tract B)” (comprising approximately 1,154 acres) are hereby withdrawn from all forms of entry, appropriation or disposal under the public land laws; from location, entry, and patent under the mining laws; and from disposition under all laws relating to mineral and geothermal leasing, and all amendments thereto.

SEC. 10. WATER RIGHTS.

(a) EFFECT ON WATER RIGHTS.—Nothing in this Act shall—
(1) constitute an express or implied reservation of water for any purpose; or

(2) affect any water rights in existence prior to the date of the enactment of this Act, including any water rights held by the United States.

(b) ADDITIONAL WATER RIGHTS.—Any new water right that the Secretary determines is necessary for the purposes of this Act shall be established in accordance with the procedural and substantive requirements of the laws of the State of Colorado.

SEC. 11. STUDY OF LANDS WITHIN AND ADJACENT TO CURECANTI NATIONAL RECREATION AREA.

(a) IN GENERAL.—Not later than 3 years after the date of the enactment of this Act, the Secretary, acting through the Director of the National Park Service, shall conduct a study concerning land protection and open space within and adjacent to the area administered as the Curecanti National Recreation Area.

16 USC 410fff-7.

16 USC 410fff-8.

16 USC 410fff-9.

Deadline.

(b) PURPOSE OF STUDY.—The study required to be completed under subsection (a) shall—

(1) assess the natural, cultural, recreational and scenic resource value and character of the land within and surrounding the Curecanti National Recreation Area (including open vistas, wildlife habitat, and other public benefits);

(2) identify practicable alternatives that protect the resource value and character of the land within and surrounding the Curecanti National Recreation Area;

(3) recommend a variety of economically feasible and viable tools to achieve the purposes described in paragraphs (1) and (2); and

(4) estimate the costs of implementing the approaches recommended by the study.

Deadline.

(c) SUBMISSION OF REPORT.—Not later than 3 years from the date of the enactment of this Act, the Secretary shall submit a report to Congress that—

(1) contains the findings of the study required by subsection (a);

(2) makes recommendations to Congress with respect to the findings of the study required by subsection (a); and

(3) makes recommendations to Congress regarding action that may be taken with respect to the land described in the report.

(d) ACQUISITION OF ADDITIONAL LAND AND INTERESTS IN LAND.—

(1) IN GENERAL.—Prior to the completion of the study required by subsection (a), the Secretary may acquire certain private land or interests in land as depicted on the Map entitled “Proposed Additions to the Curecanti National Recreation Area”, dated 01/25/99, totaling approximately 1,065 acres and entitled “Hall and Fitti properties”.

(2) METHOD OF ACQUISITION.—

(A) IN GENERAL.—Land or an interest in land under paragraph (1) may be acquired by—

(i) donation;

(ii) purchase with donated or appropriated funds;

or

(iii) exchange.

(B) CONSENT.—No land or interest in land may be acquired without the consent of the owner of the land.

(C) BOUNDARY REVISIONS FOLLOWING ACQUISITION.—Following the acquisition of land under paragraph (1), the Secretary shall—

(i) revise the boundary of the Curecanti National Recreation Area to include newly-acquired land; and

(ii) administer newly-acquired land according to applicable laws (including regulations).

PUBLIC LAW 106-76—OCT. 21, 1999

113 STAT. 1133

SEC. 12. AUTHORIZATION OF APPROPRIATIONS.

There are authorized to be appropriated such sums as are necessary to carry out this Act.

16 USC 410fff-
10.

Approved October 21, 1999.

LEGISLATIVE HISTORY—S. 323:

HOUSE REPORTS: No. 106-307 (Comm. on Resources).
SENATE REPORTS: No. 106-69 (Comm. on Energy and Natural Resources).
CONGRESSIONAL RECORD, Vol. 145 (1999):

July 1, considered and passed Senate.

Sept. 27, considered and passed House, amended.

Oct. 1, Senate concurred in House amendment.

WEEKLY COMPILATION OF PRESIDENTIAL DOCUMENTS, Vol. 35 (1999):
Oct. 21, Presidential statement.

Desmond, M., J. Savidge, et al. (2000). "Correlations between burrowing owl and black-tailed prairie dog declines: a 7-year analysis." The Journal of Wildlife Management 64(4): 1067-1075.

Jacobs, J. (2007). "Ecology and management of Whitetop (*Cardaria draba* (L.) Desv.)." United States Department of Agriculture Natural Resources Conservation Service: Invasive Species Technical Note No. MT 12.

This is from the vegetation section for Section 3:

A. Describe the management decisions that the BLM expects to make in the next five-plus years for the unit

1. Develop habitat restoration vegetation treatments in areas where pinyon pine and juniper have encroached into sagebrush communities.
2. Protection and management of T/E/S species. Determine degree of investment into protecting existing objects, surveying for additional populations, and conducting inventories for State and BLM sensitive species.
3. Determine level of engagement (staff, funds, etc.) in the Escalante River watershed invasive plant removal and monitoring. Consider expansion of these efforts into other watersheds.
4. Need a prioritized fuel treatment and resilient landscape program for forest and woody shrub vegetation communities.
6. Grazing permit renewal following the completion of the Livestock Grazing Plan Amendment and EIS.

B. Describe the scientific knowledge needed to support those management decisions

1. Information about the success of recent past and current restoration treatments and seeding project.
2. Status, trends and conditions of the three threatened and endangered plants and the extent of BLM sensitive plants. Understanding the threats, stressors, and degree of impacts.
3. Knowledge of the effectiveness of the woody plant removal treatments, re-infestation rates, and a cost-benefit analysis.
4. Understand the effectiveness of current invasive plant control methods and how success is defined. Evaluate other tools (methods, herbicides, etc.) for effectiveness and economic efficiencies.
5. Work with foresters from Color Country Fire Division and BLM State Office to develop a scientific understanding of the status, trends, and condition of the woodland vegetation communities as well as the threats and stressors.
6. Current conditions and future trajectories of the rangeland health by grazing allotment.

C. Of the scientific knowledge needed, identify which knowledge is already accessible and which knowledge needs more scientific effort. The latter are the unit's science needs

1. Analyze and summarize existing rangeland health and AIM data. Incorporate new information on harvest efficiencies and livestock distribution across the landscape.
2. Analyze current vegetation restoration datasets to evaluate pinyon pine, juniper, and sagebrush treatments and seeding projects. Evaluate the short- and long-term ecological effect of non-native seeds used in restoration seed mixes.
3. Analyze annual monitoring data on the three Threatened and Endangered species to determine status and trend. Evaluate the robustness of the current monitoring plan. Continue monitoring on a frequency appropriate for each species.
4. Continue collecting and analyzing vegetation data from the ERWP to evaluate long-term vegetation change and effects of woody invasive plant removal on geomorphology. Evaluate the success and costs of treatments.
5. Utilize Forest Service's Forest Inventory and Analysis (FIA) and Forest Health Monitoring Program (FHM) data for status and trends. Work across agencies to develop landscape scale forestry plans/

I am also considering simplifying it to:

Analysis of current data sets (rangeland health, restoration treatments, T/E/S species, riparian habitat improvements, etc.) and develop status and trends.

Design and implement monitoring sampling designs that have quantifiable objectives and are statistically robust to answer management objectives.

This is from the social science section for Section 3:

A. Describe the management decisions that the BLM expects to make in the next five-plus years for the unit (Need MLT input)

Management will assess the recreational use, visitor infrastructure and visitor impacts to ensure resource protection and compatible multiple uses.

B. Describe the scientific knowledge needed to support those management decisions

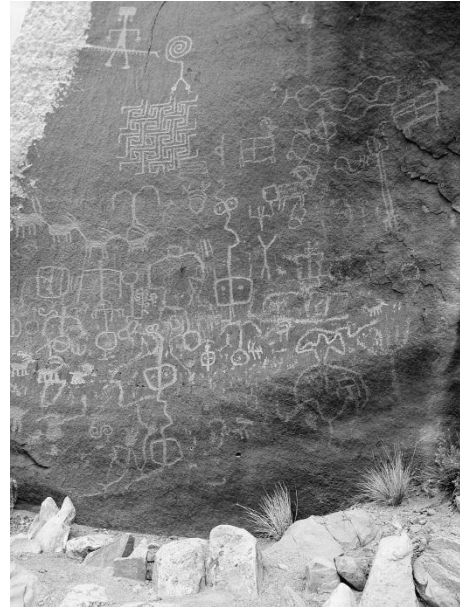
Some examples of the information needed to support management decisions for recreation resources and visitor management include visitor use, patterns, and

numbers by location; visitor impacts to resources by type, degree and location; and visitor experiences, expectations and desired outcomes.

C. Of the scientific knowledge needed, identify which knowledge is already accessible and which knowledge needs more scientific effort. The latter are the unit's science needs

Recreational and visitor research studies in conjunction with the Monument's tracking systems and staff expertise, are currently available and can be synthesized to inform recreation allocations, developing Special Recreation Management Area Plans, managing to meet visitor expectation for desired outcomes, identifying visitor infrastructure needs, and evaluate and develop stronger tools for tracking and analyzing recreational numbers and types of use. Much of the work that has been completed to date is synthesized in a report compiled by Dr. David Cole (2015). The focus area of this report is one of the most visited and impacted area in the Monument, the Escalante Canyons. Current visitor use, backcountry monitoring, and recreational experience studies can also help inform management decisions.

Some of the earlier visitor use studies are now outdated, in particular the front country, (Burr et al. 2006 use study). Because visitation has almost doubled and visitor demographics have changed, it would be timely to conduct this study again.



SCIENCE PLAN

FOR

VERMILION CLIFFS NATIONAL MONUMENT

AUGUST 2014



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1. Introduction and Scientific Mission

1.1. Purpose of NLCS Science Plans:

The National Landscape Conservations System (NLCS) was administratively established in 2000 and legislatively codified in the Omnibus Public Land Management Act of 2009 (PL 111-11). The system, also referred to as the National Conservation Lands, encompasses nearly 900 units spread across approximately 27 million acres of public lands managed by the Bureau of Land Management (BLM). The BLM is mandated to conserve, protect, and restore the outstanding cultural, ecological, and scientific values of NLCS units. Scientific investigation can aid in the conservation, protection, and restoration of these lands; and therefore, science is strategically planned and organized within NLCS units.

The objectives of NLCS 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 NLCS 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.

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. Within NLCS 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)

This science plan will be used as the basis for conducting science in Vermilion Cliffs National Monument (VCNM).

1.2. Unit and Geographic Area Description

VCNM was created on November 9, 2000 by Presidential Proclamation (#7374) to ensure protection of its wide variety of biological objects and rich human history, which have been preserved by remoteness and limited travel corridors (Appendix 1). VCNM contains unique

geologic features such as Coyote Buttes, vast cultural and historic resources, spectacular vistas from the Paria Plateau and Paria Canyon, diverse flora and fauna, and offers visitors opportunities to experience solitude. VCNM is located in northern Coconino County, Arizona in the eastern most portion of the BLM's Arizona Strip Field Office. It contains 279,566 acres of BLM-administered lands, of which 89,598 acres is the Paria Canyon/Vermilion Cliffs Wilderness (see map pg. 5).

The Resource Management Plan (RMP) for VCNM and associated Record of Decision was signed January 29, 2008. The RMP clarifies the intent of the Proclamation and the objects identified therein. The objects identified by the RMP are (BLM, 2008b, pg. 1-19):

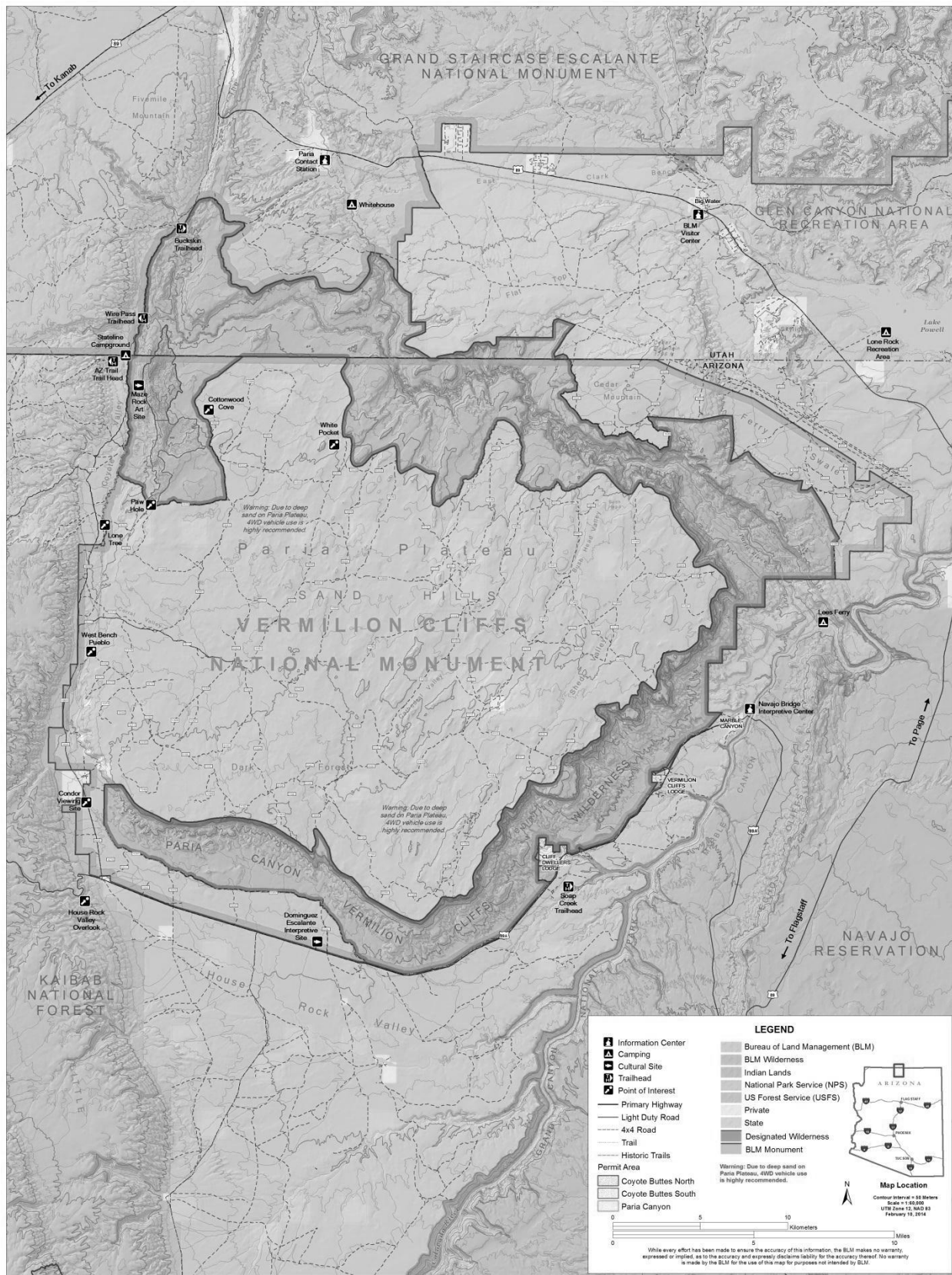
- Wildlife including California condors, bighorn sheep, pronghorn antelope, mountain lions, raptors, and fish and;
- Archaeological evidence displaying a long and rich human history spanning more than 12,000 years;
- Historic resources, including evidence of early European exploration, ranches, homesteads, mines, and roads;
- Sandstone slick rock, rolling plateaus, and brilliant cliffs with arches, amphitheaters, and massive walls;
- Cold desert flora and warm desert grassland;
- Remote and unspoiled landscape with limited travel corridors, and;
- The Paria River and widely scattered ephemeral water sources and springs.

The RMP provides a balance between authorized resource use and the protection and long-term sustainability of sensitive resources and/or monument objects. Per the RMP, scientific research is an authorized use in VCNM in order to contribute to managing natural and cultural resources and achieving desired future conditions (BLM, 2008b, pg. 2-88, DFC-SR-01).

1.3. Scientific Mission

The scientific mission of VCNM is to:

- Support the conservation, protection, and interpretation of monument values and objects identified in the Presidential Proclamation and the RMP.
- Allow and encourage pertinent science, across diverse disciplines and time-scales, 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 geologic processes and cultural and historical resources.
- 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.
- Be responsive to the BLM's National Conservation Lands 15-year Strategy and Arizona BLM's National Conservation Lands 3-year Strategy.



Map of VCNM and Surrounding Area

- 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.
- Support the Kane and Two Mile Ranches Applied Research Plan.
- Support the Friends of The Cliffs Science Strategy and Plan.
- Support the Kaibab-Vermilion Cliffs Heritage Alliance mission.
- Support ongoing efforts by the Peregrine Fund and Arizona Game and Fish Department to study the California condor and the condor reintroduction program's effectiveness.

2. Scientific Background

2.1. Kane and Two Mile Ranches Applied Research Plan

In 2005, Grand Canyon Trust, based in Flagstaff, AZ, obtained federal grazing permits that comprise the majority of lands in VCNM and the North Kaibab Ranger District of the U.S. Forest Service. In association with these permits, Grand Canyon Trust also holds title to the private lands within the allotments on their livestock grazing permits.

In 2011, Grand Canyon Trust helped form the Kane and Two Mile Ranches Research and Stewardship Partnership via a Memorandum of Understanding. The Research and Stewardship Partnership consists of the BLM (including VCNM), U.S. Forest Service, Grand Canyon Trust, Arizona Game and Fish Department, Northern Arizona University, University of Arizona, and U.S. Geological Survey. Other government agencies and non-governmental organizations will be added to the partnership as it continues to develop and expand. This collaborative partnership developed the "Kane and Two Mile Ranches Applied Research Plan" (Research Plan). The purpose of the Research Plan is to outline "an integrated research agenda designed to inform land and resource management with sound science, enhancing the ability of management agencies to work with their partners and the public to integrate conservation objectives with the sustainable use of public lands on the Colorado Plateau."

The Research Plan calls for:

- Establishing reference conditions and refining baseline soils and ecological site information;
- Exploring livestock management strategies through designed experiments and rigorous observational studies;
- Examining effects of range management on wildlife species and wildlife habitat;
- Identifying environmental and management drivers of cheatgrass invasion;
- Developing and testing of effective methods for restoring arid and semi-arid rangelands; and
- Developing landscape-scale tools and applications for monitoring and adaptive management.

A more detailed narrative of research topics and how they will be addressed can be found in the Research Plan and associated "Research Design" (Appendix I of the Research Plan), both of

which are incorporated by reference into this Science Plan. A copy of the Research Plan can be obtained by contacting the VCNM Science Coordinator (see Appendix 2).

The Research Design lays out a framework of scientific/management infrastructure needed to carry out the research questions outlined in the Research Plan. There are three design elements in the research design. These design elements comprise a multi-tiered approach to experimentation, from large to fine scale.

- Design Element 1 (implemented): Pasture-scale experimental and control areas. This will be used for landscape scale experimentation.
- Design Element 2 (not yet implemented): Replicated Enclosure/Exclosure Pairings. These would be used for experimentation that requires more intensive management or replication than pasture-scale research. Enclosure/exclosure pairings would be approximately 50-100 acres in size depending on location and vegetative productivity. The location, required planning and environmental review documents, and funding for materials need to be completed and secured before implementing this design element on BLM lands. The U.S. Forest Service has authorized exclosures on the Kaibab Ranger District and is in the implementation phase of the project.
- Design Element 3 (not yet implemented): Experimental Plot Arrays. These would be used to address fine-scaled processes that govern dynamics of ecological systems. The arrays can be used for a variety of purposes from studying invasive species to climate change. Though there are currently no experimental plot arrays in VCNM, but they are currently being planned and implemented on land outside the monument.

Several research projects from the Research Plan are on-going:

- NRCS Ecological Site Inventory
 - *Primary Investigator:* Natural Resource Conservation Service (NRCS). The project was funded by the NRCS.
 - *Background and Purpose:* Update the soil survey for the Paria Plateau. The original soil survey has inaccurate climate, soil, and ecological site mapping and does not meet the current needs of the BLM.
 - *Findings and Status:* Field work for the project was completed in 2012 and 2013. Field work confirmed the need for greater detail and more accurate information than what the current survey offers. A final report and revised draft ecological site descriptions are expected in 2014.
- Flora of Vermilion Cliffs National Monument/Budding Botanist Program
 - *Primary investigator:* Grand Canyon Trust in partnership with Friends of The Cliffs, Brigham Young University, Desert Botanical Garden, and the Arizona Natural Heritage Program. The project was funded through grants from BLM's NLCS Research Support Program and National Fish and Wildlife Foundation.

- *Background and Purpose:* Collect, inventory, and map plant specimens and populations within the boundary of VCNM, including the Paria Canyon-Vermilion Cliffs Wilderness. Inventory trips focus on previously unsampled and under-sampled areas.
- *Findings and Status:* Field work was completed in 2012 and 2013 with a final report expected in 2014.
- Raptor, Songbird, and Bat Surveys
 - *Primary Investigator:* Grand Canyon Trust in partnership with BLM, Whitman College, Friends of The Cliffs, and U.S. Forest Service. Partial funding for the project came from BLM's NLCS Research Support Program.
 - *Background and Purpose:* Establish baseline population information on songbirds, raptors, and bats in VCNM. This baseline data will aid future studies of wildlife populations and their interactions with other resources and resource uses.
 - *Findings and Status:* Field work for songbird and raptor surveys was completed in 2013. A final report is expected in 2014. Bat surveys were initiated in 2013 and are ongoing. The research has been funded again in 2014 to expand the scope of the surveys.

2.2. Monument Objects and Scientific Understanding

The following is a list of monument objects, and associated scientific research.

- Wildlife (includes California condors, bighorn sheep, pronghorn, mountain lions, raptors, and fish):
 - California Condor (*Gymnogyps californianus*) reintroduction program:
 - *Primary investigator:* The Peregrine Fund and Arizona Game and Fish Department.
 - *Background and Purpose:* In the 1980s, there were only 22 condors remaining in the wild. Since 1996, The Peregrine Fund has released captive bred condors from a facility in VCNM. As of April 30, 2014, there were 75 free flying condors in the northern Arizona-southern Utah population. The Peregrine Fund, in partnership with Arizona Game and Fish, continues to monitor and study the birds.
 - *Findings and Status:* A comprehensive study of mortality in free-ranging California condors in 2012 (Rideout, et al., 2012) demonstrated that the leading causes of death in condors are anthropogenic, with lead poisoning being the most important. Evidence suggests that lead bullet fragments are causing increased blood lead levels in condors (Chesley, et al., 2009; Parish, et al., 2009; Church, et al., 2006). The Utah Division of Wildlife Resources and Arizona Game and Fish Department coordinate active lead reduction programs. Studies have been done to measure the effectiveness of those programs (Green, et al., 2008; Sieg, et al., 2009). These studies show that the participation in voluntary lead reduction programs has the same participation levels as the percentage of compliance with California's mandated ban on lead ammunition use.

- Northern Leopard Frog (*Lithobates pipiens*):
 - *Primary Investigator*: Arizona Game and Fish Department, and the US Fish and Wildlife Service.
 - *Background and Purpose*: The northern leopard frog is a Species of Greatest Conservation Need in Arizona and was petitioned for federal listing as threatened in 2006. The US Fish and Wildlife Service and Arizona Game and Fish Department established a refuge population on VCNM in 2011 at Soap Creek Tank 2, a reinforced natural water catchment. This population could serve as a source to supplement or re-establish the frog at extirpated sites or at sites within the species' historical range, as appropriate.
 - *Findings and Status*: The frogs at Soap Creek Tank 2 have been monitored annually since 2012. To date, the frogs are reproducing and subsisting in this habitat. They are showing a good diversity of size classes and phenotypes (unpublished data). The Grand Canyon Trust, through a grant with the Wildlife Conservation Society, is in the process of restoring springs on private lands within the monument boundary. These restoration efforts may provide additional habitat for northern leopard frog.
- Mexican Spotted Owl (*Strix occidentalis lucida*)
 - *Primary Investigator*: Montana State University.
 - *Background and Purpose*: During the 2013 Mexican Spotted Owl breeding season (i.e., between 15 March and 31 August) researchers from Montana State University (Willey, 2013) surveyed a 12-mile section of the Paria Canyon (from 4 miles above to 8 miles down from the confluence with Buckskin Gulch) and approximately 3 miles of Buckskin Gulch upstream from the confluence. The researchers adopted FWS' standardized protocol, which relies on night-time surveys, during which observers imitate a variety of spotted owl calls from calling stations to elicit an owl response (USDI, 2003).
 - *Findings and Status*: No Mexican spotted owls were detected in 2013 (Willey, 2013). However, habitat in much of the survey area was determined to be excellent. Lack of occupancy by spotted owls could have been due to the presence of several great-horned owl territories and/or low population levels (many historic nest sites throughout the Colorado Plateau were unoccupied in 2013). Very high temperatures and bright moonlit nights were also encountered during the surveys, which may have caused spotted owls to be unresponsive. Surveys have been repeated in 2014 with survey areas in Buckskin Gulch and upper Paria Canyon added. A report on 2014 survey efforts and results is expected in 2014. Additional funding for monitoring in 2015 has been obtained by the BLM.
- Archaeological resources (displaying a long and rich human history spanning more than 12,000 years)
 - Most archaeological research efforts conducted in VCNM have focused on a public use site called West Bench Pueblo. West Bench Pueblo is considered an Ancestral Puebloan

site that was used by generations of Puebloans as part of a strategy of household residential mobility (O'Hara, 2009). First recorded by archaeologists in 1967, research and excavation began in 2007. Work was coordinated through the collaborative group Kaibab Vermilion Cliffs Heritage Alliance (KVCHA).¹

- Investigations at other sites within VCNM have occurred in House Rock Valley on both private and BLM sites. The areas of Pinnacle Ridge and White Knolls on VCNM have also been investigated (McFadden, 2009).
- Other information on archaeological resources is due to BLM inventories done in conjunction with ground disturbing projects. Only a small percentage of VCNM has been scientifically surveyed for archaeological resources (less than 5%). Inventory and monitoring of resources is expected to continue, primarily driven by BLM proposed projects, potential vandalism, and other adverse impacts to significant sites. Inventory and monitoring is done in coordination with the Arizona State Parks Site Steward Program.
- Historic resources (including evidence of early European exploration, ranches, homesteads, mines, and roads)
 - Scientific knowledge of historic resources is limited in VCNM. Some historical background has been researched for the development of an Archaeological Class 1 overview (Altschul & Fairley, 1989), an overview of House Rock Valley and Eastern Arizona Strip (Spangler, 2007), and a privately published hiking and exploring guide which includes the Paria Plateau (Kelsey, 2010).
 - Most information on historic resources is available due to BLM archaeological inventories done in conjunction with ground disturbing projects and proactive surveys.
- Geology (sandstone slick rock, rolling plateaus, and brilliant cliffs with arches, amphitheaters, and massive walls)
 - Studies of the soft-sediment deformation Navajo Sandstone layer of the Colorado Plateau, in VCNM, have yielded possible terrestrial analogs in geologic studies on Mars. Research of polygonal crack systems can possibly be used to understand weathering patterns on Mars (Chan, et al., 2008) and studies of ferric oxide concretions (i.e. Moki marbles) can help interpret the role of water on Mars (Chan, et al., 2012).
 - Patterns of soft-sediment deformation in the Coyote Buttes area provide unique insights into environmental conditions in the region during the early Jurassic. The deformation indicates extraordinarily wet conditions for an active dune environment. Earthquakes in the area have triggered localized liquefaction controlling the distribution of deformation (Bryant & Miall, 2010). Other research in Coyote Buttes has studied other erosional forces, like wind and groundwater systems, that drive the

¹ This partnership was formed to help protect and preserve the cultural resources of the eastern Arizona Strip. Supporting entities include BLM, Forest Service, Coconino County, Grand Canyon Trust, and Northern Arizona University. KVCHA has sponsored archaeological field schools at West Bench Pueblo.

visual features seen today (Loope, et al., 2008; Loope & Mason, 2009; Loope & Rowe, 2003).

- Studies in White Pocket have highlighted the importance of the dune topography, differential dune loading, and a shallow water table on dynamic deformation and liquefaction of lateral spreading and failure. White Pocket clearly demonstrates the dynamics of dune shape and a shallow water table in response to strong ground motion (Chan & Bruhn, 2014).
- Vegetation (cold desert flora and warm desert grasslands)
 - General Trends
 - *Primary Investigator:* University of Arizona in partnership with BLM.
 - *Background and Purpose:* Inventory and monitoring of vegetative communities drives the management of livestock grazing in VCNM. Short and long term indicators are used to evaluate livestock grazing impacts on vegetation in both cold and warm desert environments. Short term indicators include actual use (number of livestock for a specified amount of time) and key species utilization (how much of a particular plant species is used by livestock). Short term indicators can be used to link causal factors to long term issues. Long term indicators include range/vegetative trend. Trend studies can be used to extrapolate overall vegetative trends of a livestock pasture/allotment. Range trend studies are completed every 5 years, in partnership with the University of Arizona. These are used, in part, to determine whether an allotment is meeting Arizona Standards for Rangeland Health and Guidelines of Grazing Administration (BLM, 1997). Rangeland Health is not monitoring, but does provide a qualitative and comprehensive “snapshot” of an area’s ecological functionality.
 - *Findings and Status:* There are eight livestock grazing allotments either wholly or partially contained within VCNM: Sand Hills, Coyote, Soap Creek, Badger Creek, Ferry Swale, Bunting Well, Signature Rock, and House Rock. Three allotments (Sand Hills, Bunting Well, and Signature Rock) are meeting the standards for rangeland health. The House Rock, Coyote, Soap Creek, Badger Creek, and Ferry Swale Allotments are making significant progress towards meeting the standards.
 - Special Status Plants: *Sclerocactus sileri* (Siler fishhook cactus) and *Asclepias welshii* (Welsh’s milkweed)
 - *Primary Investigator:* BLM
 - *Background and Purpose:* Inventory and monitor special status plant species listed above. Welsh’s milkweed is a threatened species under the Endangered Species Act and has been monitored since 1989. Siler fishhook cactus is a BLM sensitive species and has been monitored since 1999.
 - *Findings and Status:* Overall, the population trend of Welsh’s milkweed is down from 1990 population levels. Indications are that ongoing drought conditions are responsible for lower populations. The population trend of Siler fishhook cactus is

stable. Volunteers found 30 additional populations of the fishhook cactus in during the Flora of VCNM project (see Section 2.1) (unpublished data).

- Remote, unspoiled landscape with limited travel corridors
 - Recreation Impact Monitoring
 - *Primary Investigator:* Northern Arizona University in partnership with BLM.
 - *Background and Purpose:* A recreation inventory, monitoring, and assessment program, to assess user impacts to natural resources, cultural resources, and recreational settings, based on Limits of Acceptable Change (McCool, 1998), has been in place since 1995. The Paria Special Management Area (which includes Coyote Buttes North and South, and Paria Canyon) and White Pocket area are the focal areas for this research on VCNM. The purpose of the research is to determine recreation created impacts, use patterns, and trends. These data are used to adaptively implement management actions and prescriptions to mitigate or shift impacts from sensitive areas.
 - *Findings and Status:* Overall, impact to monument resources due to recreation is minimal (unpublished data).
 - Recreation Experience Baseline Study
 - *Primary Investigator:* Colorado Mesa University, cooperation with Grand Staircase-Escalante National Monument, Kanab Field Office, and VCNM.
 - *Background and Purpose:* This is a social science research project focused on establishing the recreation experience baseline for Conservation Lands in southern Utah and northern Arizona. The study will consider the areas accessed by Highway 89 and House Rock Valley Road. Focus groups will be conducted to generate needed data to inform management decisions regarding pertinent and pressing recreation management questions. It will also test the effectiveness of current recreation management practices as they impact the articulated desired outcome preferences of the participants.
 - *Findings and Status:* The study will begin in the fall of 2015.
 - Wilderness Character Baseline Report
 - *Primary Investigator:* BLM
 - *Background and Purpose:* The Wilderness Act of 1964 directs managers to preserve wilderness character. BLM uses the Measuring Attributes of Wilderness Character BLM Implementation Guide (BLM, 2012) to establish baseline data and monitor changes to wilderness character over time. The Implementation Guide is based off the “Keeping It Wild” interagency guide (Landres, et al., 2008).
 - *Findings and Status:* The baseline report for the Paria Canyon-Vermilion Cliffs Wilderness is expected to be finalized in September 2014.
- The Paria River and widely scattered ephemeral water sources and springs:
 - *Primary Investigator:* Grand Canyon Trust in partnership with BLM.

- *Background and Purpose:* In 2008, Grand Canyon Trust, BLM, and the Arizona Water Protection Fund started the Paria Canyon Riparian Restoration project. The focus of the project was to remove invasive species, *Tamarix ramosissima* (tamarisk) and *Elaeagnus angustifolia* (Russian olive) from the Paria River riparian area to improve riparian functionality and enhance the area's wilderness characteristics.
- *Findings and Status:* In 2013, Grand Canyon Trust began monitoring treated areas to determine their effectiveness and to adapt future restoration and management efforts along the Paria River. Monitoring will continue in 2014 with a report expected by the end of the year. Findings from monitoring efforts could be used to inform land managers of effective methods to treat invasive species in remote riparian areas such as Paria Canyon.

2.3. Landscape Scale Assessments

Though many landscape scale assessments are coarse and limited in utility when focused on a specific land management unit, they can give perspective on a unit's place in the larger context of a broad-based condition or threat. The following is a snapshot of conclusions that can be drawn about VCNM from specific landscape scale assessments.

- *Rapid Ecological Assessments (REA):* Climate change and other widespread environmental influences are affecting BLM-managed land throughout the West. To improve the understanding of the existing condition of these landscapes, and how conditions may be altered by ongoing environmental changes and land use demands, the BLM has begun conducting REAs. VCNM is within the Colorado Plateau REA; the report for this REA was completed in 2012.² One critical attribute of this REA was terrestrial intactness, a scientifically-defensible attribute that can be determined by existing geospatial datasets and reasonably tracked through time (Bryce, et al., 2012). According to the REA, VCNM has high terrestrial intactness because of its relative low number of threatened and endangered species, threats, disturbances, and conservation elements (i.e., resources of conversation concern within the ecoregion).
- *HabiMap/CHAT:* The Arizona Game and Fish Department developed HabiMap Arizona to make information contained within the State Wildlife Action Plan available in an accessible and interactive format. Much of that data is compiled into a single model of wildlife conservation potential or the Species and Habitat Conservation Guide model. VCNM is rated from low to moderate wildlife habitat value in this model (Arizona Game and Fish Department, 2013). HabiMap provides data to Western Governors' Association's Wildlife Council's Crucial Habitat Assessment Tool (CHAT). CHAT combines west-wide state wildlife habitat data into a common framework to create an aggregate crucial habitat GIS layer. Wildlife habitat in VCNM ranks in the "least crucial" habitat category (Western Governors' Association, 2014).

² http://www.blm.gov/wo/st/en/prog/more/Landscape_Approach/reas/coloplateau.html

3. Management decisions and science needs

3.1. Scientific Needs

- In general, research will:
 - Inform land management decisions in VCNM;
 - 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 VCNM's Science Plan and RMP.
- Management decisions VCNM expects to make in the next 5-10 years will generally be related to the following issues:
 - Livestock grazing management;
 - Updates to route designations (i.e. travel management);
 - Invasive species control;
 - Riparian area management;
 - Adjustments to recreation management (e.g., Paria Business Plan, special recreation permit management, etc.);
 - Management and protection of wilderness characteristics; and
 - 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.).
- As the management questions in VCNM continue to evolve, so do the science needs. Thus, the scientific needs will remain fluid and opportunities for research should remain open and inclusive.
- Science needs can be met with either primary research or by synthesizing existing research, and will be connected to the baseline and existing information identified in Section 2.

3.2. Specific on-going and future science needs for VCNM are addressed in two tables. Table 1 identifies the scientific research from Section 2 that is on-going in VCNM. Table 2 identifies potential future research. In general, scientific investigations are related to the protection, conservation, and interpretation of monument objects.

3.3. Science needs are categorized as high, medium, or low³ priorities. Science needs are prioritized to reflect the following:

- Level of threats and impacts to the integrity monument objects;
- Need for interpretation of monument objects;
- Goals and objectives identified in the VCNM RMP;
- Management and resource issues identified by BLM resource specialists, managers, partners, and the general public; and,
- Science that can be applied on a landscape level versus localized research.

³ These are pragmatic decisions (i.e., low priority science needs are still important).

Table 1 - On-Going Research

Monument Object/Issue	Research Topic/Question Description	Priority Level (High, Medium, Low)	Related Management Decision
Issues identified in the <u>Kane and Two Mile Applied Research Plan</u>	<u>See Kane and Two Mile Applied Research Plan</u>	High	Livestock grazing management; invasive species control
Wildlife	<i>California condor:</i> Continue research to help establish a self sustaining population, including studies related to condor movement; behavior; foraging ecology; and toxicology (specifically, lead poisoning and effectiveness of lead reduction programs in Arizona and Utah).	High	
	<i>Northern leopard frog:</i> Monitor the growth and development of embryos/larvae and juvenile frogs at Soap Creek Tank #2, as well as monitoring the survival and reproductive success of the population.	Medium	
	Raptor, bat, and songbird surveys/counts for inventory and monitoring	Medium	
	<i>Mexican spotted owl:</i> Continue surveys in Paria Canyon and Buckskin Gulch	Medium	Recreation management
Archaeology	Archaeological research at West Bench Pueblo and other sites.	Medium	Recreation management; travel management
Geology	Refine models on how soft sediment deformation occurs in Navajo Sandstone. For example, establish a relationship between deformation features, early Jurassic climate, deformation dynamics, and ancient reptilian behaviors.	Low	
Vegetation	Continue long term vegetation trend studies to study impacts from resource uses such as livestock grazing.	High	Livestock grazing management
	Continue support of NRCS efforts to write new and refine existing ecological site descriptions.	High	Livestock grazing management

	Continue inventory and monitoring of special status plant species (<i>Sclerocactus sileri</i> and <i>Asclepias welshii</i>).	High	Livestock grazing management; recreation management.
Remote, unspoiled landscape with limited travel corridors	Support assistance agreement for recreation and wilderness impact monitoring, with special attention to travel and the Coyote Buttes Paria Canyon Special Management Area.	High	Recreation management; travel management; wilderness characteristic management.
	Complete Wilderness Character Baseline Report in September 2014. Continue monitoring wilderness character every 5 years to detect any changes.	High	Wilderness characteristic management.
	Continue support of Colorado Mesa University's Recreation Experience Baseline Study. Study is expected to be complete in 2015.	High	Recreation management; wilderness characteristic management
Paria River	Continue effectiveness monitoring of treatment of tamarisk and Russian olive along the Paria River.	High	Invasive species control; riparian area management

Table 2 - Future Potential Research

Monument Object/Issue	Research Topic/Question Description	Priority Level (High, Medium, Low)	Related Management Decision
Wildlife	Research into understanding wildlife connectivity and movement between VCNM and other landscapes.	Medium	Livestock grazing management; recreation management; travel management
	Nest research and monitoring for peregrine falcons and golden eagles.	Low	
	Identify and inventory locations of pinyon jay nesting colonies.	Low	
	Investigations into locations of any burrowing owl or ferruginous hawk sightings or nest sites.	Low	
	Investigate and refine habitat models for Houserock Valley chisel toothed kangaroo rat (<i>Dipodomys microps leucotis</i>) (O'Farrell, 1997).	Low	
	Small mammal studies in the Paria/Buckskin corridor to assess prey base for Mexican spotted owl.	Low	
Archaeology	Surveys, recording, and site preservation and monitoring, will be critical to future project implementation, especially when ground disturbing activities are planned. High priority areas for future inventories include: <ul style="list-style-type: none"> • Coyote Buttes (intense ongoing recreation impacts) • White Pockets (intense ongoing recreation impacts) • Designated motorized routes and routes to be closed • Paria Plateau (ongoing recreation and vandalism) • House Rock Valley (ongoing recreation and vandalism) • Paria Canyon (ongoing recreation impacts in a narrow canyon) 	High	Recreation management; wilderness characteristic management; travel management
	Conduct soil surveys and testing research to help identify agricultural potential and possible actual use of VCNM by archaeological and	Medium	

	historic cultures. These studies would build knowledge related to archaeological site distribution and historical climate change.		
Historic Resources	Document on the ground sites and encourage field survey, recording, preservation, oral histories, monitoring, archival data mining, and ethnography.	Medium	
Geology	Formal inventory and monitoring of paleontological resources.	Low	
	Research into the possibility of Navajo sandstone once being an ancient carbon dioxide reservoir. Findings could give insights into techniques for subsurface carbon sequestration (Loope et al. 2010; Weber et al. 2011).	Medium	
Remote, unspoiled landscape with limited travel corridors	Through recreation monitoring, establish and further refine Limits of Acceptable Change for general recreation use and Special Recreation Permits.	Medium	Recreation management; travel management; wilderness characteristic management.

4. Meeting Science Needs

4.1. An effective internal organization is necessary to strategically identify and address science in VCNM. Due to the VCNM's limited staff, the Monument Manager will serve as the unit's science coordinator, collaborating with appropriate BLM staff in the Arizona Strip District and science partners. The roles of the science coordinator in relation to scientific inquiries on VCNM are:⁴

- Serving as the point of contact for scientific inquiries, from both internal and external sources. Scientific inquiry proposals must be submitted in writing. Contact information for the science coordinator is listed in Appendix 3.
- Coordinating these inquiries with the Arizona Strip District Wildlife Program Lead, who has collateral duties to process research permits for the district. This collateral duty position will work with resource specialists on VCNM and Arizona Strip Field Office to (if applicable): identify the issues in conducting the research; ensure appropriate planning and environmental reviews are in place; and ensure appropriate mitigation measures and research permit stipulations are implemented. The Wildlife Program Lead will also prepare the research permit for signature by the Arizona Strip Field Manager. Contact information for these employees is listed in Appendix 2.
- Coordinating internal/external scientific inquiries with the Arizona Strip Field Manager.
- Coordinating the inquiry process with the applicant and other scientific partner, if necessary.
- 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 is critical to the success of implementing of the Science Plan. This collaboration will ensure that research on VCNM is pertinent to the protection of monument objects and future management decisions.

- Existing Scientific Partnerships with VCNM:
 - Friends of The Cliffs (VCNM's friends group)
 - Kane and Two Mile Ranches Research and Stewardship Partnership

⁴ The process of obtaining and authorizing scientific inquiries is outlined in Section 5.2.

- Other government agencies:
 - US Forest Service
 - US Fish and Wildlife Service
 - US Geological Survey
 - Arizona Game and Fish Department
 - Natural Resource Conservation Service
- Not for profit organizations:
 - The Peregrine Fund
 - Grand Canyon Trust
- Institutions for higher learning:
 - Dixie State University
 - Northern Arizona University
 - Montana State University
 - University of Utah
 - University of Arizona
- Other partnerships that may be developed to further VCNM’s science needs include, but are not limited to: adjacent BLM administrative units (Grand Staircase-Escalante National Monument, Kanab Field Office, etc.); other adjacent federal land management agencies (Glen Canyon National Recreation Area, Grand Canyon National Park, etc.); universities such as Southern Utah University and Brigham Young University; local government agencies such as Coconino County and Kane County; etc.
- Outreach to existing and potential partners and collaborators will be critical in soliciting help to meet the science needs of VCNM. Methods of outreach to VCNM partners will include posting this Science Plan on VCNM’s website, mailing the plan to existing and potential science partners, issuing a press release when the Science Plan is completed, using social media to promote the plan, etc.

5. Science Protocols

5.1. General Science Guidelines

- Scientific inquiries will comply with current and relevant agency laws and regulations.
- Scientific inquiries will not detrimentally impact the long term health or sustainability of monument objects or other resources of VCNM.

- Scientists initiating research projects within VCNM must be aware of existing data within the BLM and should incorporate these data into projects whenever possible.
- Proposed research within the Paria Canyon-Vermilion Cliffs Wilderness should comply with appropriate laws and regulations including the Wilderness Act of 1964 and BLM wilderness policy (Manual 6340).
 - The “Research and Scientific Activities Toolbox” will be used to guide what types of scientific activities are appropriate in wilderness⁵.
- VCNM, when applicable, will encourage internal and external science inquiries to adopt the BLM’s Assessment, Inventory, and Monitoring (AIM) Strategy (Toevo, Taylor, Spurrier, MacKinnon, & Bobo, 2011).
- Proposed research will follow guidelines in the Department of the Interior’s “Integrity of Scientific and Scholarly Activities” policy establish in Departmental Manual Part 305 Chapter 3.⁶
- External scientific projects must apply for and receive a research permit from the Arizona Strip Field Manager in order to proceed (see section 5.2).

5.2. Authorization and tracking process

- Proposals, including those from the Research and Stewardship Partnership, will be submitted to the VCNM Monument Manager (science coordinator).
 - 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 specialist to determine the scientific validity and integrity of the proposal, and potential impacts to resource and resource uses.

⁵ See <http://www.wilderness.net/science>

⁶ See <http://elips.doi.gov/elips/0/doc/3045/Page1.aspx>

- The Monument Manager will brief the Arizona Strip Field Manager. In coordination with the Monument Manager, the Field Manager will determine whether the proposal:
 - Is consistent with this Science Plan;
 - Meets VCNM's scientific mission;
 - Conforms with VCNM's RMP;
 - Is consistent with the Paria Canyon-Vermilion Cliffs Wilderness Management Plan (BLM, 1986), if applicable; 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 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).
 - The Arizona Strip District Wildlife Program Lead 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.
 - Reporting for all scientific investigations will require:
 - Annual progress reports filed with the Monument Manager.
 - A final report that includes an executive summary, research background and results; results' relevancy to VCNM 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 Communications of Completed Science

6.1. Internal Communications

- All reports described in Section 5 will be stored, organized, and shared on a share drive or sharepoint site, accessible to all staff on the Arizona Strip District. The Monument Manager should strive to organize periodic presentations of scientific results to District staff.

6.2. Communication to 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.

6.3. Communication of Scientific Results to the Public

- The Monument Manager, in coordination with the Arizona Strip District Public Affairs Officer, will strive to make information on science projects within VCNM accessible to the general public. This includes posting updates on VCNM'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 tumblr; brown bag lunch presentations; leading field tours; participating in community outreach events, etc.

7. Integrating Science into Management

7.1. Direct communication between scientists, Monument Manager, Arizona Strip Field Manager, and the Arizona Strip District Manager will be encouraged. It is the responsibility of the Monument Manager to ensure that scientific findings are communicated to the Field Manager and the District Manager via methods outlined in Section 6. Subsequently, the managers will be able to use the scientific information, as appropriate, in management decisions related to VCNM.

7.2. The Kane and Two Ranches Applied Research Plan outlines mechanisms for integrating science and research into management (page 47). Those mechanisms and approaches are incorporated by reference into this plan.

7.3. Integrating scientific findings into management decisions should not end scientific inquiry into a specific topic. In fact, using science in the decision making process should provide an opportunity to identify future science needs to adaptively manage for certain objectives. For example, scientific inquiries into recreation impacts on natural resources and social settings in Coyote Buttes and Paria Canyon could yield information that could change the number of people allowed into the permit area (currently 20 people/day are allowed).

8. Science Plan Review and Approval

This plan will be used as the basis for conducting science in VCNM. “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 VCNM and BLM.

Kevin Wright
Monument Manager
Vermilion Cliffs National Monument

Matt Preston
NLCS Science Coordinator
Washington Office

Lorraine M. Christian
Field Office Manager
Arizona Strip Field Office

Nikki Moore
NLCS Division Chief
Washington Office

Ken Mahoney
Arizona NLCS Lead
Arizona State Office

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Appendix 1

Proclamation 7374—Vermilion Cliffs National Monument

November 9, 2000

By the President of the United States of America

A Proclamation

Amid the sandstone slickrock, brilliant cliffs, and rolling sandy plateaus of the Vermilion Cliffs National Monument lie outstanding objects of scientific and historic interest. Despite its arid climate and rugged isolation, the monument contains a wide variety of biological objects and has a long and rich human history. Full of natural splendor and a sense of solitude, this area remains remote and unspoiled, qualities that are essential to the protection of the scientific and historic objects it contains.

The monument is a geological treasure. Its centerpiece is the majestic Paria Plateau, a grand terrace lying between two great geologic structures, the East Kaibab and the Echo Cliffs monoclines. The Vermilion Cliffs, which lie along the southern edge of the Paria Plateau, rise 3,000 feet in a spectacular escarpment capped with sandstone underlain by multicolored, actively eroding, dissected layers of shale and sandstone. The stunning Paria River Canyon winds along the east side of the plateau to the Colorado River. Erosion of the sedimentary rocks in this 2,500 foot deep canyon has produced a variety of geologic objects and associated landscape features such as amphitheaters, arches, and massive sandstone walls.

In the northwest portion of the monument lies Coyote Buttes, a geologically spectacular area where crossbeds of the Navajo Sandstone exhibit colorful banding in surreal hues of yellow, orange, pink, and red caused by the precipitation of manganese, iron, and other oxides. Thin veins or fins of calcite cut across the sandstone, adding another dimension to the landscape.

Humans have explored and lived on the plateau and surrounding canyons for thousands of years, since the earliest known hunters and gatherers crossed the area 12,000 or more years ago. Some of the earliest rock art in the Southwest can be found in the monument. High densities of Ancestral Puebloan sites can also be found, including remnants of large and small villages, some with intact standing walls, fieldhouses, trails, granaries, burials, and camps.

The monument was a crossroad for many historic expeditions. In 1776, the Dominguez-Escalante expedition of Spanish explorers traversed the monument in search of a safe crossing of the Colorado River. After a first attempt at crossing the Colorado near the mouth of the Paria River failed, the explorers traveled up the Paria Canyon in the monument until finding a steep hillside they could negotiate with horses. This took them out of the Paria Canyon to the east and up into the Ferry Swale area, after which they achieved their goal at the Crossing of the Fathers east of the monument. Antonio Armijo's 1829 Mexican trading expedition followed the Dominguez route on the way from Santa Fe to Los Angeles.

Later, Mormon exploring parties led by Jacob Hamblin crossed south of the Vermilion Cliffs on missionary expeditions to the Hopi villages. Mormon pioneer John D. Lee established Lee's Ferry on the Colorado River just south of the monument in 1871. This paved the way for homesteads in the monument, still visible in remnants of historic ranch structures and associated objects that tell the stories of early settlement. The route taken by the Mormon explorers along the base of the Paria Plateau would later become known as the Old Arizona Road or Honeymoon Trail. After the temple

in St. George, Utah was completed in 1877, the Honeymoon Trail was used by Mormon couples who had already been married by civil authorities in the Arizona settlements, but also made the arduous trip to St. George to have their marriages solemnized in the temple. The settlement of the monument area by Mormon pioneers overlapped with another historic exploration by John Wesley Powell, who passed through the monument during his scientific surveys of 1871.

The monument contains outstanding biological objects that have been preserved by remoteness and limited travel corridors. The monument's vegetation is a unique combination of cold desert flora and warm desert grassland, and includes one threatened species, Welsh's milkweed. This unusual plant, known only in Utah and Arizona, colonizes and stabilizes shifting sand dunes, but is crowded out once other vegetation encroaches.

Despite sporadic rainfall and widely scattered ephemeral water sources, the monument supports a variety of wildlife species. At least twenty species of raptors have been documented in the monument, as well as a variety of reptiles and amphibians. California condors have been reintroduced into the monument in an effort to establish another wild population of this highly endangered species. Desert bighorn sheep, pronghorn antelope, mountain lion, and other mammals roam the canyons and plateaus. The Paria River supports sensitive native fish, including the flannelmouth sucker and the speckled dace.

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 Vermilion Cliffs 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 Vermilion Cliffs 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 "Vermilion Cliffs National Monument" attached to and forming a part of this proclamation.

The Federal land and interests in land reserved consist of approximately 293,000 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, to implement the purposes of this proclamation.

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

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 ninth day of November, in the year of our Lord two thousand, 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,
8:46 a.m., November 13, 2000]

NOTE: This proclamation was published in the *Federal Register* on November 15. This item was not received in time for publication in the appropriate issue.

Appendix 2: Contact Information

	Name	Title	Phone	Address	Email
Science Coordinator	Kevin Wright	Monument Manager (VCNM)	435-688-3241	345 E Riverside Dr. St. George, UT 84790	kjwright@blm.gov
Arizona Strip District Research Coordinator	Jeff Young	Arizona Strip District Wildlife Biologist	435-688-3373	345 E Riverside Dr. St. George, UT 84790	j8young@blm.gov
Authorized Officer	Lorraine Christian	Arizona Strip Field Office Manager	435-688-3323	345 E Riverside Dr. St. Georg, UT 84790	lmchrist@blm.gov